WORLD METEOROLOGICAL ORGANIZATION

CLOUD PHYSICS AND WEATHER MODIFICATION RESEARCH PROGRAMME

(WMP Report No. 9)

REGISTER OF NATIONAL WEATHER MODIFICATION PROJECTS

1984 and 1985

Technical Document
WMO/TD - No. 182

GENEVA, July 1987

NOTE

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CONTENTS

I. INTRODUCTION

As part of the Weather Modification Programme approved by the Seventh World Meteorological Congress (Geneva, 1975), and re-established as the Cloud Physics and Weather Modification Research Programme by the Tenth Congress (1987), the Secretary-General maintains a Register of experiments and operations in weather modification carried out within Member countries.

The present publication is the tenth of its kind and is based on information received from Member countries on experiments and operations sponsored by governmental agencies and private concerns that took place during 1984 and 1985. Data for each year are segregated. For various reasons, the Register does not contain information on all weather modification projects.

The first seven issues of the Register were similar in layout and in the gathered information. The eighth issue (1982) contained substantially different information and format than did the earlier Registers. With the endorsement of the EC Panel of Experts/CAS Working Group on Cloud Physics and Weather Modification (fifteenth session, 1983), the 1983 issue returned to the format and information of the first seven issues (with some modifications). This Register continues that tradition except that, in accordance with Resolution 24 (Cg-IX) data for the two years 1984 and 1985 were gathered at one time and are reported in this publication.

To assist the reader in understanding the contents of each of the 12 columns used in the tabular presentation, detailed explanations are given in Section II. The questionnaire which was sent to all Members in June 1984 is reproduced, in Annex A of Appendix C to the report, in the four official languages of WMO, to ensure that the tabular information will be readily understood by all readers. Information from these questionnaires related to 1984 projects is given in Part IV of the Register and Part VI contains information on 1985 projects. The form to be used in reporting completed programmes or for which a physical and/or statistical evaluation has been carried out is reproduced as Annex B of Appendix C. Reports on completed programmes are found in Section VIII.

The list of Members for which information is included in the Register is given in Section III for 1984 data and Section V for 1985 data. The Members which replied that no weather modification activities had taken place in their country during 1984 are listed in Appendix A and in Appendix B for 1985.

Requests for further information on the projects may be addressed to the reporting agency for each country which is included in Section VII of the Register. The WMO Secretariat will be happy to assist if necessary.

II. DETAILED EXPLANATIONS OF COLUMNS USED IN TABULAR INFORMATION IN THE REGISTER

(The figure in brackets following the column heading title is the similar item in the questionnaire shown in Appendix C).

Column 1: WMO Register No.

This consists of country indicator letters (according to the ISO Standard 3166-1974) and a serial number for each project.

Column 2: Objective of project, type of organization carrying it out (1) and (2)

Dev.	=	Development	PE	=	Precipitation Enhancement
Fog	=	Fog dissipation	(E)	=	Emergency
Hail	=	Hail suppression	(R)	=	Routine
Op.	=	Operational	PR	=	Precipitation Redistribution
			Res.	=	Research

Column 3: Approximate size of project area (3)

Given in square kilometers for target and control (if any) areas.

Column 4: Name of project (4)

Reference numbers are also quoted when supplied.

Column 5: Location of project area (5)

In some cases where co-ordinates of several points delineating the area were given, these have been replaced by a single point at approximately the centre of the area. Towns and islands may be denoted by name; A/P = Airport.

Column 6: Year project commenced and whether or not it will be continued (6)

No	=	indicates project will not be continued
Yes	=	indicates project will be continued
(?)	=	indicates project status is unknown

Column 7: Nature of organization sponsoring project (7)

Indicated by abbreviations as follows:

Agr.	=	Agricultural	(P)	=	Private
Def.	=	Defense	Rec.	=	Recreation
(G)	=	Government	Res.	=	Research
Hyd.	=	Hydrological	Trans.	=	Transportation
Muni.	=	Municipal	Wea. Ser.	=	Meteorological

Column 8: Apparatus, seeding location (8)

Abbreviations are as follows:

Air	=	Airborne	G/B	=	Ground-Based
A/C	=	Aircraft	Temp.	=	Temperature

Column 9: Agents, dispersal rates (8)

Self-explanatory.

Column 10: Characteristics of clouds treated, seeding criteria (9)

LWC	=	Liquid water content	Temp.	=	Temperature
Obs.	=	Observations			

Column 11: Active period during reporting year (10)

Months of activity are inclusive.

Jan	=	January	July	=	July
Feb	=	February	Aug	=	August
Mar	=	March	Sept	=	September
Apr	=	April	Oct	=	October
May	=	May	Nov	=	November
June	=	June	Dec	=	December

Column 12: Documentation (12 and (13)

First (Yes or No) applies to analysis of costs and benefits; Second (Yes or No) applies to provisions for evaluation. The notation (H) indicates that the evaluation is based on comparison of historical data.

III - LIST OF COUNTRIES REPORTING 1984 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ARGENTINA											
AR 1	Res. Dev. Op. Hail	1500 Target	Mendoza Gov.: Dirección de Investigación de Lucha Antigranizo	Central San Martín Northern Province of Mendoza	1978 Yes	Agr., (G), (P)	Air & G/B: in-cloud seeding at -6 to -10°C using rockets	16.8 g per rocket 35 kg AgI total	Convective clouds; predominant cloud base temp. +4 to +10°C. Operations alert based on weather service severe storm forecast; seeding criteria based on 10 and 3.2 cm radar reflectivity.	169 days: Oct-Mar	Yes/ Yes (H)
AUSTRIA											
AU 1	Op. Hail	500 Target	Hail Defense Project "Lower Austria"	Districts of Krems-Langenlois	1981 Yes	Agr. (P)	Air: 2 A/C, cloud base seeding with acetone burners	10 l/hr (7% AgI solution), 40 hr burning/yr	Convective clouds; predominant cloud base temp. +12 to +16°C. Operations alert based on thunderstorm forecast from the Vienna Airport; seeding alarm based on radar echo intensity greater than 35 DBZ.	20 days: 15 May to 15 Sept	No/ Yes (H)
AU 2	Op. Hail	1600 Target	Hail Defense Project "Styria"	Districts of Gleisdorf-Weiz	1982 Yes	Agr. (P)	Air: 4 A/C, cloud base seeding with acetone burners	10 l/hr (7% AgI solution), 70 hr burning/yr	Convective clouds; predominant cloud base temp. +12 to +16°C. Operations alert based on thunderstorm forecast from the Vienna Airport; seeding alarm based on radar echo intensity greater than 35 DBZ.	30 days: 15 May to 15 Sept	No/ Yes (H)
BULGARIA											
BG 1	Res. Dev. Op. Hail	14000 Target	BG 1	42°N - 24°E; 43°30'N-23°30'E	1969 Yes	Agr. (G), Wea. Ser. (G)	Air: in cloud seeding at T = -5 to -10°C using rockets	11500 kg PbI_2 (total)	Convective clouds; predominant cloud base temp. +13°C. Seeding criteria based on radar reflectivity.	36 Days: May-Sept	Yes/ Yes (H)
CANADA											
CA 1	Res. PE PR	10200 Target	Southern Alberta Cloud Seeding and Plume Study	Southern Alberta - High River - Granum - Vauxall area	1981 Yes	Agr. (G), Res. (G)	G/B: 83 impregnated coke & arc rod generators at 62 locations	0.2 to 30 g/hr/generator, 29.127 kg AgI total	Convective clouds; predominant cloud base temp. 0° to -5°C. Operations criteria based on upper level synoptic circulation, air mass characteristics & wind flow levels for the AgI plume concentration.	27 Days: 18 June to 13 Aug	Yes/ Yes (H)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CANADA											
CA 2	Res. PE(E), Hail	20000 Target 62000 Control	Alberta Hail Project	130 km radius of Red Deer Industrial Airport	1974 - 1979 operation; 1980-1984 experimental Yes	Agr. (G), Res. (G)	Air: cloud base, top & in-cloud at -8 to 0°C using 5 aircraft 6 acetone burners, (AgI), pyrotechnic flare (AgI) generators, (solid CO_2) dispensing generator	2250 g/hr wing pyrotechnics; 14400 g/hr droppable pyrotechnics total of 195.18 kg; 130 g/hr AgI, NH_4I acetone burners, total consumption 376.8 lt.	Convective clouds; predominant cloud base temp. 0°C. Operations criteria based on radar obs. that cloud growth meets seeding criteria followed by A/C monitoring that confirms that the internal structure of clouds (temp., drafts, particle spectra meet the seeding criteria.	29 Days: 20 June to 31 Aug	Yes/ Yes (H) Randomized experiment
DOMINICAN REPUBLIC											
DM 1	Op. PE	6500 Target 6500 Control	Water Augmentation for Hydroelectric Operations of the Dominican Electric Corp.	18°20'N, 70°20'W;; 19°20'N, 71°20'W	1984 Yes	Energy (G)	-	Mixture of NaI, NH_4I, acetone burned in propane flame	Convective clouds, operations criteria based on sounding and radar echo.	-	-
FRANCE											
FR 1	Op. & Res. Hail	55000 Target 470000 Control	Association Nationale d'Etude et de Lutte Contre les Fléaux Atmosphérique (Prévention de la Grêle)	Southwest France, Depts. 09, 11, 16, 17, 31, 33, 40, 64, 65, 66, 81	1952 Yes	Agr. (P) Type 1901 Assoc.	G/B: 448 acetone burners	8 g/hr/generator, 591 kg AgI total	Convective clouds; predominant cloud base temp. 0 to +10°C.	20 to 42 Days: (depending on Dept.) Apr-Oct	Yes/ Yes (H)
GERMANY, FEDERAL REPUBLIC OF											
DE 1	Res. Hail	1700 Target 4000 Control	Hail Suppression in Oberschwaben	Southern Federal Republic of Germany Kreis-Ravensburg	1978 Yes	Agr. (G), Agr. (P)	Air: cloud base seeding using 2 A/C and acetone burners	13 kg AgI total	Convective clouds; predominant cloud base temp. +5°C.	30 Days: May-Sept	Yes/ Yes (H)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
GERMANY, FEDERAL REPUBLIC OF (Contd.)											
DE 2	Op. Res. Hail	2700 Target 7000 Control	Hail Suppression Project Stuttgart Area	Stuttgart area	1979 (1980 operations Yes	Agr. (G), Agr. (P)	Air: cloud base seeding using 1 A/C and pyrotechnic flares	70 g/l solution/ flare (or $2x10^{12}$ AgI particles/ flare), 194 flares total (AgI)	Convective clouds, predominant cloud base temp. +15°C (highly variable). Operations criteria based on upper air stability, & 24-hr forecast. Seeding criteria based on radar echo greater than 25 DBZ above 0°C isotherm & RHI tops above 25000 feet.	May-Oct	Yes/Yes Hail pads, hail cell analysis
DE 3	Ops. Hail	200 Target 400 Control	Hail Suppression Mühldorf-Altötting	Bavaria, FRG	1983 Yes	Agr. (G-local)	Air: cloud base seeding using 1 A/C and acetone burner	4 l/hr HSEOLL, 100 l total	Convective clouds, predominant cloud base temp. 0 to +30°C. Operations use information from the Munich Meteorological Office.	31 Days: May-Aug	No/No
DE 4	Ops. Hail	2800 Target 2800 Control	Weather Modification Project - South Bavaria Area Rosenheim Miesbach	Country District Rosenheim Miesbach	1957 Yes	Agr. (G-local)	Air: cloud base seeding using 1 A/C acetone burner	10 kg AgI - acetone solution/ hr (700-800g AgI/ hr), 210 kg solution total	Convective clouds, predominant cloud base temp. +4 to +6°C. Cb with tops above specified threshold level are seeded.	25 Days: 1 May - 15 Sept	Yes/No
HUNGARY											
HU 1	Op. Hail	1500 Target (from 1983 Register) 2500 total HU 1 & HU 2 reported in 1985	Hail Suppression Project of Baranya County	South Hungary 45°55'-46°05'N, 18°55'E	1976 Yes	Wea. Ser. (G), Ins. (G)	Air: in-cloud seeding between -5 and -10°C using rockets	1508g "Oblako", 66g "PGI-M" and 408g "Alazany" rockets 1200 kg PbI_2 total (for HU 1 (1984/85) and HU 2 (1985)	Convective clouds, mesoscale bands. Criteria for seeding: height of 40 DBZ radar echo (S band MRL-5) & tendency parameter of cell development.	21 Days: Apr-Oct	Yes/ Yes (H)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
INDIA											
IN 1	Res. PE	1600 Target 1600 Control	Warm Cloud Modification Experiment, Maharashtra State	Maharashtra State, 18°N to 19°06'N, 74°15'E to 74°38'E	1973 Yes	Wea. Ser. (G)	Air: in-cloud seeding 600 m above cloud base using 1 A/C & solid dispensers	600 to 1800 kg/hr, 24000 kg NaCl total	Convective clouds; predominant cloud base temp. +18 to +20°C. Operations criteria based on sounding, low cloud amount, wind velocity & synoptic conditions.	July-Sept	Yes/Yes Randomized, cloud physics obs.
ISRAEL											
IL 1	Res. Op. PE (R)	16000 Target 2300 Control	Rain Enhancement Project (EMS/MEKOROT) Israel	Entire country North of Beer-Sheba, northern part seeded routinely, southern part randomized seeding except in drought years	1961 Yes	Agr. (G) Hyd. (G)	Air and Ground: acetone burners and pyrotechnics	-	Convective, orographic, synoptic scale disturbances & bands organized on the mesoscale. Predominant cloud base temp. +5 to 0°C. Operations criteria: cloud bases <5000 MSL, top >10000 ft cloud top temp. <-8°C.	-	Yes/Yes Ramdomized
ITALY											
IT 1	Dev. and Op. Hail	2000 Target 6000 Control	Campagna Sperimentale Difensa Antigrandine "VICENZA"	Province of Venice (NE Italy)	1972 Yes	Agr. (G)	Air and Ground: 12 ground based kerosene + B.T.A. burners, 1 A/C using pyrotechnic flares seeding at cloud base	1.2 kg/hr, 280 kg AgI total from ground; 2 to 3 kg/hr AgI from A/C	Convective clouds; synoptic scale disturbances; predominant cloud base temp. +10 to +20°C. Operations criteria based on synoptic situation & dynamic analysis.	31 Days: May-Sept	Yes/Yes
MEXICO											
MX 1	Op. PE(R) PE(E)	20000 Target	State of Mexico	-	1982 (?)	State Gov.	Air: 1 A/C seeding at cloud base	83 kg AgI total	Convective, stratiform, and orographic clouds. Synoptic scale disturbances, clouds bands organized on mesoscale. Predominant cloud base temp. +20°C.	May-Oct	No/ Yes (H)
MX 2	Op. PE (R) (E)	20000 Target	Puebla	-	1971 (interrupted in 1976 & 1983)	State Gov.	Air: 1 A/C seeding at cloud base	61 kg AgI total	Convective, stratiform, and orographic clouds. Synoptic scale disturbances, clouds bands organized on mesoscale. Predominant cloud base temp. +20°C.	May-Oct	No/ Yes (H)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
MEXICO (contd.)											
MX 3	Op. PE(R) PE(E)	3000 Target	Iguala	-	1984 (?)	State Gov.	Air: 1 A/C seeding at cloud base	40 kg AgI total	Convective, stratiform, & orographic clouds. Synoptic scale disturbances, clouds bands organized on mesoscale. Predominant cloud base temp. +20°C.	May-Oct	No/No
MOROCCO											
MA 1	Res. Op. PE(E)	16400 Target, 7000 S Control 3500 N Control	Programme Al-Chait No. 608 - 0190 U.S. AID	Central High Atlas Mountains	1984 Yes	Wea. Ser. (G)	Air: 5 A/C using acetone burners & pyrotechnics seeding at cloud base, summit & in-cloud at -5°C	375 g/h/aircraft, 20.6 kg AgI total plus 4.5 kg AgI using pyrotechnics	Orographic clouds, synoptic scale disturbances. Seeding criteria requires cloud summit temp. equal to or less than -5°C.	Nov-Apr	Yes/ Yes (H)
NORWAY											
NO 1	Ops. Fog	5-10 Target	-	Oslo Airport, Fornebu; Oslo Airport, Gardermoen	1964 Yes	Trans. (G)	Air: 1 A/C seeding in-cloud at temp. less than -1°C using solid dispensing units	100 to 150 kg dry ice (solid CO_2) each seeding, approximately 5000 kg CO_2 total	Stratiform clouds with base temp. between -3°C and -10°C. Criteria for operation depends mainly on temp.	About 40 Days: Jan-Mar, Nov-Dec	No/No
SPAIN											
ES 1	Op. Res. Hail	7 Target	Hail Suppression Actions with Application of Ice- Forming Nuclei	Provinces of Zaragoza, La Rioja, Alava, Navarra	1973 (G/B gen- er- ators) 1984 A/C	Agr. (G) and (P)	G/B and Airborne: A/C in-cloud seeding at about 0°C using acetone burner generators	AgI	Convective clouds. Seeding criteria based on radar reflectivity of 35 DBZ above 0°C isotherm.	June-Sept	Yes/ No
UNION OF SOVIET SOCIALIST REPUBLICS											
SU 1	Op. Hail	6700 Target	Hail Suppression	Uzbek SSR	1967 Yes	Agr. (G), Wea. Serv. (G)	Air: in-cloud seeding between -6 and -9°C using rockets and artillery shells carrying explosive and/or pyrotechnic flare generators	AgI	Convective clouds, predominant cloud base temp. between +10 and +15°C. Operations alert based on probability of hail >0.4; seeding criteria based on radar reflectivity at 3.2 cm being less than that at 10 cm wave length.	42 Days: Apr-Aug	Yes/ Yes (H)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNION OF SOVIET SOCIALIST REPUBLICS (Contd.)											
SU 2	Op. Hail	6700 Target	Hail Suppression	Tajik SSR	1964 Yes	Agr. (G), Wea. Serv. (G)	Air: in-cloud seeding between -6 and -10°C using rockets and artillery shells carrying explosive and/or pyrotechnic flare generators	AgI	Convective clouds, predominant cloud base temp. +10 and +15°C. Operations alert based on hail probability >0.4; seeding criteria requires ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length to be <1.	28 Days: Apr-Aug	Yes/ Yes (H)
SU 3	Res. and Dev. PE(R)	10000 Target	Research to Investigate Possibilities for Precipitation Enhancement in the Volga River Basin	Penza Region	1982 Yes	Res. (G), Wea. Serv. (G)	Air: cloud top seeding using pyrotechnic flare generators carried by two A/C	AgI and dry ice (solid CO_2)	Convective clouds, predominant cloud base temp. +10 and +15°C; layer clouds with predominant cloud base temp. between 0 and -5°C; seeding criteria based on temp. conditions & presence of supercooled liquid water.	40 Days: May-July; Nov-Mar	No/ Yes (H) For layer clouds radar measurement of precipitation
SU 4	Res. and Op. Fog	3500 x 500 x 100 m Target volume	Artificial Dissipation of Supercooled Fog	Airport at Kishinev, Moldavia	1984 Yes	Res. (G) Wea. Serv. (G)	G/B: liquid propane spray	Propane	Cloud temp. between -5 and -15°C. Seeding criteria based on temp. conditions, wind speed & presence of supercooled liquid water.	12 Days: Nov-Dec Jan-Mar 1984 and 1985	Yes/ Physical evaluation based on observations of visibility in the target & surrounding areas
SU 5	Op. Hail	10850 Target	Hail Suppression	Georgian SSR	1964 Yes	Agr. (G), Wea. Serv. (G)	Air: explosive and pyrotechnic flare generators carried by rockets and artillery shells. Seeding at cloud base & in-cloud at temp. between -3 and -9°C	AgI	Convective clouds, predominant cloud base temp. +5 and +10°C. Seeding criteria based on forecast probability of hail greater than 0.4; ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	66 Days: Apr-Oct	Yes/ Yes (H)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNION OF SOVIET SOCIALIST REPUBLICS (Contd.)											
SU 6	Op. Hail	19700 Target	Hail Suppression	Moldavian SSR	1964 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud between -6 and -15°C and at cloud base using rockets carrying pyrotechnic flare generators	AgI	Convective clouds, predominant cloud base temp. +5 to +10°C. Operation alert based on forecast of 0.4 or greater probability of hail; seeding criteria based on ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	61 Days: May-Sept	Yes/ Yes (H)
SU 7	Op. Hail	2800 Target	Hail Suppression	Ukranian SSR Odessa Region	1980 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud between -6 and -10°C and at cloud base using rockets carrying pyrotechnic flare generators	AgI	Convective clouds, predominant cloud base temp. +10 to +15°C. Operations alert based on forecast of 0.4 or greater probability of hail; seeding criteria based on ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	29 Days: May-Sept	Yes/ Yes (H)
SU 8	Op. Hail	10850 Target	Hail Suppression	Armenian SSR	1964 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud between -4 and -8°C and at cloud base using rockets and artillery shells carrying pyrotechnic flare and explosive generators	AgI	Convective clouds, predominant cloud base temp. 0 to -8°C. Operations alert based on forecast of 0.4 or greater probability of hail; seeding criteria based on ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	68 Days: Apr-Oct	Yes/ Yes (H)
SU 9	Op. Hail	4300 Target	Hail Suppression	Ukranian SSR, Crimea Region	1968 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud at -6 and at cloud base using rockets carrying pyrotechnic flare generators	AgI	Convective clouds, predominant cloud base temp. +15°C. Operations alert based on forecast of 0.4 or greater probability of hail; seeding criteria based on ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	27 Days: May-Sept	Yes/ Yes (H)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNION OF SOVIET SOCIALIST REPUBLICS (Contd.)											
SU 10	Op. Hail	7700 Target	Hail Suppression	Krasnodar Region	1967 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud at -6 and at cloud base using rockets and artillery shells carrying pyrotechnic flare and explosive generators	AgI	Convective clouds, predominant cloud base temp. +7 to +14°C. Operations alert based on forecast of 0.4 or greater probability of hail; seeding criteria based on ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	44 Days: May-Sept	Yes/ Yes (H)
SU 11	Op. Hail	12200 Target	Hail Suppression	Azerbaijan SSR	1967 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud between -0 and -12°C and at cloud base using rockets and artillery shells carrying pyrotechnic flare and explosive generators	AgI	Convective clouds, predominant cloud base temp. +3 to +9°C. Operations alert based on forecast of 0.4 or greater probability of hail; seeding criteria based on ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	47 Days: Apr-Oct	Yes/ Yes (H)
SU 12	Op. Hail	7120 Target	Hail Suppression	Northern Caucasus	1967 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud between -3 and -15°C and at cloud base using rockets and artillery shells carrying pyrotechnic flare and explosive generators	AgI	Convective clouds, predominant cloud base temp. +9 to +14°C. Operations alert based on forecast of 0.4 or greater probability of hail; seeding criteria based on ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	45 Days: May-Sept	Yes/ Yes (H)
SU 13	Res. Hail	2500 Target 3000 Control	Complex Hail Experiment	Kabardino-Balkarian ASSR	1983 Yes	Res. (G), Wea. Serv. (G)	Air: seeding in-cloud between -3 and -9°C and at cloud base using rockets and artillery shells carrying pyrotechnic flare and explosive generators	AgI	Convective clouds, predominant cloud base temp. +5 to +10°C. Operations alert based on forecast of 0.4 or greater probability of hail; seeding criteria based on ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	6 Days: May-Aug	Yes/No Physical effects of seeding mon-itor-ed

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNITED STATES OF AMERICA											
US 1	Op. PE(R)	1350 Target 988 Control	84-172 KDWDC Project	Kaweah River Watershed, California	1976 Yes	Hyd. (P)	G/B and Air: 5 G/B generators, 1 A/C; G/B and cloud top seeding using acetone burner generators & pyrotechnic flares	2-20 g/min/ pyrotechnic flare generator; 10-20 g/hr/acetone burning generator, 4.349 kg AgI total	Orographic clouds	29 Days: Jan-Apr, Nov-Dec	No/No
US 2	Op. PE(R)	614 Target 2600 Control	Upper American River Project	Sacramento, California	1979 Yes	Hyd., Energy (G-Muni.)	G/B: 8 acetone burning generators	20 g/hr/generator, 2.864 kg AgI total	Orographic clouds	9 Days: Mar, May, Nov, Dec	No/No
US 3	Op. PE(R)	3120 Target 15600 Control	84-491 Kern River Project	Kern River Watershed, California	1982 Yes	Hyd. (P)	Air: 1 A/C carrying pyrotechnic flares seeding AgI at cloud top and in-cloud	60 to 30,000 g/hr, 0.8 kg AgI total	Orographic clouds	4 Days: Mar, Apr	No/No
US 4	Op. PE(R)	2600 Target	84-507 T-18	Texas portion of the water-shed of Red Bluff Lake	1983 Yes	Energy and Hyd. (P)	G/B: 13 arc-type AgI generators	0.5 to 2.0 g AgI/hr/generator, 5.527 kg AgI total	Convective clouds & synoptic scale disturbances.	144 Days: Jan-Dec	No/No
US 5	Op. PE(R)	9100 Target	84-516 Colorado River Municipal Water District Project	Big Springs, Texas	1975 Yes	Agr. (P)	Air: A/C carrying pyrotechnic generators	2.7 to 7.1 g/min, 5.52 kg AgI total	Convective and layer clouds.	20 Days: May-Sept	No/No
US 6	Op. Hail	25474 Target	84-521 Western Kansas Weather Modifi-cation	12 Western Kansas Counties	1975 Yes	Hyd. (G-local)	Air: 1 or 3 A/C acetone burning and solid dispensing generators	0.126 l/min, 26.346 kg AgI total; 0.4536 kg/ min, 1059 kg dry ice (solid CO_2) total	Convective clouds	52 Days: May-Sept	No/No
US 7	Op. PE(R)	9178 Target	84-522 North Dakota Weather Modification Project District I	West Central North Dakota	1977 Yes	Energy (G-state)	Air: in-cloud seed-ing using acetone burner, solid dispensing & pyrotechnic flares carried by A/C	50.48 kg AgI total; 502.12 dry ice solid CO_2) total	Convective clouds. Seeding criteria based on cloud base height, cloud base diameter, temp. & liquid water content.	16 Days: Jun-Aug	No/Yes
US 8	Op. PE(R)	22523 Target	84-523 North Dakota Weather Modification Project District II	Northwestern North Dakota	1977 Yes	Agr. (G-state)	Air: cloud base & in-cloud (-2 to -12.5°C) seeding using acetone burn-ing, solid dispensing & pyrotechnic flare generators carried by A/C	68.98 kg AgI total; 441 kg dry ice (solid CO_2) total	Convective clouds. Seeding criteria based on cloud base height, cloud base diameter, temp., & liquid water content.	40 Days: May-Aug	No/Yes

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNITED STATES OF AMERICA (Contd.)											
US 9	Op. PE(R) and Hail	6973 Target	84-524 Harding County Weather Modification Program	Harding County South Dakota	1977 Yes	Agr. (G-local)	Air: cloud base, top and in-cloud (-2 to -12.5°C) seeding using acetone burning, solid dispensing & pyrotechnic flare generators carried by A/C	19.02 kg AgI total	Convective clouds. Seeding criteria based on cloud base height, cloud base diameter, temp., & liquid water content.	26 Days: Jun-Aug	No/Yes
US 10	Res.	3484 Target	84-526 - 1984 State Federal Cooperative Field Research Project	Stark County, North Dakota	? Yes	Res. (G-Federal & State)	Air: cloud base and in-cloud (-2 to 12.5°C) seeding using AgI-NH_4I-CIO_4 $NaCl_4$ acetone solution burning generator carried by 1 A/C	0.470 kg AgI total	Convective clouds	4 Days: July	No/No
US 11	Op. Fog	26 Target	84-527 Supercooled Fog Dispersal Project	Salt Lake City, Utah	1972 Yes	Trans. (P)	Air: cloud top seed using 1 A/C dispensing dry ice (solid CO_2)	35295 kg dry ice total	Layer clouds. Seeding criteria based on occurrence of supercooled fog.	27 Days: Dec-Mar	No/No
US 12	Res.	780 Target	84-525 Utah Water Research Laboratory Balloon Elevated Seeding Technology	Logan, Utah	1982 Yes	Other (G-state)	Air: cloud base and in-cloud seeding using pyrotechnic flares carried by balloons	0.5 g/unit 0.008 kg AgI total	Orographic clouds	1 Day: Feb	No/No
US 13	Op. PE(R)	9100 Target	84-520 Santa Barbara County Cloud Seeding	Santa Barbara County, California	1982 Yes	Agr. (P), Hyd. (P)	G/B. and Air: 1 G/B generator, 1 A/C seeding in-cloud	5 g/min, 3.885 kg AgI total	Bands organized on mesoscale.	5 Days: Mar-Apr	Yes/No
US 14	Ops. PE(R)	468 Target	84-528 Wind River Weather Modification Project	Big Sandy River Drainage, Wyoming	1972 Yes	Agr. (P), Hyd. (P)	G/B: AgI-NH_4I propane fueled generators	10 to 15 g/hr; 5.263 kg AgI total	Orographic clouds, predominant cloud base temp. less than 0°C.	17 Days: Nov-Feb	No/No
US 15	Op. PE(R)	9100 Target	84-530 Santa Barbara County Cloud Seeding	Santa Barbara County, California	1982 Yes	Agr. (P), Hyd. (P)	G/B and Air: seeding at ground and in-cloud	25 g/hr; 18.3 kg AgI total	Bands organized on mesoscale.	15 Days: Nov-Apr	Yes/No

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNITED STATES OF AMERICA (Contd.)											
US 16	Op. PE(R)	650	84-531 Mokelumne Project	Central Sierra Nevada Mountains, California	1974 Yes	Agr. (P), Energy (P)	G/B: 5 acetone burning generators	25 g/hr, 13.76 kg AgI total	Orographic clouds. Seeding criteria based on height of freezing level, height of -10°C isotherm, cloud type, temp., average wind speed & direction	31 Days: Nov-Apr	No, Ramdomized experiment with evaluation
US 17	Op. PE(R)	1300 Target 364 Control	84-532 Lake Almanor Project	Northern Sierra Nevada Mountains, California	1972 Yes	Agr. (P), Energy (P)	G/B: 5 acetone burning generators	25 g/hr, 24.047 kg AgI total	Orographic clouds & bands organized on mesoscale. Seeding criteria based on height of freezing level, height of -10°C isotherm, cloud top temp., average wind speed & direction.	26 Days: Nov-Mar	No, Ramdomized experiment with evaluation
US 18	Snow enhancement for ski area	260 Target	84-536 Sun Valley Ski Area	Sun Valley, Idaho	1980 Yes	Rec. (P)	G/B and Air: 1 to 2 generators, in-cloud seeding using 1 A/C, acetone & pyrotechnic burning generators	100 to 300 g/hr, 6.57 kg AgI total	Orographic clouds having predominant cloud base temp. <0°C.	18 Days: Nov-Feb	No/No
US 19	Ops. Fog	5.2 Target	84-537 Ground-Based Cold Fog Dissipation System	Elmendorf AFB, Alaska	1971 Yes	Def. (G)	G/B: 24 units to spray liquid propane	12 gal/hr/dispenser, 800 gal propane total	Layer clouds, predominant cloud base temp. <0°C. Seeding criteria is occurrence of supercooled fog.	6 Days: Nov-Jan	Yes/Yes
US 20	Ops. PE(R)	260 Target 2072 Control	84-534 Central Colorado Project	Vail and Beaver Creek, Colorado	1978 Yes	Agr. (P), Forestry (P), Rec. (P)	G/B: 8 acetone burning generators	5-40 g/hr, 5.686 kg AgI total	Orographic clouds, bands organized in mesoscale.	38 Days: Nov-Mar	No/Yes
US 21	Ops. PE(R)	3900 Target 2072 Control	84-535 San Juan Program	Southwest Colorado	1977 Yes	Agr. (P), Hyd. (P)	G/B: 6 acetone burning generators	5 to 40 g/hr, 4.035 kg AgI total	Orographic clouds	19 Days: Nov-Feb	No/Yes
US 22	Ops. PE(R)	218 Target	84-518 Project OC-4	Hitch Ranch, Oklahoma	1983 Yes	Agr. (P)	G/B: 10 arc type generators	0.5 or 2 g/hr, 2.516 kg AgI total	Convective and layer clouds.	115 Days: Mar-Oct	No/No

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNITED STATES OF AMERICA (Contd.)											
US 23	Ops. Fog	26 Target	84-519 Fog Dispersal Project	Medford, Oregon	1980 Yes	Trans (P)	Air: 1 A/C, cloud top seeding using solid dispensing unit	1899 kg dry ice (solid CO_2) total	Layer clouds. Criteria for seeding is the occurrence of super-cooled fog.	11 Days: Jan-Feb	No/No
US 24	Ops. Fog	130 Target	84-538 Cold Fog Dispersal System	Fairchild AFB, Washington	? Yes	Def. (G)	G/B: 23 units to spray liquid propane	10 gal/hr, 6845 gals propane total	Layer clouds, predominant cloud base temp. <0°C. Seeding criteria is the occurrence of super-cooled fog.	46 Days: Oct-Mar	Yes/Yes
US 25	Ops. PE(R)	3120 Target 835 Control	84-529 Big Creek Project, San Joaquin River	Upper San Joaquin River, California	1972 Yes	For-estry (P), Hyd. (P)	G/B and Air: acetone burning & pyrotech-nic flare generators. Airborne seeding is in-cloud	4.256 kg AgI total	Orographic clouds	28 Days: Oct-Dec	No/No
US 26	Appl. Res. PE	800 Target	Sierra Co-operation Pilot Project	Central Sierra Nevada, California	1976 Yes	Hyd. (G)	Air: 1 A/C seeding in-cloud (-7 to -13°C) and at cloud top. Seeding region selection based on numerical model incorporating 3-dimensional flow & crystal growth & fallout, pyrotechnic flare & solid dispensing generators	20 g/flare/10 sec flight, 8 kg AgI total; 6 lbs/run or about 0.5 kg/km 250 kg dry ice (solid CO_2) total	Convective, layer and orographic clouds with predominant cloud base temp. of +5°C. Seeding criteria based on neutrally stable or orographically induced cloud following descent of upper clouds inducing supercooled liquid water. Target-ing model runs to see if winds, liquid water & temp. conditions will allow crystal fallout in target area.	12 Days: Jan-Mar	Yes/Yes Direct observa-tions in cloud and at ground
ZIMBABWE											
ZW 1	Op. PE(R)	390500 Target	National Cloud Seeding Operation (NACSO) Zimbabwe	Zimbabwe	1972 Yes	Wea. Serv. (G)	Air: seeding at cloud top and in-cloud at temp. -10°C or below, using pyrotechnic flares	AgI; 2283 pyrotechnic cartridges type TBZ consumed	Convective clouds, cloud base temp. about +20°C. Seeding criteria: developing Cu with tops at or below -10°C (about 21000 ft AMSL); 1935 clouds seeded.	66 Days: Nov/1984 through Apr/1985	Yes/Yes Ramdom-ized experi-ment

V - LIST OF COUNTRIES REPORTING 1985 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ARGENTINA											
AR 1	Res. Dev. Op. Hail	1500 Target	Mendoza Gov. Dirección de Investigación de Lucha Antigranizo	Central San Martín Northern Province of Mendoza	1978 Yes	Agr., (G), (P)	Air and G/B: in-cloud seeding at -6 to -10°C using rockets	16.8 g per rocket, 35 kg AgI total	Convective clouds, predominant cloud base temp. +4to +10°C. Operations alert based on weather service severe storm forecast; seeding criteria based on 10 and 3.2 cm radar reflectivity.	169 days: Oct-Mar	Yes/ Yes (H)
AUSTRIA											
AU 1	Op. Hail	500 Target	Hail Defense Project "Lower Austria"	Districts of Krems-Langenlois	1981 Yes	Agr. (P)	Air: 2 A/C, cloud base seeding with acetone burners	10 l/hr (7% AgI solution), 70 hr burning/yr	Convective clouds, predominant cloud base temp. +12 to +16°C. Operations alert based on thunderstorm forecast from the Vienna Airport; seeding criteria based on radar echo intensity greater than 35 DBZ.	20 days: 15 May to 15 Sept	No/ Yes (H)
AU 2	Op. Hail	1600 Target	Hail Defense Project "Styria"	Districts of Gleisdorf-Weiz	1982 Yes	Agr. (P)	Air: 4 A/C, cloud base seeding with acetone burners	10 l/hr (7% AgI solution), 40 hr burning/yr	Convective clouds, predominant cloud base temp. +12 to +16°C. Operations alert based on thunderstorm forecast from the Vienna Airport; seeding criteria based on radar echo intensity greater than 35 DBZ.	30 days: 15 May to 15 Sept	No/ Yes (H)
BULGARIA											
BG 1	Res., Dev., Op. Hail	14000 Target	BG 1	42°N - 24°E; 43°30'N-23°30'E	1969 Yes	Agr. (G), Wea. Ser. (G)	Air: rockets, in-cloud seeding at T = -5 to -10°C	10600 kg PbI_2 (total)	Convective clouds, predominant cloud base temp. +13°C. Seeding criteria based on radar reflectivity.	38 Days: May-Sept	Yes/ Yes (H)
CANADA											
CA 1	Res. PE(R)	10200 Target	Southern Alberta Cloud and Seeding Plume Study	Southern Alberta - High River - Taber area	1981 ?	Agr. (G), Res. (G)	G/B: coke and arc rod generators at 80 locations	2 to 30 g/hr/ generator, 21.5 kg AgI total	Convective clouds, predominant cloud base temp. +5°C. Operational criteria based on synoptic situation, upper level winds & prognostic maps for plume.	27 Days: 10 June to 26 July	Yes/ Yes (H)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CANADA											
CA 2	Res. PE(R), Hail	28200 Target 68000 Control	Alberta Hail Project	130 Km radius of Red Deer Industrial Airport, Alberta	1974 - 1979 operational 1980-1985 Experimental No	Agr. (G), Res. (G)	Air: cloud base and top seeding, in-cloud seeding at -8 to 0°C using 5 acetone AgI burners, pyrotechnic flares (AgI) and CO_2 solid dispensing generators	2250 g/hr wing pyrotechnics, 10000 g/hr droppable pyrotechnics, 107.5 kg AgI total; 19.9 kg CO_2 pellets, NH_4I (solution) 130 g/hr, 162 l	Convective clouds, predominant cloud base temp. 0°C. Operations criteria based on radar obs. that cloud growth meets seeding criteria followed by aircraft obs. confirming that cloud temp. & structure meet seeding criteria.	3 June to 31 Aug	Yes/ Yes (H) Ramdomized experiment
DOMINICAN REPUBLIC											
DM 1	Op. PE	6500 Target 6500 Control	-	18°20'N, 70°20'W;; 19°20'N, 71°20'W	1984 Yes	Energy (G)	-	Mixture of NaI, NH4I, acetone burned in propane flame	Convective clouds. Operations criteria based on sounding and radar echo.	108 Days: Mar-July	-
FRANCE											
FR 1	Op. & Res. Hail	55000 Target 470000 Control	Association Nationale d'Etude et de Lutte Contre les Fléaux Atmosphérique (Prévention de la Grêle)	Southwest France, Depts. 09, 11, 16, 17, 31, 33, 40, 64, 65, 66, 81	1952 Yes	Agr. (P)	G/B: 448 acetone burners	8 g/hr/generator, 591 kg AgI total	Convective clouds, predominant cloud base temp. 0 to +10°C.	20 to 42 Days: (depending on Dept.) Apr-Oct	Yes/ Yes (H)
GERMANY, FEDERAL REPUBLIC OF											
DE 1	Res. Hail	1700 Target 4000 Control	Hail Suppression in Oberschwaben	Southern Federal Republic of Germany Kreis-Ravensburg	1978 Yes	Agr. (G), Agr. (P)	Air: cloud base seeding using 2 A/C and acetone burners	13 kg AgI total	Convective clouds, predominant cloud base temp. +5°C.	30 Days: May-Sept	Yes/ Yes (H)
DE 2	Op. & Res. Hail	2700 Target 7000 Control	Hail Suppression Project Stuttgart Area	Stuttgart area	1979 (1980 in field) Yes	Agr. (G), Agr. (P)	Air: cloud base seeding using 1 A/C and pyrotechnic flares	70 g/l solution/ flare (or 2×10^{12} AgI particles/ flare), 289 flares total (AgI)	Convective clouds, predominant cloud base temp. +15°C (highly variable): Operations criteria based on upper air stability, & 24-hr forecast. Seeding criteria based on radar echo greater than 25 DBZ above 0°C isotherm & RHI tops above 25000 feet.	May-Oct	Yes/Yes Hail pads cell analysis

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
GERMANY, FEDERAL REPUBLIC OF (Contd.)											
DE 3	Ops. Hail	200 Target 400 Control	Hail Suppression Mühldorf-Altötting	Bavaria, FRG	1983 Yes	Agr. (G-local)	Air: cloud base seeding using 1 A/C, and acetone burner	4 l/hr HSEOLL, 100 l total	Convective clouds; predominant cloud base temp. 0 to +30°C. Operations use the Munich Meteorological Office Information.	31 Days: May-Aug	No/No
DE 4	Ops. Hail	2800 Target 2800 Control	Weather Modification Project - South Bavaria Area Rosenheim - Miesbach	Country District Rosenheim - Miesbach	1957 Yes	Agr. (G-local)	Air: cloud base seeding using 1 A/C, and acetone burner	10 kg/hr AgI solution (700-800 g/hr AgI), 250 kg acetone solution total	Convective clouds, (orographic); predominant cloud base temp. +4 to +6°C. Cb with tops above specified threshold level are seeded.	25 Days: 1 May to 15 Sept	Yes/No
HUNGARY											
HU 1	Op. Hail	1500 Target*	Hail Suppression Project of Baranya County	South Hungary 45°55'-46°05'N, 18°55'E	1976 Yes	Wea. Ser. (G), Ins. (G)	Air: in-cloud seeding between -5° and -10°C using rockets	1508g "Oblako", 66g "PGI-M" and 408g "Alazany" rockets 1200 kg, PbI_2 total for HU 1 (1984/85) and HU 2 (1985)	Convective clouds, mesoscale bands. Criteria for seeding: height of 40 DBZ echo (S band MRL-5) and tendency parameter of cell development.	42 Days: Apr-Oct (HU 1 and HU 2)	Yes/ Yes (H)
HU 2	Op. Hail	1000 Target*	Hail Suppression Project of Bács-Kiskun County	South Hungary 46°-46°25'N, 18°55'-19°25'E	1985 Yes	Wea. Ser. (G), Ins. (G)	Air: in-cloud seeding between -5° and -10°C using rockets	1508g "Oblako", 66g "PGI-M" and 408g "Alazany" rockets, 1200 kg PbI_2 total (for HU 1 (1984/85) & HU 2 (1985)	Convective clouds, mesoscale bands. Criteria for seeding height of 40 DBZ radar echo (S band MRL-5) & tendency parameter of cell development.	42 Days: Apr-Oct (HU 1 and HU 2)	Yes/ Yes (H)
INDIA											
IN 1	Res. PE	1600 Target 1600 Control	Warm Cloud Modification Experiment, Maharashtra State	Maharashtra State, 18°N to 19°06'N, 74°15'E to 74°38'E	1973 Yes	Wea. Ser. (G)	Air: in-cloud seeding 600 m above cloud base using 1 A/C, solid dispensers	600 to 1800 kg/hr, 24000 kg NaCl total	Convective clouds; predominant cloud base temp. +18 to +20°C. Operations criteria based on sounding, low cloud amount, wind velocity & synoptic conditions.	July-Sept	Yes/Yes Ramdomized cloud physics obs.

* Total target area for HU 1 and HU 2 is reported as 2500 km^2. 1983 Register reported HU 1 target area of 1500, which is used here.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ISRAEL											
IL 1	Res. Op. PE(R)	16000 Target 2300 Control	Rain Enhancement Project (EMS/MEKOROT) Israel	Entire country north of Beer-Sheba, northern part seeded routinely, southern part randomized seeding except in drought years	1961 Yes	Agr. (G), Hyd. (G)	Air and Ground: 63 G/B generators, 3 A/C seeding at cloud base. Acetone burners and pyrotechnic flares	A/C 600 g/hr, G/B generators 11 g/hr, 150 kg AgI (total)	Convective, orographic, synoptic scale disturbances & bands organized on the mesoscale. Predominant cloud base temp. +5 to 0°C. Operations criteria: cloud bases <5000 MSL, tops >10000 ft, cloud top temp. <-8°C.	33 Days: Nov-May	Yes/Yes Ramdomized
ITALY											
IT 1	Dev. and Op. Hail	2000 Target 6000 Control	Campagna Sperimentale Difensa Antigrandine "VICENZA"	Province of Venice (NE Italy)	1972 Yes	Agr. (G)	Air and Ground: 12 ground based kerosene + B.T.A. burners, 1 A/C using pyrotechnic flares seeding at cloud base	1.2 kg/hr, 350 kg AgI total from ground; 2 to 3 kg/hr AgI from A/C	Convective clouds, synoptic scale disturbances; predominant cloud base temp. +10 to +20°C. Operations criteria based on synoptic situation & dynamic analysis.	38 Days: May-Sept	Yes/Yes
MADAGASCAR											
MG 1	Ops. PE(E)	100 to 250 Target	-	Agricultural regions experiencing high precipitation deficit	1985 Yes	Wea. Ser. (G)	Air: 1 A/C seeding in-cloud within strong ascending drafts using solid dispensing units	15 kg/hr NaCl	Convective clouds, predominant cloud base temp. +15 to +20°C. Seeding in afternoons on days of moderate or strong instability.	30 Days: Oct-Apr	No/No
MEXICO											
MX 1	Op. PE(R) PE(E)	20000 Target	State of Mexico	-	1982 (?)	State Gov.	Air: 1 A/C seeding at cloud base	75 kg AgI total	Convective, stratiform, and orographic clouds, synoptic scale disturbances, clouds bands organized on mesoscale. Predominant cloud base temp. +20°C.	May-Oct	No/No
MOROCCO											
MA 1	Res. Op. PE(E)	16400 Target, 7000 S Control 3500 N Control	Programme Al-Chait	Central High Atlas Mountains	1984 Yes	Wea. Ser. (G)	Air: 5 A/C using acetone burners and pyrotechnics seeding at cloud base, summit and in-cloud at -5°C	375 g/h/aircraft, 20.6 kg AgI total plus 4.5 kg AgI using pyrotechnics	Orographic clouds, synoptic scale disturbances. Seeding criteria requires cloud summit temp. equal to or less than -5°C.	Nov.-Apr	Yes/ Yes (H)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
NORWAY											
NO 1	Ops. Fog	5-10 Target	-	Oslo Airport, Fornebu; Oslo Airport, Gardermoen	1964 Yes	Trans. (G)	Air: 1 A/C seeding in-cloud at temp. less than -1°C using solid dispensing units.	100 to 150 kg dry ice (solid CO_2) each seeding, approximately, 5000 kg CO_2 total	Stratiform clouds, predominant cloud base temp. -3°C and -10°C. Criteria operation depends mainly on temp.	Approx-imately 40 days: Jan-Mar, Nov-Dec	No/No
UNION OF SOVIET SOCIALIST REPUBLICS											
SU 1	Op. Hail	8600 Target	Hail Suppression	Uzbek SSR	1967 Yes	Agr. (G), Wea-Serv. (G)	Air: in-cloud seeding between -6 and -9°C using rockets and artillery shells carrying explosive and/or pyrotechnic flare generators.	AgI	Convective clouds, predominant cloud base temp. +10 and +15°C. Operational alert based on probability of hail >0.4; seeding criteria based on radar reflect-ivity at 3.2 cm being less than that at 10 cm wave length.	55 Days: Apr-Aug	Yes/ Yes (H)
SU 2	Op. Hail	7000 Target	Hail Suppression	Tajik SSR	1964 Yes	Agr. (G), Wea. Serv. (G)	Air: in-cloud seeding between -6 and -10°C using rockets and artillery shells carrying explosive and/or pyrotechnic flare generators	AgI	Convective clouds, predominant cloud base temp. +10 and +15°C. Operations alert based on forecast hail proba-bility >0.4; seeding criteria based on radar reflectivity at 3.2 cm being less than that at 10 cm wave length.	39 Days: Apr-Aug	Yes/ Yes (H)
SU 3	Res. and Dev. PE (R)	10000 Target	Research to Investigate Possibilities for Precipitation Enhancement in the Volga River Basin	Penza Region	1982 Yes	Res. (G), Wea. Serv. (G)	Air: cloud top seeding using pyro-technic flare generators carried by two A/C	AgI and dry ice (solid CO_2)	Convective clouds, predominant cloud base temp. between +10 and +15°C; layer clouds with predominant base temp. between 0 and -5°C. Seeding criteria based on temp. condi-tions & presence of supercooled liquid water.	40 Days: May-Jul, Nov-Mar	No/ Yes (H) For layer clouds physical asses-ment uses radar measure-ments of precip-ita-tion

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNION OF SOVIET SOCIALIST REPUBLICS (Contd.)											
SU 4	Res. and Op. Fog	3500 x 500 x 100 m Target volume	Artificial Dissipation of Supercooled Fog	Airport at Kishinev, Moldavia	1985 Yes	Res. (G), Wea. Serv. (G)	G/B: liquid propane spray	Propane	Predominant cloud base temp. -5 and -15°C. Seeding criteria based on temp. conditions, wind speed & presence of supercooled liquid water.	12 Days: Nov-Dec Jan-Mar	Yes/ Physical evaluation based on observations of visibility in the target & surrounding area
SU 5	Op. PE(R)	5000 Target 10000 Control	Seeding of Clouds to Enhance Winter Precipitation	Krivoy Rog, Ukranian SSR	1985 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud at temperatures less than -4°C using 4 A/C and solid dispensing units	Dry ice (solid CO_2)	Layer clouds with predominant cloud base temp. of 0°C. Criteria for seeding includes cloud thickness greater than 500 m.	30 Days: Jan-Feb Nov-Dec	Yes/Yes Comparison of precipitation in target & control within 12-hr periods
SU 6	Op. PE (R)	1000 Target 1000 Control	Seeding of Clouds to Enhance Precipitation	Uzbek SSR, Kashkadarinskaya Region	1985 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud between -4 and -18°C using rockets and 1 A/C carrying pyrotechnic flare generators and solid dispensing units	AgI and dry ice (solid CO_2)	Layer and orographic clouds, synoptic scale disturbances & bands organized on mesoscale. Predominant cloud base temp. -2 and -6°C. Seeding criteria cloud base temp. -4 to -20°C, cloud thickness >300 m, base <1000 m, changes in absolute moisture saturation, speed of cloud glaciation.	15 Days: Feb-Apr	Yes/ Yes (H) Instrumental evaluation of part of experiment with use of MRVK "Precipitation"
SU 7	Op. PE(R)	3000 Target	Precipitation Enhancement	Georgian SSR	1985 Yes	Agr. (G), Wea. Serv. (G)	Air: pyrotechnic flare and explosive generators carried by rockets and artillery shells, seeding at cloud base and in-cloud at temp. between -4 and -18°C	AgI	Convective clouds, predominant cloud base temp. between +5 and +10°C. Seeding criteria requires clouds thicker than 2 km.	27 Days: May-Sept	Yes/ Yes (H) Hydrological evaluation

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNION OF SOVIET SOCIALIST REPUBLICS (Contd.)											
SU 8	Op. Hail	10850 Target	Hail Suppression	Georgian SSR	1964 Yes	Agr. (G), Wea. Serv. (G)	Air: explosive and pyrotechnic flare generators carried by rockets & artillery shells. Seeding at cloud base and in-cloud at temp. between -3 and -9°C	AgI	Convective clouds, predominant cloud base temp. +5 and +10°C. Seeding criteria based on forecast probability of hail greater than 0.4 & ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	73 Days: Apr-Oct	Yes/ Yes (H)
SU 9	Op. Hail	22000 Target	Hail Suppression	Moldavian SSR	1964 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud between -6 and -15°C and at cloud base using rockets carrying pyrotechnic flare and explosive generators	AgI	Convective clouds, predominant cloud base temp. +5 to +10°C. Operations alert based on forecast of 0.4 or greater probability of hail; seeding criteria based on ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	44 Days: May-Sept	Yes/ Yes (H)
SU 10	Op. Hail	3050 Target	Hail Suppression	Ukranian SSR Odessa Region	1980 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud between -6 and -10°C and at cloud base using rockets carrying pyrotechnic flare generators	AgI	Convective clouds, predominant cloud base temp. +10 to +15°C. Operations alert based on forecast of 0.4 or greater probability of hail; seeding criteria based on ratio of radar reflectivity at 3.3 cm to that at 10 cm wave length being <1.	29 Days: May-Sept	Yes/ Yes (H)
SU 11	Op. Hail	11220 Target	Hail Suppression	Armenian SSR	1964 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud between -4 and -8°C and at cloud base using rockets and artillery shells carrying pyrotechnic flare and explosive generators	AgI	Convective clouds, predominant cloud base temp. 0 to +8°C. Operations alert based on forecast of 0.4 or greater probability of hail; seeding criteria based on ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	65 Days: Apr-Oct	Yes/ Yes (H)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNION OF SOVIET SOCIALIST REPUBLICS (Contd.)											
SU 12	Op. Hail	4950 Target	Hail Suppression	Ukranian SSR, Crimea Region	1968 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud at -6 and at cloud base using rockets carrying pyrotechnic flare generators	AgI	Convective clouds, predominant cloud base temp. +15°C. Operations alert based on forecast of 0.4 or greater probability of hail; seeding criteria based on ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	24 Days: May-Sept	Yes/ Yes (H)
SU 13	Op. Hail	7700 Target	Hail Suppression	Krasnodar Region	1967 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud at -6 and at cloud base using rockets and artillery shells carrying pyrotechnic flare and explosive generators	AgI	Convective clouds, predominant cloud base temp. +7° to +14°C. Operations alert based on forecast of 0.4 or greater probability of hail; seeding criteria based on ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	40 Days: May-Sept	Yes/ Yes (H)
SU 14	Op. Hail	12400 Target	Hail Suppression	Azerbaijan SSR	1967 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud between -0 and -12°C and at cloud base using rockets and artillery shells carrying pyrotechnic flare and explosive generators	AgI	Convective clouds, predominant cloud base temp. +3 to +9°C. Operations alert based on forecast of 0.4 or greater probability of hail; seeding criteria based on ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	58 Days: Apr-Oct	Yes/ Yes (H)
SU 15	Op. Hail	8700 Target	Hail Suppression	Northern Caucasus	1967 Yes	Agr. (G), Wea. Serv. (G)	Air: seeding in-cloud between -3 and -15°C and at cloud base using rockets and artillery shells carrying pyrotechnic flare explosive generators	AgI	Convective clouds, predominant cloud base temp. +9 to +14°C. Operations alert based on forecast of 0.4 or greater probability of hail & seeding criteria based on ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	44 Days: May-Sept	Yes/ Yes (H)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNION OF SOVIET SOCIALIST REPUBLICS (Contd.)											
SU 16	Res. Hail	2500 Target 3000 Control	Complex Hail Experiment	Kabardino-Balkarian ASSR	1983 Yes	Res. (G), Wea. Serv. (G)	Air: seeding in-cloud between -3 and -9°C and at cloud base using rockets carrying pyrotechnic flare and explosive generators	AgI	Convective clouds, predominant cloud base temp. +5 to +10°C. Operations alert based on forecast of 0.4 or greater probability of hail; seeding criteria based on ratio of radar reflectivity at 3.2 cm to that at 10 cm wave length being <1.	6 Days: May-Aug	Yes/No Physical effects of seeding monitored
UNITED STATES OF AMERICA											
US 1	Ops. PE(R)	4160 Target 7800 Control	Kings River Project	Kings River Watershed, California	1973 Yes	Hyd. (P)	G/B and Air: 15 ground based generators; cloud top seeding using 1 A/C, acetone burning and pyrotechnic flare generators	1.8 kg AgI total	Synoptic scale disturbances.	9 Days: July-Sept	No/No
US 2	Op. PE(R)	1350 Target 988 Control	85-172 KDWDC Project	Kaweah River Watershed, California	1976 Yes	Hyd., (P)	G/B and Air: 5 G/B generators, cloud top seeding by 1 A/C, acetone burning generators and pyrotechnic flares	2-20 g/min/pyrotechnic flare generator, 10-20 g/hr/acetone burning generator, 7.542 kg AgI total	Orographic clouds	Jan-Mar, Nov, Dec	No/No
US 3	Op. PE	-	Tahoe-Truckee Project	Lake Tahoe - Truckee River Watershed, Nevada and California	1977 Yes	Hyd. (G-State)	G/B: 6 acetone, isopropylamine and kerosene burning generators	42 g/hr/generator (isopropylamine), 22 g/hr/generator (acetone), 4.8 kg AgI total	Orographic clouds	15 Days: Mar-May, Dec	No/No
US 4	Ops. PE(R)	13000 Target	Walker River Project	Walker River Watershed, California and Nevada	1977 Yes	Hyd. (G-State)	Air: 2 A/C seeding at cloud top using acetone burning and pyrotechnic flare generators	2 g/min/pyrotechnic flare, 0.5 to 3.0 gal/hr (27 AgI/acetone), 3.865 kg AgI total	Orographic clouds	26 Days: Mar-Jun, Nov-Dec	No/No
US 5	Op. PE	614 Target 2600 Control	Upper American River Project	Sacramento, California	1979 Yes	Hyd., Energy (G-Muni.)	G/B: 8 acetone burning generators	20 g/hr/generator, 14.776 kg AgI total	Orographic clouds	19 Days: Jan-Mar, Nov, Dec	No/No
US 6	Op. PE(R)	1196 Target	Ruby Mountains Project	Nevada	1981 Yes	Res. (G-State)	G/B: 6 G/B aerosol generators	50 g/hr, 0.497 kg AgI total	Orographic clouds	4 Days: Dec	No/No

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNITED STATES OF AMERICA (Contd.)											
US 7	Op. PE(R)	3120 Target 15600 Control	85-491 Kern River Project	Kern River Watershed, California	1982 Yes	Hyd. (P)	Air: 1 A/C using pyrotechnic flares seeding AgI at cloud top and in-cloud	60 to 30,000 g/hr, 4.29 kg AgI total	Orographic clouds	16 Days: Nov-Feb	No/No
US 8	Op. PE(R)	2600 Target	85-507 T-18	Texas portion of the water-shed of the Red Bluff Lake	1983 Yes	Energy and Hyd. (P)	G/B: 13 arc-type AgI generators	0.5 to 2.0 g AgI/ hr/generator, 5.776 kg AgI	Convective clouds & synoptic scale disturbances.	Jan-Dec	No/No
US 9	Op. PE(R)	1820 Target 2600 Control	Santa Clara Valley Project	Santa Clara City, California	? Yes	Hyd. (G-local)	G/B: using AgI-NH_4I generators	35 g/hr, 6.633 kg AgI total	Orographic clouds	5 Days: Jan and Mar	No/No
US 10	Op. PE(R)	6240 Target 26000 Control	85-540 Utah Snowpack Augmentation Program	Southern Utah Washington County	1985 Yes	Hyd. (G-local)	G/B: 12 propane burning AgI generators	6 g/hr, 4.4 kg AgI total	Orographic clouds	12 Days: Jan-Mar	No/No
US 11	Op. PE(R)	9100 Target	85-541 Colorado River Municipal Water District Project	Big Springs, Texas	1975 Yes	Agr. (P)	Air: A/C, pyrotechnic generators, in-cloud seeding at -10°C	2.7 to 7.1 g/min, 5.160 kg AgI total	Convective & layer clouds.	18 Days: Apr-Sept	No/No
US 12	Op. PE(R)	218 Target	85-542 Project OC-4	South Central Texas County, Oklahoma	1977 Yes	Agr. (P)	G/B: 10 arc type generators	0.5 to 2 g/hr/ generator, 2.774 kg AgI total	Convective & layer clouds.	115 Days: Apr-Oct	No/No
US 13	Op. PE(R) and Op. Hail	31200 Target	85-544 Western Kansas Weather Modification	West Central and Southwest Kansas	1975 Yes	Hyd. (G-local)	Air: 4 A/C, acetone burning & solid dispensing gen-erators, seeding at cloud base & top	0.126 l/min, 42.851 kg AgI total; 1 or 2 lbs/ min, 786 kg dry ice (solid CO_2) total	Convective clouds	53 Days: Apr-Sept	No/No
US 14	Ops. Fog	26 Target	85-545 Fog Dispersal Project	Medford, Oregon	1972 Yes	Trans (P)	Air: 1 A/C, cloud top seeding using solid dispensing unit	6650 kg dry ice (solid CO_2) total	Layer clouds. Criteria for seeding is the occurrence of super-cooled fog.	17 Days: Dec-Feb	No/No
US 15	Ops. Fog	52 Target	85-546 Airport Fog Dispersal Project	Spokane, Washington	1979 Yes	Trans (P)	Air: 1 A/C, cloud top seeding using solid dispensing unit	6 lbs/mile, 7682 kg dry ice (solid CO_2) total	Layer clouds, predominant cloud base temp. 0°C. Seeding criteria based on occurrence of supercooled fog.	19 Days: Nov-Jan, Mar	No/No

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNITED STATES OF AMERICA (Contd.)											
US 16	Op. PE(R)	11700 Target	85-547 City of San Angelo	San Angelo, Texas	1985 Yes	Hyd. (G-City)	Air: 1 A/C seeding at cloud base and in-cloud using acetone burning & pyrotechnic flare generators	150-225 g/hr/generator (acetone), 2 g/s/generator (pyrotechnic), 21.123 kg AgI total	Convective clouds	36 Days: Apr-Oct	No/No
US 17	Op. PE(R)	11700 Target	85-548 City of Corpus Christi	Southwest of Corpus Christi, Texas	? Yes	Hyd. (G-City)	Air: 1 A/C seeding at cloud base & cloud top using acetone burning & pyrotechnic flare generators	150-225 g/hr/generator (acetone), 2 g/s/generator (pyrotechnic), 2.905 kg AgI total	Convective clouds	16 Days: May-Sept	No/No
US 18	Op. PE(R)	9178 Target	85-549 North Dakota Weather Modification Project District I	West Central North Dakota	1977 Yes	Energy (G-State)	Air: in-cloud (-2°C -12.5°C) and cloud base seeding using acetone burning, solid dispensing & pyrotechnic flare generators carried by A/C	32.2 kg AgI total; 149.8 dry ice (solid CO_2) total	Convective clouds. Seeding criteria based on cloud base height, cloud base diameter, temp., & liquid water content.	35 Days: June-Aug	No/No
US 19	Op. Hail and PE(R)	17711 Target	85-550 North Dakota Weather Modification Project District II	Northwestern North Dakota	1977 Yes	Agr. (G-State)	Air: in-cloud (-2 to -12.5°C) and cloud base seeding using acetone burning, solid dispensing & pyrotechnic flare generators carried by A/C	28.450 kg AgI total; 404.7 kg dry ice (solid CO_2) total	Convective clouds. Seeding criteria based on cloud base height, cloud base diameter, temp., & liquid water content.	35 Days: June-Aug	No/No
US 20	Op. PE(R) and Hail	6973 Target	85-551 Harding County Weather Modification Program	Harding County, South Dakota	1977 Yes	Agr. (G-local)	Air: cloud top & in-cloud (-2 to -12.5°C) seeding using acetone burning, solid dispensing & pyrotechnic flare generators carried by A/C	7.140 kg AgI total	Convective clouds. Seeding criteria based on cloud base height, cloud base diameter temp., & liquid water content.	15 Days: June-Aug	No/No
US 21	Op. PE(R)	20280 Target	85-552 Edwards Underground Water District	West of San Antonio, Texas	? Yes	Hyd. (G-local)	Air: 2 A/C seeding at cloud top and in-cloud using acetone burning and pyrotechnic flare generators	150-225 g/hr/generator (acetone), 2 g/sec/hr per pyrotechnic flare, 0.790 kg AgI total	Convective clouds	7 Days: July-Sept	No/No

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNITED STATES OF AMERICA (Contd.)											
US 22	Op. PE(R)	2829 Target	85-554 OC-16	Comanche County, Oklahoma	1985 Yes	Agr. (G-local) Hyd. (G-local)	G/B: 22 arc type generators	0.5 or 2.0 g/hr, 2.231 kg AgI total	Convective clouds	52 Days: July-Oct	No/No
US 23	Op. Fog	26 Target	85-555 Supercooled Fog Dispersal Project	Salt Lake City, Utah	1972 Yes	Trans. (P)	Air: cloud top seeding using 1 A/C dispensing dry ice (solid CO_2)	709 kg dry ice total	Layer clouds. Seeding criteria based on occurrence of supercooled fog.	1 Day: Dec	No/No
US 24	Op. PE(R)	5348 Target	85-556 Delaware	Central Delaware	1985 ?	Agr. (G-State)	Air: 1 A/C seeding in-cloud at -10°C using pyrotechnic flare generators	10 g/m/flare, 0.220 kg AgI total	Convective clouds	9 Days: July-Sept	No/No
US 25	Op. PE(R)	260 Target 1300 Control	85-557 Brian Head Snowpack Augmentation	Eastern Iron County, Utah	? ?	Hyd. (P)	Air: 1 A/C seeding at cloud top using solid dispensing & pyrotechnic flare generators	10.1 g/cloud, 0.520 kg AgI total, 1-10 lb/cloud, 432 kg dry ice (solid CO_2) total	Orographic clouds	5 Days: Oct-Dec	No/No
US 26	Ops. PE(R)	468 Target	85-558 Wind River Weather Modification Project	Big Sandy River Drainage, Wyoming	1972 Yes	Agr. (P) & Hyd. (P)	G/B: AgI-NH_4I propane fueled generators	10 to 15 g/hr, 7.410 kg AgI total	Orographic & layer clouds, predominant cloud base temp. less than 0°C.	24 Days: Jan-Mar	No/No
US 27	Op. PE(R)	6240 Target	85-560 Utah Snowpack Augmentation Project	Mountain Watersheds in Utah	1974 No	Energy (G-State) Hyd. (G-State)	G/B: propane operated AgI generators	6 g/hr, 4.306 kg AgI total	Orographic clouds & bands organized on mesoscale.	4 Days Nov-Dec	Yes/Yes
US 28	Op. PE(R)	650 Target	85-561 Mokelumne Project	Central Sierra Nevada Mountains, California	1974 Yes	Agr. (P) Energy (P)	G/B: 5 acetone burning generators	25 g/hr, 2.408 kg AgI total	Orographic clouds, bands organized on mesoscale. Seeding criteria based on height of freezing level, height of -10°C isotherm, cloud top temp., average wind speed & direction.	5 Days: Nov-Dec	No/Yes Ramdomized experiment

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNITED STATES OF AMERICA (Contd.)											
US 29	Op. PE(R)	1300 Target	85-562 Lake Almanor Project	Northern Sierra Nevada Mountains, California	1972 Yes	Agr. (P), Energy (P)	G/B: 5 acetone burning generators	25 g/hr, 11.388 kg AgI total	Orographic clouds. Seeding criteria based on height of freezing level, height of -10°C isotherm, cloud top temp., average wind speed & direction	9 Days: Nov-Dec	No/Yes Randomized Experiment
US 30	Ops. Fog	5.2 Target	85-563 Ground-based Cold Fog Dissipation System	Elmendorf AFB, Alaska	1971 Yes	Def. (G)	G/B: 24 tanks (dispensers) spraying liquid propane	12 gal/hr/dispenser, 1890 gal propane total	Layer clouds, predominant cloud base temp. <0°C. Seeding criteria is the occurrence of supercooled fog.	9 Days: Nov-Dec	No/Yes
US 31	Ops. Fog	130 Target	85-564 Cold Fog Dispersal System	Fairchild AFB, Washington	1971 Yes	Def. (G)	G/B: 23 liquid propane spraying units	10 gal/hr, 4660.6 kg propane total	Layer clouds, predominant cloud base temp. <0°C. Seeding criterion is the occurrence of supercooled fog.	14 Days: Nov-Dec	Yes/Yes
US 32	Ops. PE(R) snow for ski area	260 Target	85-566 Sun Valley Ski Area	Sun Valley, Idaho	1980 Yes	Rec. (P)	G/B and Air: 1 to 2 generators, in-cloud seeding using 1 A/C, acetone and pyrotechnic burning generators	100 to 300 g/hr, 3.7 kg AgI total	Orographic clouds, predominant cloud base temp. <0°C.	12 Days: Nov-Dec	No/No
US 33	Ops. PE(R)	3900 Target 2072 Control	85-568 San Juan Program	Southwest Colorado	1977 Yes	Agr. (P), Hyd. (P)	G/B: 6 acetone burning generators	5 to 40 g/hr, 1.925 kg AgI total	Orographic clouds, bands organized on mesoscale.	7 Days: Nov-Feb	Yes/Yes
US 34	Ops. PE(R)	260 Target 2072 Control	85-567 Central Colorado Project	Vail and Beaver Creek, Colorado	1978 Yes	Agr. (P), Forestry Rec. (P)	G/B: 8 acetone burning generators	5-40 g/hr, 5.173 kg AgI total	Orographic clouds, bands organized on mesoscale.	17 Days: Nov-Feb	Yes/Yes

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNITED STATES OF AMERICA (Contd.)											
US 35	Appl. Res. PE	800 Target	Sierra Co-operative Pilot Project	Central Sierra Nevada, California	1976 Yes	Hyd. (G)	Air: 1 A/C seeding in-cloud (-7 to -13°C) and at cloud top. Seeding region selection based on numerical model incorporating a 3-dimensional flow & crystal growth & fallout pyrotechnic flare & solid dispensing generators	20 g/flare/10 sec flight 10 kg AgI total 6 lbs/run or about 0.5 kg/km 250 kg dry ice (solid CO_2) total	Convective, layer, orographic clouds with predominant cloud base temp. of +5°C. Seeding criteria based on neutrally stable or orographically induced cloud following descent of upper clouds inducing supercooled liquid water. Targeting model runs to see if winds, liquid water & temp. conditions will allow crystal fallout in target area.	10 Days: Jan-Mar	Yes/Yes Direct physical observations in cloud and at ground
ZIMBABWE											
ZW 1	Op. PE(R)	390500 Target	National Cloud Seeding Operation (NACSO) Zimbabwe	Zimbabwe	1972 Yes	Wea. Serv. (G)	Air: 2 A/C seeding at cloud top and in-cloud at temp. -10°C or below, using pyrotechnic flares	AgI, 1908 pyro-technic cartridges type TBZ consumed	Convective clouds, cloud bases are estimated to be about +20°C. Developing Cu with tops at or below -10°C (about 21000 ft AMSL) seeded.	50 Days: Nov/85 through Apr/86	Yes/Yes Randomized experiment 1935 clouds seeded

VII - ADDRESSES OF REPORTING AGENCIES

ARGENTINA	Ministerio de Gobierno Provincia de Mendoza Dirección de Investigación de Lucha Antigranizo Casa de Gobierno Cuerpo Central, 3rd. Piso 5500 MENDOZA
AUSTRALIA	Bureau of Meteorology GPO Box 1289 K MELBOURNE, Vic., 3001
AUSTRIA	Zentralanstalt für Meteorologie und Geodynamik Hohe Warte 38 A-1190 WIEN
BULGARIA	Hydrometeorological Service Institute of Hydrology and Meteorology Blvd. Lenin 66 SOFIA
CANADA	Atmospheric Environment Service 4905 Dufferin St. DOWNSVIEW, Ontario M3H 5T4
DOMINICAN REPUBLIC	Corporación Dominicana de Electricidad Dirección de Desarrollo Hidroeléctrico Edificio 8, Jardines del Embajador SANTO DOMINGO
FRANCE	ANELFA 52, rue Alfred-Duméril 31400 TOULOUSE
GERMANY, FEDERAL REPUBLIC OF	Deutscher Wetterdienst Frankfurter Str. 135 6050 OFFENBACH AM MAIN

ADDRESSES OF REPORTING AGENCIES (Contd.)

HUNGARY	Meteorological Service of the Hungarian People's Republic P.O. Box 38 H-1525 BUDAPEST
INDIA	Indian Institute of Tropical Meteorology Shivajinagar PUNE - 411005
ISRAEL	E.M.S., Hebrew University of Jerusalem Mekorot Water Co. E.M.S. Rainfall Stimulation Branch P.O. Box 20 BEN GURION AIRPORT 70100
ITALY	Consorzio Provinciale Antigrandine Via Gazzolle, 1 VICENZA
MADAGASCAR	Service Météorologique Division Climatologie et Prévision Générale Bureau de Pluie Provoquée B.P. 1254 101 ANTANANARIVO
MEXICO	Dirección General de Estudios Información y Estadistica Sectorial Secretaría de Agricultura y Recursos Hidraúlicos Ave. Observatorio No. 192 Col. Observatorio C.P. 11860 MEXICO, D.F.
MOROCCO	Direction de la Météorologie Nationale Programme AL-GHAIT Aéreport d'ANFA B.P. 8106 CASABLANCA-CASA-OASIS 02
NORWAY	Civil Aviation Administration P.O. Box 8124, Dep. 0032 OSLO 1

ADDRESSES OF REPORTING AGENCIES (Contd.)

SPAIN	Instituto Nacional de Meteorología Sección de Meteorología Agrícola Apartado 285 MADRID
SWITZERLAND	Swiss Meteorological Institute Division de la Recherche Krähbühlstrasse 58 CH-8044 ZURICH
USA	National Oceanic and Atmospheric Administration 6010 Executive Blvd. ROCKVILLE, MD 20852 U.S. Bureau of Reclamation Division of Atmospheric Resources Research 471 Maidu Drive AUBURN, CA 95603
USSR	USSR State Committee for Hydrometeorology and Control of Natural Environment 12, Pavlik Morozov Street 123376 MOSCOW
ZIMBABWE	Department of Meteorological Services P.O. Box BE 150 Belvedere HARARE

VIII - REPORTS ON COMPLETED WEATHER MODIFICATION PROJECTS

W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

R/CLA/4, ANNEX B
(Australia)

REPORT ON COMPLETED WEATHER MODIFICATION PROJECT

(Please mark X in box or boxes which apply)

MEMBER OF WMO: AUSTRALIA

1. Description of project

1.1 Project identification (name/location/organization)
Tasmanian Area Cloud Seeding Experiment Stage II
Hydro-Electric Commission Tasmania Australia

1.2 Purpose(s) of project:

Precipitation augmentation - rainfall /X/ snow / /

Hail suppression / /

Lightning suppression / /

Other (please specify) . . . . . .

. . . . . .

1.3 Major cloud type involved:

Orographic / / Cumulus / / Stratiform /X/ Frontal / /

2. Duration of project

2.1 Project duration in years: 5 years

2.2 Operational period within each year: from April

to September inclusive.

3. Seeding operation

3.1 Seeding agent: AgI /X/ CO_2 / / NaCl / /

Other (please specify) . . . . . .

3.2 Generator(s): On ground / / Airborne /X/

If on ground, please give number of generators: . . . . . .

ANNEX B, p. 2
(Australia)

3.3 Procedure for airborne seeding:

Altitude of seeding 2000 - 4500 m

Length of seeding track 45 km

Seeding rate 0.67 Kg h^{-1}

4. Project design

4.1 Basic design: Target only / / Target + control /X/

Cross-over / /

4.2 Distance between areas: 20 - 60 km km

4.3 Area definition: Fixed /X/ Variable / / Both fixed control areas(3) and variable control area

If variable, give basis for definition Upwind of target area (subsidiary analysis) 90° sector containing 10 raingauges

4.4 Area subdivisions, if any (give number and nature) 4 control areas .

1. North Control - 2. South Control - 3. North West Control - 4. Upwind Control

5. Project site

5.1 Project terrain: Mountainous /X/ Hilly / / Flat / /

5.2 Size of target area: 3200 km^2

5.3 Size of control area(s): 11680 km^2

5.4 Number of precipitation gauges:

5.4.1 All types of precipitation gauges: in target area 17

in control area(s). 80

5.4.2 Recording precipitation gauges: in target area 10

in control area(s). 17

5.5 Other verification quantities (e.g., radar reflectivity, aircraft cloud measurements, hailpads, etc.):

Aircraft cloud measurements - Temp, liquid water content, depth

6. Experimental unit

6.1 Duration of unit in hours or days: 1-day

6.2 Conditions determining whether unit is seedable or not:

Cloud top temp. Colder than -5°C, liquid water content $\geq$ 0.1 g/m^3

6.3 Total number of units seeded and not seeded (in case of cross-over design this applies to each area):

Suitable seeded days = 57 - Suitable unseeded days = 32

6.4 Randomization of experimental units:

Unrestricted / / Restricted /X/

If restricted, give nature of restriction: Ratio of seeded to unseeded = 2·1

6.5 ~~Standard~~ Mean seeding period: 1·5 hours

7. Overall project results (no stratification or partitioning)

7.1 Name of statistical test(s) and/or analysis (analyses): (A) Double ratio analysis (B) Least squares regression

7.2 Transformation(s) for each test: NONE

7.3 Results for each test and/or analysis: (A) DR = 1:30 Sig @ 1% level
(Target west only) (B) L.S. Reg. = +22% Sig @ 1% level
Target east (A) D.R. = 1·21 Sig = 17% - (B) L.S. Reg. = ?

7.3.1 Qualitative:

No difference / / More precipitation /X/ Less precipitation / /

Less hail mass / /

Other qualitative results:

7.3.2 Quantitative:

Seed/no-seed ratio: Statistical significance:

8. Basis for assessment of results

8.1 Analytical specifications fixed before the project

8.1.1 Nature of stratification(s), if any Westerly wind sector, 231° - 300°

8.1.2 Sample size for each stratification (No. of seed/no-seed units)

39 days of westerly winds 28 seeded/11 unseeded

8.1.3 Test(s) and/or analysis (analyses) for each stratification:

Double ratio and least squares regression

8.1.4 Transformation(s) for each stratification and each test:

NONE

8.1.5 Results for each stratification, test and transformation:

8.1.5.1 Qualitative: More precipitation

8.1.5.2 Quantitative: →

Target west	DR =	1.37	Sig 0.5%
	LSR =	+27%	Sig 2%
Target east	DR =	1.81	Sig 2%
	LSR =	+61%	Sig 1%

ANNEX B, p. 4
(Australia)

8.2 Analytical specifications chosen after the project Numerous physical analyses. See report.

8.2.1 Nature of partitioning(s):

8.2.2 Sample size for each partition (No. of seed/no-seed units):

8.2.3 Test(s) and/or analysis (analyses) for each partition:

8.2.4 Transformation(s) for each partition and each test:

8.2.5 Results for each partition, test and transformation:

8.2.5.1 Qualitative:

8.2.5.2 Quantitative:

9. Extended area effects (i.e., outside the target area)

9.1 Sign of effect: - No discernible effect.

9.2 Maximum distance observed: 80 km

9.3 Statistical significance (size of area and probability):

10. Comments

11. Principal references to published results (where details of above may be found):

Analysis of hydro-electric commission cloud seeding in Tasmania 1979-83
D.E. Shaw; W.D. King; and E. Turton

C.S.I.R.O. Division of Atmospheric Research
P.O. Box 134 Epping
N.S.W. 2121
Australia

W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

R/CLA/4, ANNEX B
(Austria)

REPORT ON COMPLETED WEATHER MODIFICATION PROJECT

(Please mark X in box or boxes which apply)

MEMBER OF WMO: AUSTRIA

1. Description of project

1.1 Project identification (name/location/organization) " 2 Projects
(1) Hail defense "Lower Austria"/Krems-Langenlois/Kulturenschutz /F. Langenlois
(2) Hail defense "Styria"/Weiz-Gleisdorf/Steir. Hägelabwehr

1.2 Purpose(s) of project:

Precipitation augmentation - rainfall / / snow / /

Hail suppression /X/

Lightning suppression / /

Other (please specify) . . . . . .

1.3 Major cloud type involved:

Orographic / / Cumulus /X/ Stratiform / / Frontal / /

2. Duration of project

2.1 Project duration in years: 5 (10 planned)

2.2 Operational period within each year: from May 15

to Sept. 15 inclusive.

3. Seeding operation

3.1 Seeding agent: AgI /X/ CO_2 / / NaCl / /

Other (please specify) . . . . . .

3.2 Generator(s): On ground / / Airborne /X/

If on ground, please give number of generators: . . . . . .

ANNEX B, p. 2
(Austria)

3.3 Procedure for airborne seeding:

Altitude of seeding . . . . . m

Length of seeding track . . . . . m or km

Seeding rate 10 l 7% solution . . . . . h^{-1}

4. Project design

4.1 Basic design: Target only /X/ Target + control / /

Cross-over / /

4.2 Distance between areas: . . . . . km

4.3 Area definition: Fixed /X/ Variable / /

If variable, give basis for definition . . . . . .

4.4 Area subdivisions, if any (give number and nature) . . . . . .

. . . . . .

5. Project site

5.1 Project terrain: Mountainous / / Hilly /X/ Flat / /

5.2 Size of target area: (1) 500 (2) 1600 km^2

5.3 Size of control area: . . . . . km^2

5.4 Number of precipitation gauges:

5.4.1 All types of precipitation gauges: in target area 15

in control area . . . . . .

5.4.2 Recording precipitation gauges: in target area 40

in control area . . . . . .

5.5 Other verification quantities (e.g., radar reflectivity, aircraft cloud measurements, hailpads, etc.):

Hail-pads-network (mean distance 2 km) (1) 126 (2) 240

6. Experimental unit

6.1 Duration of unit in hours or days: (1) 20 days (2) 30 days

6.2 Conditions determining whether unit is seedable or not: . . . . . .

Forecast, radar reflectivity, observation cloud development

6.3 Total number of units seeded and not seeded (in case of cross-over design this applies to each area):

. . . . . .

6.4 Randomization of experimental units:

Unrestricted /__/ Restricted /__/

If restricted, give nature of restriction: . . . . . .

. . . . . .

6.5 Standard seeding period: (1) 40 . . (2) 70 . . hours

7. Overall project results (no stratification or partitioning)

7.1 Name of statistical test(s) and/or analysis (analyses): 100-200 cases
Analysis with met-radar-hailpad-seeding-insurance-data

7.2 Transformation(s) for each test: . . . . . .

7.3 Results for each test and/or analysis: . . . . . .

7.3.1 Qualitative:

No difference /__/ More precipitation /__/ Less precipitation /__/

Less hail mass /__/

Other qualitative results: Actually testing hail damage - rate in target area and sourroundings

7.3.2 Quantitative:

Seed/no-seed ratio: . . . . . Statistical significance: . . . . .

8. Basis for assessment of results

8.1 Analytical specifications fixed before the project

8.1.1 Nature of stratification(s), if any OROGRAPHY

8.1.2 Sample size for each stratification (No. of seed/no-seed units)
20 for each

8.1.3 Test(s) and/or analysis (analyses) for each stratification:
Vertical distribution of met. elements

8.1.4 Transformation(s) for each stratification and each test:

8.1.5 Results for each stratification, test and transformation:

8.1.5.1 Qualitative: The orographic reasons for the hail development could be ascertained - high correlation between hail pad data and crop damages was found.

8.1.5.2 Quantitative:

8.2 Analytical specifications chosen after the project Work in progress

8.2.1 Nature of partitioning(s):

8.2.2 Sample size for each partition (No. of seed/no-seed units):

8.2.3 Test(s) and/or analysis (analyses) for each partition:

8.2.4 Transformation(s) for each partition and each test:

8.2.5 Results for each partition, test and transformation:

8.2.5.1 Qualitative:

8.2.5.2 Quantitative:

9. Extended area effects (i.e., outside the target area)

9.1 Sign of effect:

9.2 Maximum distance observed:

9.3 Statistical significance (size of area and probability):

10. Comments : Comparisons between hail damage in target area and surroundings using hail-insurance data are planned.

11. Principal references to published results (where details of above may be found):

ORGANISATION METEOROLOGIQUE MONDIALE

R/CLA/4, ANNEXE B
(France (1)

RAPPORT SUR UN PROJET DE MODIFICATION ARTIFICIELLE DU TEMPS DEJA REALISE

(veuillez cocher x dans la ou les cases appropriées)

MEMBRE DE L'OMM : FRANCE
(Groupement national d'étude des fléaux atmosphériques)

1. Description du projet

1.1 Identification du projet (titre/zone d'exécution/organisation) .....
GROSSVERSUCH IV Test de la méthode soviétique de lutte anti-grêle
.....
par 3 pays Italie - Suisse - France.
.....

1.2 But(s) du projet :

augmentation des précipitations - pluie [ ] neige [ ]

suppression de la grêle [X]

suppression de la foudre [ ]

autres modifications (veuillez préciser) .....

.....

1.3 Principaux types de nuages traités :

Orographiques [ ] Cumulus [X] Stratiformes [ ] Système frontal [ ]

2. Durée du projet

2.1 Durée du projet, en années : 3 années préparations, 5 années d'expérimentation
4 années d'analyse.

2.2 Période opérationnelle au cours de chaque année : du .....15 mai..... au
...15 septembre.....inclusivement.

3. Opérations d'ensemencement

3.1 Agent d'ensemencement : AgI [X] CO_2 [ ] NaCl [ ]

Autres (veuillez préciser)

3.2 Générateur(s) Au sol [ ] Aéroporté [ ]

Dans le cas de générateurs au sol, veuillez indiquer le nombre de générateurs utilisés .....

3.3 Méthode d'ensemencement par ~~aaaaaaiixaéxaaaaxxx~~ fusées sol/air

Altitude de l'ensemencement ....4000 à 8000 mètres..... m

Longueur de la trajectoire suivie pour l'ensemencement .....8000..... m ~~xxxkxx~~

Taux d'ensemencement .....84 g par fusée..... kg h^{-1}

4. Conception du projet

4.1 Conception de base : Zone cible seulement [ ]

Zone cible et zone témoin [ ] Zone cible ~~xet/~~ ou zone témoin [X]
sans distinction Tirage au sort

4.2 Distance entre les zones ..... km

4.3 Définition d'une zone : Fixe [X] Variable [ ]

Si elle est variable, veuillez indiquer les critères de définition .....

.....

4.4 Subdivisions des zones, le cas échéant (indiquer le nombre et la nature)

.....

5. Site du projet

5.1 Terrain : montagneux [ ] accidenté [X] plat [ ]

5.2 Superficie de la zone cible .....1200..... km^2

5.3 Superficie de la zone témoin .....1200..... km^2 même zone

5.4 Nombre de ~~pluviomètres~~ grêlimètres :

5.4.1 Tous types de ~~pluviomètres~~ grêlimètres : Dans la zone cible .....340.....
Dans la zone témoin .....

5.4.2 Pluviographes : Dans la zone cible .....30.....
Dans la zone témoin .....

5.5 Autres mesures de vérification (par exemple, réflectivité radar, mesure des nuages par aéronefs, coussins à grêle, etc.) : .....
Réflectivité radar - Calcul Energie cinétique
.....

6. Unité expérimentale

6.1 Durée de l'unité en heures ou en jours .....12 h/21 heures.....

6.2 Conditions permettant de déterminer si une unité est ensemençable ou pas :
Prévision jour - Alarme - Mesure radar 3 cm critère K soviétique.

6.3 Nombre total d'unités ensemencées et non ensemencées (dans le cas de la conception avec zone cible et/ou zone témoin, sans distinction, ceci s'applique à chaque zone : 220 unités

6.4 Répartition aléatoire des unités expérimentales :

illimitée [ ] limitée [X]

Dans ce dernier cas, indiquer la nature des limites fixées 5 ans

6.5 Période standard d'ensemencement : 12 h/21 h heures

7. Résultats d'ensemble du projet (pas de stratification ou de division)

7.1 Test(s) statistique(s) et/ou analyses : Confirmatoires : Test t, Mann Whitney, C_X, Rerandomization .

7.2 Transformation(s) pour chaque test Non, Log,

7.3 Résultats de chaque test et/ou analyses :

7.3.1 Qualitatifs :

Pas de différence [X] augmentation des précipitations [ ]

Diminution des précipitations [ ]

Diminution de la masse de grêle [ ]

Autres résultats qualitatifs :

7.3.2 Quantitatifs :

Rapport ensemencement/pas d'ensemencement : Pas d'effet

Signification statistique Très supérieur à 005

8. Critères choisis pour l'évaluation des résultats

8.1 Spécifications analytiques fixées avant le projet oui

8.1.1 Nature de la ou des stratifications(s), le cas échéant oui

8.1.2 Dimension de l'échantillon pour chaque stratification (nombre d'unités ensemencement/pas d'ensemencement)

8.1.3 Test(s) et/ou analyse(s) pour chaque stratification : Même type de test - Analyse variance - Analyse discriminante.

8.1.4 Transformation(s) pour chaque stratification et pour chaque test :

8.1.5 Résultats pour chaque stratification, test et transformation :

8.1.5.1 Qualitatifs :

8.1.5.2 Quantitatifs : Analyse discriminante avec la fonction

$-2,41 \log S_G + 1,54 \log N_{Tm} - 1,67$ $p = 0,005$

Variables d'intensité moyenne $\overline{N}_G = (N_G/S_G)$ $p = 0,05$

8.2 Spécifications analytiques choisies <u>après</u> le projet oui

8.2.1 Nature de la ou des subdivision(s) : Type d'orage, prédicteur météo.

8.2.2 Dimension de l'échantillon pour chaque subdivision (nombre d'unité ensemencement/pas d'ensemencement) :

8.2.3 Test(s) et/ou analyse(s) pour chaque subdivision :

8.2.4 Transformation(s) pour chaque subdivision et chaque test :

8.2.5 Résultats pour chaque subdivision, test et transformation

8.2.5.1 Qualitatifs :

8.2.5.2 Quantitatifs :

9. Effets observés (c'est-à-dire à l'extérieur de la zone cible)

9.1 Indice de l'effet :

9.2 Distance maximale observée :

9.3 Signification statistique (superficie de la zone et probabilité)

10. Commentaires

Résultats confirmatoires : pas d'effet.
Résultats exploratoires : effets statistiques, mais difficilement interprétables en sens physique.
L'analyse discriminante montre une différence entre 2 échantillons avec ($p = 0,005$).
. Les variables d'intensité moyenne $\overline{N}_G$ sont statistiquement inférieures ($p = 0,05$).
. Avec un prédicteur météo l'énergie cinétique de la grêle est inférieure dans les cas Seed ($p = 0,015$).

11. Principales références à des résultats publiés (dans lesquels sont indiqués les détails des procédures ci-dessus)

REFERENCES

D'Aubigny, G.T., Banmandzadeh, 1985 : First results of exploratory data analysis in Grossversuch IV experiment on hail suppression. Proc., W.M.O./IAMAP, 4th Sci. Conf. Weather Modification, Honolulu, vol. II, pp. 607-612.

Der Megreditchian, G., J.F. Mezeix, 1985 : Exploratory analysis of the results of Grossversuch IV experiment. Proc. W.M.O./IAMAP, 4th Sci. Conf. Weather Modification, Honolulu, voL II, pp. 601-605.

Federer, B., A. Waldvogel, W. Schmid, H.H. Schieres, F. Hampel, N. Schweingruber, W. Stabel, J. Bader, J.F. Mezeix, N. Doras, G. d'Aubigny, G. Der Megreditchi: D. Vento, 1986 : First results of Grossversuch IV. J. Clim Appl. Meteo, in press.

Mezeix, J.F., 1983 : Climatologie et prévention de la grêle dans l'expérience italo-franco-suisse Grossversuch IV. Thèse d'Etat, Univ. Clermont-Fd. II, 243 p.

Mezeix, J.F. and D. Vento, 1984 : Results of Grossversuch IV using hailpad data, 9th Int. Cloud Physics Conf., vol. V, Tallin.

Mezeix, J.F., 1985 : Exploratory evaluations of the Grossversuch IV experiment using hailpad data. Proc. W.M.O./IAMAP, 4th Sci. Conf. Weather Modification, Honolulu, vol. II, pp. 535-540.

Mezeix, J.F., 1985 : Recherches récentes en matière de lutte anti-grêle. Résultats de l'expérience italo-franco-suisse Grossversuch IV. C.R. Acad. Agri. de France, 71, n° 11.

Mezeix, J.F., A. Waldvogel, D. Vento, 1986 : La Grêle. La Recherche, n° 175, pp. 300-310.

Waldvogel, A., 1984 : Results of Grossversuch IV using radar data. 9th Int. Cloud Physics Conf., vol. III, Tallin.

ORGANISATION METEOROLOGIQUE MONDIALE

R/CLA/4, ANNEXE B

(France (2)

RAPPORT SUR UN PROJET DE MODIFICATION ARTIFICIELLE DU TEMPS DEJA REALISE

(veuillez cocher x dans la ou les cases appropriées)

MEMBRE DE L'OMM : .....FRANCE.....

1. Description du projet

1.1 Identification du projet (titre/zone d'exécution/organisation) .....
.ANELFA. Sud-Ouest.FRANCE.....
.....

1.2 But(s) du projet :
augmentation des précipitations - pluie [ ] neige [ ]
suppression de la grêle [X]
suppression de la foudre [ ]
autres modifications (veuillez préciser) .....
.....

1.3 Principaux types de nuages traités :
Orographiques [ ] Cumulus [X] Stratiformes [ ] Système frontal [ ]

2. Durée du projet

2.1 Durée du projet, en années : 35

2.2 Période opérationnelle au cours de chaque année : du ...1er AVRIL..... au .....31 OCTOBRE.....inclusivement.

3. Opérations d'ensemencement

3.1 Agent d'ensemencement : AgI [X] CO_2 [ ] NaCl [ ]

Autres (veuillez préciser)

ANNEXE B, p. 2
(France (2)

3.2 Générateur(s) Au sol [X] Aéroporté [ ]

Dans le cas de générateurs au sol, veuillez indiquer le nombre de générateurs utilisés ...448.....

3.3 Méthode d'ensemencement par appareil aéroporté

Altitude de l'ensemencement ..... m

Longueur de la trajectoire suivie pour l'ensemencement ..... m ou km

Taux d'ensemencement ..... kg h^{-1}

4. Conception du projet

4.1 Conception de base : Zone cible seulement [ ]

Zone cible et zone témoin [X] Zone cible et/ou zone témoin sans distinction [ ]

4.2 Distance entre les zones En.partie.limitrophes km

4.3 Définition d'une zone : Fixe [X] Variable [ ]

Si elle est variable, veuillez indiquer les critères de définition .....

.....

4.4 Subdivisions des zones, le cas échéant (indiquer le nombre et la nature)

Zones cible, témoin et tampon.....

5. Site du projet

5.1 Terrain : montagneux [ ] accidenté [ ] plat [X]

5.2 Superficie de la zone cible .....55.000..... km^2

5.3 Superficie de la zone témoin .....470.000..... km^2

5.4 Nombre de pluviomètres :

5.4.1 Tous types de pluviomètres : Dans la zone cible .....
Dans la zone témoin .....

5.4.2 Pluviographes : Dans la zone cible .....
Dans la zone témoin .....

5.5 Autres mesures de vérification (par exemple, réflectivité radar, mesure des nuages par aéronefs, coussins à grêle, etc.) : Données.des.assurances

..grêle.....

6. Unité expérimentale

6.1 Durée de l'unité en heures ou en jours ..année.....

6.2 Conditions permettant de déterminer si une unité est ensemençable ou pas :

.Toutes.les.unités.sont.ensemencées.....

6.3 Nombre total d'unités ensemencées et non ensemencées (dans le cas de la conception avec zone cible et/ou zone témoin, sans distinction, ceci s'applique à chaque zone : ...43.....

6.4 Répartition aléatoire des unités expérimentales :

illimitée ☐ limitée ☐

Dans ce dernier cas, indiquer la nature des limites fixées .....

.....

6.5 Période standard d'ensemencement : ....30.jours.X.10... heures/an

7. Résultats d'ensemble du projet (pas de stratification ou de division)

7.1 Test(s) statistique(s) et/ou analyses : ."Bivariate.test".de.Maronna.et..

....Yohai.....

7.2 Transformation(s) pour chaque test .Transformation.logarithmique.....

7.3 Résultats de chaque test et/ou analyses :

7.3.1 Qualitatifs :

Pas de différence ☐ augmentation des précipitations ☐

Diminution des précipitations ☐

Diminution de la masse de grêle ☒

Autres résultats qualitatifs : .....

.....

7.3.2 Quantitatifs :

Rapport ensemencement/pas d'ensemencement : .-.41.%.sur.dommages.....

Signification statistique ..1.%.....

8. Critères choisis pour l'évaluation des résultats

8.1 Spécifications analytiques fixées avant le projet

8.1.1 Nature de la ou des stratifications(s), le cas échéant

8.1.2 Dimension de l'échantillon pour chaque stratification (nombre d'unités ensemencement/pas d'ensemencement)

8.1.3 Test(s) et/ou analyse(s) pour chaque stratification :

8.1.4 Transformation(s) pour chaque stratification et pour chaque test :

8.1.5 Résultats pour chaque stratification, test et transformation :

8.1.5.1 Qualitatifs :

8.1.5.2 Quantitatifs :

8.2 Spécifications analytiques choisies <u>après</u> le projet

8.2.1 Nature de la ou des subdivision(s) :

8.2.2 Dimension de l'échantillon pour chaque subdivision (nombre d'unité ensemencement/pas d'ensemencement) :

8.2.3 Test(s) et/ou analyse(s) pour chaque subdivision :

8.2.4 Transformation(s) pour chaque subdivision et chaque test :

8.2.5 Résultats pour chaque subdivision, test et transformation

8.2.5.1 Qualitatifs :

8.2.5.2 Quantitatifs :

9. Effets observés (c'est-à-dire à l'extérieur de la zone cible)

9.1 Indice de l'effet : Pas d'effet sur la grêle dans la zone tampon

9.2 Distance maximale observée :

9.3 Signification statistique (superficie de la zone et probabilité)

10. Commentaires

11. Principales références à des résultats publiés (dans lesquels sont indiqués les détails des procédures ci-dessus)

Publications scientifiques dans lesquelles sont descrits l'expérience et ses résultats : DESSENS, J., 1986 - Hail in Southwestern France.

PART I - Hailfall charactéristics and hailstorm environment.
PART II - Results of a 30 year hail prevention project with silver iodide seeding from the ground.
Journal of Climate and Applied Meteorology, 25, 35-58

W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

R/CLA/4, ANNEX B
(Israel)

REPORT ON COMPLETED WEATHER MODIFICATION PROJECT

(Please mark X in box or boxes which apply)

MEMBER OF WMO: ISRAEL ~~XXXXX~~

1. Description of project

1.1 Project identification (name/location/organization) . . . . . The Israeli Rainfall Enhancement Project Israel, Mekorot Water Co. Ltd.

1.2 Purpose(s) of project:

Precipitation augmentation - rainfall /X/ snow /X/

Hail suppression /_/

Lightning suppression /_/

Other (please specify) . . . . . .

1.3 Major cloud type involved:

Orographic /_/ Cumulus /X/ Stratiform /_/ Frontal /X/

2. Duration of project

2.1 Project duration in years: 26 years

2.2 Operational period within each year: from November to April inclusive.

3. Seeding operation

3.1 Seeding agent: AgI /X/ CO_2 /_/ NaCl /_/

Other (please specify) . . . . . .

3.2 Generator(s): On ground /X/ Airborne /X/

If on ground, please give number of generators: 63

3.3 Procedure for airborne seeding:

Altitude of seeding . . . 600 - 1800 . . . m

Length of seeding track . 60 - 120 . . . m or km

Seeding rate . . . . . 0.6 . . Kg h^{-1}

4. Project design

4.1 Basic design: Target only [ ] Target + control [X]

Cross-over [ ]

4.2 Distance between areas: . . . . . 20 . . . . . km

4.3 Area definition: Fixed [X] Variable [X]

If variable, give basis for definition Routes dependent on wind direction

4.4 Area subdivisions, if any (give number and nature) . . . 18 . . . .

. . . . . .

5. Project site

5.1 Project terrain: Mountainous [ ] Hilly [X] Flat [ ]

5.2 Size of target area: . . 16000 . . . . . km^2

5.3 Size of control area: . . 2300 . . . . . km^2

5.4 Number of precipitation gauges:

5.4.1 All types of precipitation gauges: in target area Daily and recording

in control area . daily and recording

5.4.2 Recording precipitation gauges: in target area . daily and recording

in control area . daily and recording

5.5 Other verification quantities (e.g., radar reflectivity, aircraft cloud measurements, hailpads, etc.):

Radar reflectivity

. . . . . .

6. Experimental unit

6.1 Duration of unit in hours or days: . . A day . . . . . .

6.2 Conditions determining whether unit is seedable or not: . Radar reflectivity cloud tops height cloud top temp. and cloud base

. . . . . .

6.3 Total number of units seeded and not seeded (in case of cross-over design this applies to each area):

. . . . . 33 . . . . . .

6.4 Randomization of experimental units:

Unrestricted / / Restricted /X/

If restricted, give nature of restriction: . . . . . .

. . . . . .

6.5 Standard seeding period: .2,5.hours.average. . hours

7. Overall project results (no stratification or partitioning)

7.1 Name of statistical test(s) and/or analysis (analyses): . WMW . . . .
Rerandomization
. . . . . .

7.2 Transformation(s) for each test: . . . . . .

7.3 Results for each test and/or analysis: 15%.-.24%.Rerand.. . . . . .

7.3.1 Qualitative:

No difference / / More precipitation /X/ Less precipitation / /

Less hail mass / /

Other qualitative results: . . . . . .

. . . . . .

7.3.2 Quantitative:

Seed/no-seed ratio: .1,15 - 1,24 Statistical significance: . p ≤ 3% . .

8. Basis for assessment of results

8.1 Analytical specifications fixed before the project

8.1.1 Nature of stratification(s), if any according to cloud top temp., rain duration, no. of rain periods

8.1.2 Sample size for each stratification (No. of seed/no-seed units) 33

8.1.3 Test(s) and/or analysis (analyses) for each stratification: WMW, Rerand.

8.1.4 Transformation(s) for each stratification and each test: published

8.1.5 Results for each stratification, test and transformation:

8.1.5.1 Qualitative: —

8.1.5.2 Quantitative: X

8.2 Analytical specifications chosen after the project No

8.2.1 Nature of partitioning(s): See 8.1.1

8.2.2 Sample size for each partition (No. of seed/no-seed units): 33

8.2.3 Test(s) and/or analysis (analyses) for each partition: WMW, Rerand.

8.2.4 Transformation(s) for each partition and each test: -

8.2.5 Results for each partition, test and transformation: published

8.2.5.1 Qualitative: -

8.2.5.2 Quantitative: Yes

9. Extended area effects (i.e., outside the target area)

9.1 Sign of effect: positive

9.2 Maximum distance observed: 50 - 80 Km

9.3 Statistical significance (size of area and probability): NA

10. Comments

11. Principal references to published results (where details of above may be found):

1. Quantative Diffusion Estimates of Cloud Seeding Nuclei Released from Airporne Generators/ A. Gagin and M. Aroyo, Journal of Weather Modification Vol 1 1985
2. The Relationship between Height and Precipitation Characteristics of Summertime Convective Cells in South Florida/A. Gagin, D. Rosenfeld, R.E. Lopez, Journal of the Atms. Sce. Vol 42 No. 1 1985
3. Results of Seeding for Dynamic Effects on Rain-Cell Properties in FACE-2/A. Gagin, D. Rosenfeld, M. Woodley, P.E. Lopez, Jornal of Climatic Applied Met. Vol 25 1986
4. Conceptual Evaluation of "Static" and "dynamic" Seeding Modes on Recent Analyses of Israeli II and FACE II Experiments /A. Gagin , AMS Monograph on Glaciogenic Seeding for precipitation Enhancement 1986

W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

R/CLA/4, ANNEX B
(Italy)

REPORT ON COMPLETED WEATHER MODIFICATION PROJECT

(Please mark X in box or boxes which apply)

MEMBER OF WMO: ITALY

1. Description of project

1.1 Project identification (name/location/organization) International experiment Grossversuch IV (in Switzerland) carried out by ETH (Switzerland) with a cooperation from GNEFA (France) and UCEA (Italy)

1.2 Purpose(s) of project:

Precipitation augmentation - rainfall [ ] snow [ ]

Hail suppression [X]

Lightning suppression [ ]

Other (please specify) . . . . . .

1.3 Major cloud type involved:

Orographic [ ] Cumulus [ ] Stratiform [ ] Frontal [ ]

2. Duration of project

2.1 Project duration in years: six

2.2 Operational period within each year: from May

to September inclusive.

3. Seeding operation

3.1 Seeding agent: AgI [X] CO_2 [ ] NaCl [ ]

Other (please specify) . . . . . .

3.2 Generator(s): On ground [ ] Airborne [ ]

If on ground, please give number of generators: . . . . . .

3.3 Procedure for airborne seeding:

Altitude of seeding . . . . . m

Length of seeding track . . . . . m or km

Seeding rate . . . . . Kg h^{-1}

4. Project design

4.1 Basic design: Target only / / Target + control / /

Cross-over / /

4.2 Distance between areas: . . . . . km

4.3 Area definition: Fixed /X/ Variable / /

If variable, give basis for definition . . . . . .

4.4 Area subdivisions, if any (give number and nature) . . . . . .

. . . . . .

5. Project site

5.1 Project terrain: Mountainous / / Hilly /X/ Flat / /

5.2 Size of target area: . . . . . km^2

5.3 Size of control area: . . . . . km^2

5.4 Number of precipitation gauges:

5.4.1 All types of precipitation gauges: in target area . . . . . .

in control area . . . . . .

5.4.2 Recording precipitation gauges: in target area . . . . . .

in control area . . . . . .

5.5 Other verification quantities (e.g., radar reflectivity, aircraft cloud measurements, hailpads, etc.):

radar reflectivity, aircraft cloud measurements, hailpads . . . . . .

6. Experimental unit

6.1 Duration of unit in hours or days: . . 9 hours . . . . . .

6.2 Conditions determining whether unit is seedable or not: . 3 cm. . . .

radar Soviet criterium . . . . . .

6.3 Total number of units seeded and not seeded (in case of cross-over design this applies to each area):

. 96 seeded and 129 not seeded cells . . . . . .

6.4 Randomization of experimental units:

Unrestricted /X/ Restricted / /

If restricted, give nature of restriction: . . . . . .

. . . . . .

6.5 Standard seeding period: . . . . . hours

7. Overall project results (no stratification or partitioning)

7.1 Name of statistical test(s) and/or analysis (analyses): for Italian evaluations of data of hailpads: Mann-Whitney, Kolmogorov-Smirnov, Fisher

7.2 Transformation(s) for each test: . . . . . .

7.3 Results for each test and/or analysis: . . . . . .

7.3.1 Qualitative:

No difference /X/ More precipitation / / Less precipitation / /

Less hail mass / /

Other qualitative results: . . . . . .

. . . . . .

7.3.2 Quantitative:

Seed/no-seed ratio: . . . . . Statistical significance: . . . . . .

8. Basis for assessment of results

8.1 Analytical specifications fixed before the project

8.1.1 Nature of stratification(s), if any

8.1.2 Sample size for each stratification (No. of seed/no-seed units)

8.1.3 Test(s) and/or analysis (analyses) for each stratification:

8.1.4 Transformation(s) for each stratification and each test:

8.1.5 Results for each stratification, test and transformation:

8.1.5.1 Qualitative:

8.1.5.2 Quantitative:

8.2 Analytical specifications chosen after the project

8.2.1 Nature of partitioning(s):

8.2.2 Sample size for each partition (No. of seed/no-seed units):

8.2.3 Test(s) and/or analysis (analyses) for each partition:

8.2.4 Transformation(s) for each partition and each test:

8.2.5 Results for each partition, test and transformation:

8.2.5.1 Qualitative:

8.2.5.2 Quantitative:

9. Extended area effects (i.e., outside the target area)

9.1 Sign of effect:

9.2 Maximum distance observed:

9.3 Statistical significance (size of area and probability):

10. Comments

11. Principal references to published results (where details of above may be found):

B. Federer, A. Waldvogel, W. Schmid, H.H. Schiesser, F. Hampel, M. Schweingruber, W. Stahel, I. Bader, J.F. Mezeix, N. Doras, G. D'Aubigny, G. Der Megreditchian, D. Vento - Main results of Grossversuch IV - J. of Climate and Appl. Met. - July 1986.

W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

R/CLA/4, ANNEX B
(Madagascar)

REPORT ON COMPLETED WEATHER MODIFICATION PROJECT

(Please mark X in box or boxes which apply)

MEMBER OF WMO: MADAGASCAR

1. Description of project

1.1 Project identification (name/location/organization) . . . . . .
Artificial rainfall . . . . . .
. . . . . .

1.2 Purpose(s) of project:

Precipitation augmentation - rainfall /X/ snow / /

Hail suppression / /

Lightning suppression / /

Other (please specify) . . . . . .
. . . . . .

1.3 Major cloud type involved:

Orographic / / Cumulus /X/ Stratiform / / Frontal / /

2. Duration of project

2.1 Project duration in years: Annually and if requested . . . . . .

2.2 Operational period within each year: from . October . . . . . .
to April . . . . . inclusive. VERY OFTEN MAY TO SEPTEMBER

3. Seeding operation

3.1 Seeding agent: AgI / / CO_2 / / NaCl /X/

Other (please specify) . . . . . .

3.2 Generator(s): On ground / / Airborne /X/

If on ground, please give number of generators: . . . . . .

3.3 Procedure for airborne seeding:

Altitude of seeding between 1500 and 3000 m

Length of seeding track 100 km

Seeding rate 15 Kg h^{-1}

4. Project design

4.1 Basic design: Target only /X/ Target + control / /

Cross-over / /

4.2 Distance between areas: . . . . . km

4.3 Area definition: Fixed / / Variable /X/

If variable, give basis for definition Rice culture

4.4 Area subdivisions, if any (give number and nature) . . . . . .

. . . . . .

5. Project site

5.1 Project terrain: Mountainous / / Hilly /X/ Flat /X/

5.2 Size of target area: 100/250 km^2

5.3 Size of control area: . . . . . km^2

5.4 Number of precipitation gauges: 3

5.4.1 All types of precipitation gauges: in target area ASSOCIATION

in control area . . . . . .

5.4.2 Recording precipitation gauges: in target area . . . . . .

in control area . . . . . .

5.5 Other verification quantities (e.g., radar reflectivity, aircraft cloud measurements, hailpads, etc.):

. . . . . .

6. Experimental unit

6.1 Duration of unit in hours or days: . . . . . .

6.2 Conditions determining whether unit is seedable or not: . . . . . .

. . . . . .

6.3 Total number of units seeded and not seeded (in case of cross-over design this applies to each area):

. . . . . .

6.4 Randomization of experimental units:

Unrestricted / / Restricted / /

If restricted, give nature of restriction: . . . . . .

. . . . . .

6.5 Standard seeding period: . . . . . hours

7. Overall project results (no stratification or partitioning)

7.1 Name of statistical test(s) and/or analysis (analyses): . . . . . .

. . . . . .

7.2 Transformation(s) for each test: . . . . . .

7.3 Results for each test and/or analysis: . . . . . .

7.3.1 Qualitative:

No difference / / More precipitation /X / Less precipitation / /

Less hail mass / /

Other qualitative results: . . . . . .

. . . . . .

7.3.2 Quantitative:

Seed/no-seed ratio: . . . . . Statistical significance: . . . . . .

8. Basis for assessment of results

8.1 Analytical specifications fixed before the project

8.1.1 Nature of stratification(s), if any

8.1.2 Sample size for each stratification (No. of seed/no-seed units)

8.1.3 Test(s) and/or analysis (analyses) for each stratification:

8.1.4 Transformation(s) for each stratification and each test:

8.1.5 Results for each stratification, test and transformation:

8.1.5.1 Qualitative:

8.1.5.2 Quantitative:

8.2 Analytical specifications chosen after the project

8.2.1 Nature of partitioning(s):

8.2.2 Sample size for each partition (No. of seed/no-seed units):

8.2.3 Test(s) and/or analysis (analyses) for each partition:

8.2.4 Transformation(s) for each partition and each test:

8.2.5 Results for each partition, test and transformation:

8.2.5.1 Qualitative:

8.2.5.2 Quantitative:

9. Extended area effects (i.e., outside the target area)

9.1 Sign of effect:

9.2 Maximum distance observed:

9.3 Statistical significance (size of area and probability):

10. Comments : The project concerns regions of rice culture where deficiencies in water are evident.

11. Principal references to published results (where details of above may be found):

W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

R/CLA/4, ANNEX B
(Morocco)

REPORT ON COMPLETED WEATHER MODIFICATION PROJECT

(Please mark X in box or boxes which apply)

MEMBER OF WMO: MOROCCO

1. Description of project

1.1 Project identification (name/location/organization) . . . . . .
Al-Chait Programme - Central High Atlas Mountains - . . . . . .
of the National Meteorological Service . . . . . .

1.2 Purpose(s) of project:

Precipitation augmentation - rainfall /X/ snow /X/

Hail suppression / /

Lightning suppression / /

Other (please specify) . . . . . .

. . . . . .

1.3 Major cloud type involved:

Orographic /X/ Cumulus / / Stratiform / / Frontal /X/

2. Duration of project

2.1 Project duration in years: & . . . . . .

2.2 Operational period within each year: from 1 Novenber . . . . . .

to 30 April . . . . . inclusive.

3. Seeding operation

3.1 Seeding agent: AgI /X/ CO_2 / / NaCl / /

Other (please specify) . . . . . .

3.2 Generator(s): On ground / / Airborne /X/

If on ground, please give number of generators: . . . . . .

ANNEX B, p. 2
(Morocco)

3.3 Procedure for airborne seeding:

Altitude of seeding . . . . . m

Length of seeding track . . . 2 x 60 . . . XX or km

Seeding rate : Using 2 aircrafts 0.375 Kg h^{-1}

4. Project design

4.1 Basic design: Target only / / Target + control /X/

Cross-over / /

4.2 Distance between areas: 200 km to the centre

4.3 Area definition: Fixed /X/ Variable / /

If variable, give basis for definition . . . . . .

4.4 Area subdivisions, if any (give number and nature) . . . . . .

North and South control zones. . . . . .

5. Project site

5.1 Project terrain: Mountainous /X/ Hilly / / Flat / /

5.2 Size of target area: 16,400 . . . . . km^2

5.3 Size of control area(s). 7000 + 3500 . . . . km^2

5.4 Number of precipitation gauges:

5.4.1 All types of precipitation gauges: in target area HELLMAN . . . .

in control area HELLMAN . . . .

5.4.2 Recording precipitation gauges: in target area 2000 cm^2 (J_e RICHARD) . . . .

" " "

in control area . . . . . .

5.5 Other verification quantities (e.g., radar reflectivity, aircraft cloud measurements, hailpads, etc.):

Radar reflectivity - Cloud physics measurements by aircrafts . .

6. Experimental unit

6.1 Duration of unit in hours or days: ? 1 to 3 days . . . . . .

6.2 Conditions determining whether unit is seedable or not: t $-10^{o}C$ . . . . . .

. . . . . .

6.3 Total number of units seeded and not seeded (in case of cross-over design this applies to each area):

NONE . . . . . .

6.4 Randomization of experimental units:

Unrestricted /__/ Restricted /__/

If restricted, give nature of restriction: . . . . . .

. . . . . .

6.5 Standard seeding period: . ? . . . . . hours ?

7. Overall project results (no stratification or partitioning)

7.1 Name of statistical test(s) and/or analysis (analyses): . . . . . .

Study has not been completed . . . . . .

7.2 Transformation(s) for each test: . . . . . .

7.3 Results for each test and/or analysis: . . . . . .

7.3.1 Qualitative:

No difference /__/ More precipitation /__/ Less precipitation /__/

Less hail mass /__/

Other qualitative results: . . . . . .

. . . . . .

7.3.2 Quantitative:

Seed/no-seed ratio: . . . . . Statistical significance: . . . . . .

8. Basis for assessment of results

8.1 Analytical specifications fixed before the project

8.1.1 Nature of stratification(s), if any

8.1.2 Sample size for each stratification (No. of seed/no-seed units)

8.1.3 Test(s) and/or analysis (analyses) for each stratification:

8.1.4 Transformation(s) for each stratification and each test:

8.1.5 Results for each stratification, test and transformation:

8.1.5.1 Qualitative:

8.1.5.2 Quantitative:

8.2 Analytical specifications chosen after the project

8.2.1 Nature of partitioning(s):

8.2.2 Sample size for each partition (No. of seed/no-seed units):

8.2.3 Test(s) and/or analysis (analyses) for each partition:

8.2.4 Transformation(s) for each partition and each test:

8.2.5 Results for each partition, test and transformation:

8.2.5.1 Qualitative:

8.2.5.2 Quantitative:

9. Extended area effects (i.e., outside the target area)

9.1 Sign of effect:

9.2 Maximum distance observed:

9.3 Statistical significance (size of area and probability):

10. Comments

11. Principal references to published results (where details of above may be found):

W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

R/CLA/4, ANNEX B
(Switzerland)

REPORT ON COMPLETED WEATHER MODIFICATION PROJECT

(Please mark X in box or boxes which apply)

MEMBER OF WMO: SWITZERLAND

1. Description of project

1.1 Project identification (name/location/organization) . . . . . .
Grossversuch IV, Central Switzerland, Atmospheric Physics ETH,
8093 Zurich, GNEFA 63170 Aubière, France, UCEA, 00186 Rome, Italy

1.2 Purpose(s) of project:

Precipitation augmentation - rainfall / / snow / /

Hail suppression /X/

Lightning suppression / /

Other (please specify) . . . . . .

. . . . . .

1.3 Major cloud type involved:

Orographic / / Cumulus /X/ Stratiform / / Frontal / /

2. Duration of project

2.1 Project duration in years: 6 (1977-1982) . . . . . .

2.2 Operational period within each year: from . 15.May. . . . . .
to . September 1985 . . . . . inclusive.

3. Seeding operation

3.1 Seeding agent: AgI /X/ CO_2 / / NaCl / /

Other (please specify) . . . . . .

3.2 Generator(s): On ground / / Airborne / /

If on ground, please give number of generators: . . . . . .

3.3 Procedure for airborne seeding: Rockets/Oblako + PGIM

Altitude of seeding -5°C - -10°C . . . . . m

Length of seeding track 8400 . . . . . m ~~XXXXXX~~

Seeding rate Variable 120 kg pyrotech. mix. ~~xxx~~ h^{-1}

4. Project design

4.1 Basic design: Target only /X/ Target + control / /

Cross-over / /

4.2 Distance between areas: . . . . . km

4.3 Area definition: Fixed /X/ Variable / /

If variable, give basis for definition . . . . . .

4.4 Area subdivisions, if any (give number and nature) . . . . . .

. . . . . .

5. Project site

5.1 Project terrain: Mountainous / / Hilly /X/ Flat / /

5.2 Size of target area: 1200 . . . . . km^2

5.3 Size of control area: 1200 . . . . . km^2

5.4 Number of precipitation gauges:

5.4.1 All types of precipitation gauges: in target area . . . . . .

in control area . . . . . .

5.4.2 Recording precipitation gauges: in target area . . . . . .

in control area . . . . . .

5.5 Other verification quantities (e.g., radar reflectivity, aircraft cloud measurements, hailpads, etc.):

10 cm quantitative radar, 330 hailpads . . . . . .

6. Experimental unit

6.1 Duration of unit in hours or days: Noon - 09 p.m. . . . . .

6.2 Conditions determining whether unit is seedable or not: . . . . . .

Randomization + Seeding criterion . . . . . .

6.3 Total number of units seeded and not seeded (in case of cross-over design this applies to each area):

Seeded: 37 days, 113 cells - Not seeded: 46 days, 140 cells . . . . . .

6.4 Randomization of experimental units:

Unrestricted /X/ Restricted / /

If restricted, give nature of restriction: . . . . . .

. . . . . .

6.5 Standard seeding period: Seeding criterion . ~~xxxxx~~

7. Overall project results (no stratification or partitioning)

7.1 Name of statistical test(s) and/or analysis (analyses): . . . . . .
Radar: Randomization test / Hailpads: +- test

7.2 Transformation(s) for each test: In (hail kinetic energy)

7.3 Results for each test and/or analysis: . . . . . .

7.3.1 Qualitative:

No difference /X/ More precipitation / / Less precipitation / /

Less hail mass / /

Other qualitative results: . . . . . .

. . . . . .

7.3.2 Quantitative: Seed/no-seed ratio: Radar 2.53 / Hailpads: 0.77
Statistical significance: Radar: P = 0.16 / Hailpads: P = 0.56

8. Basis for assessment of results

8.1 Analytical specifications fixed before the project : Please see below

8.1.1 Nature of stratification(s), if any

8.1.2 Sample size for each stratification (No. of seed/no-seed units)

8.1.3 Test(s) and/or analysis (analyses) for each stratification:

8.1.4 Transformation(s) for each stratification and each test:

8.1.5 Results for each stratification, test and transformation:

8.1.5.1 Qualitative:

8.1.5.2 Quantitative:

Response to 8.1 : See: Federer, B. et al., 1986: Main results of Grossversuch IV. J. Climate Appl. Meteor., in print. Table 22: Summary of Statistical tests on seeding effects in Grossversuch IV. Kind of analysis: CONFIRMATORY

8.2 Analytical specifications chosen after the project: See below Point 11

8.2.1 Nature of partitioning(s):

8.2.2 Sample size for each partition (No. of seed/no-seed units):

8.2.3 Test(s) and/or analysis (analyses) for each partition:

8.2.4 Transformation(s) for each partition and each test:

8.2.5 Results for each partition, test and transformation:

8.2.5.1 Qualitative:

8.2.5.2 Quantitative:

9. Extended area effects (i.e., outside the target area)

9.1 Sign of effect: See: Schiesser, H.H., 1985: Grossversuch IV: "Extended ares" effects on rainfall. J. Climate Appl. Meteor., 24, 236-252.

9.2 Maximum distance observed:

9.3 Statistical significance (size of area and probability):

10. Comments : More research will be done using the single rocket as the statistical unit !

11. Principal references to published results (where details of above may be found): See points 8 and 9.

Response to Point 8.2

See: The same paper as mentioned above - kind of analysis: Exploratory; in addition an evaluation with one rocket as statistical unit.

See: Waldvogel, A. and H.H. Schiesser, 1985: Time evolution of seeded hail cells in Grossversuch IV. Preprints, Fourth WMO Scientific Conference on Weather Modification, Honolulu, 541-546.

W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

R/CLA/4, ANNEX B
(USA)

REPORT ON COMPLETED WEATHER MODIFICATION PROJECT

(Please mark X in box or boxes which apply)

MEMBER OF WMO: USA

1. Description of project

1.1 Project identification (name/location/organization) . Sierra Co-operative Pilot Project, Central Sierra Nevada, California - U.S. Bureau of Reclamation

1.2 Purpose(s) of project:

Precipitation augmentation - rainfall / / snow /X/

Hail suppression / /

Lightning suppression / /

Other (please specify) . . . . . .

. . . . . .

1.3 Major cloud type involved:

Orographic /X/ Cumulus /X/ Stratiform /X/ Frontal /X/ Frontal induced stratiform

2. Duration of project

2.1 Project duration in years: 10

2.2 Operational period within each year: from 1 Jan.

to 30 March inclusive.

3. Seeding operation

3.1 Seeding agent: AgI /X/ CO_2 /X/ NaCl / /

Other (please specify) . 3-way randomization

3.2 Generator(s): On ground / / Airborne /X/

If on ground, please give number of generators: . . . . . .

3.3 Procedure for airborne seeding:

Altitude of seeding ~ 3000 m

Length of seeding track 37 km

Seeding rate 160 .5 Kg h^{-1} AgI Kg h^{-1} CO_2

4. Project design

4.1 Basic design: Target only /XX/ Target + control / /

Cross-over / /

4.2 Distance between areas: . . . km

4.3 Area definition: Fixed /X/ Variable /X/

If variable, give basis for definition Variable for cumulus

4.4 Area subdivisions, if any (give number and nature) . . .

5. Project site

5.1 Project terrain: Mountainous /X/ Hilly / / Flat / /

5.2 Size of target area: 800 km^2

5.3 Size of control area: . . . km^2

5.4 Number of precipitation gauges: 13

5.4.1 All types of precipitation gauges: in target area 13

in control area . . .

5.4.2 Recording precipitation gauges: in target area 13

in control area . . .

5.5 Other verification quantities (e.g., radar reflectivity, aircraft cloud measurements, hailpads, etc.):

Cloud physics aircraft, 5cm and 1cm radar, radiometer ground 2D-C and photomicrographs. Chemical tracer studies

6. Experimental unit

6.1 Duration of unit in hours or days: 2 hrs

6.2 Conditions determining whether unit is seedable or not: Liquid water above threshold (.1mm radiometer) and crystals can target to the fixed target area based on real-time model output.

6.3 Total number of units seeded and not seeded (in case of cross-over design this applies to each area):

1984 all seeded 1985 - 3 seed 4 no-seed

6.4 Randomization of experimental units:

Unrestricted /__/ Restricted /X/

If restricted, give nature of restriction: When used, site director communicates to seeder just before seeding using envelope method

6.5 Standard seeding period: 2 hours

7. Overall project results (no stratification or partitioning) None to date

7.1 Name of statistical test(s) and/or analysis (analyses): Orographic MRPP for convective clouds

7.2 Transformation(s) for each test: .....

7.3 Results for each test and/or analysis: Not yet performed

7.3.1 Qualitative: Orographic stratiform

No difference /__/ More precipitation /X/ Less precipitation /__/

Less hail mass /__/

Other qualitative results: More ice crystals in plume when liquid water present. Increases .1- 2mm/hr snowfall rate at surface using one aircraft.

7.3.2 Quantitative: Convective - Aircraft data only.

Seed/no-seed ratio: 2DC IWC +100% at 20 min. Statistical significance: N/A 2DP IWC +25% at 20 min. A&B clouds only

8. Basis for assessment of results

8.1 Analytical specifications fixed before the project YES
A well defined conceptual model.

8.1.1 Nature of stratification(s), if any Degree at liquid water and ice crystal concentration A→D clouds

8.1.2 Sample size for each stratification (No. of seed/no-seed units) OROGRAPHIC
Convective clouds 44 seed)) Not all ramdomized
31 no seed)
5 seeded
4 non-seeded
6 seeded
(not randomized)

8.1.3 Test(s) and/or analysis (analyses) for each stratification:
Proposed: graphical, summary statistics, confidence intervals, linear models.

8.1.4 Transformation(s) for each stratification and each test:

8.1.5 Results for each stratification, test and transformation:
To be completed at end of project.

8.1.5.1 Qualitative: Significant microphysical effects on cloud physics aircraft on 2D-C and 2D-P for both convective and stratiform clouds.

8.1.5.2 Quantitative:

8.2 Analytical specifications chosen after the project

8.2.1 Nature of partitioning(s): Pre-seeded cloud physics measurement of liquid water and ice crystal concentration along seed line.

8.2.2 Sample size for each partition (No. of seed/no-seed units):

8.2.3 Test(s) and/or analysis (analyses) for each partition:

8.2.4 Transformation(s) for each partition and each test:

8.2.5 Results for each partition, test and transformation:

8.2.5.1 Qualitative:

8.2.5.2 Quantitative:

9. Extended area effects (i.e., outside the target area)

9.1 Sign of effect: Not available at this time although observations being made.

9.2 Maximum distance observed: 30 km downwind

9.3 Statistical significance (size of area and probability):

10. Comments: Running basically a physical studies experiment or link in the chain with statistical studies of secondary importance due to small sample size and limited randomization.

11. Principal references to published results (where details of above may be found):

Rodi, A.R. and J.A. Flueck, 1986: A study of aggregate seeding effects in winter convective clouds in the high sierra. Preprints, 10th conference on Weather Modification, May 27-30, Washington, D.C., 39-44.

Reynolds, D.W. and A.S. Dennis, 1986: Reference given in Part A.

Bureau of Reclamation, 1985: Design of a Randomized Exploratory Fixed Target Experiment on Widespread Orographic Clouds. U.S. Dept. of Interior, Denver Federal Center, Denver, 10, 52 pp.

Bureau of Reclamation, 1983: The design of SCPP-1, a randomized precipitation augmentation experiment on winter cellular convection in the central Sierra Nevada. (Second Revision). Div. Atmoc. Resources Research, D-1200, P.O. Box 25007, Denver, CO, 61 pp.

APPENDIX A

REGISTER OF NATIONAL WEATHER MODIFICATION PROJECTS

List of Members reporting NO weather modification projects in 1984

BRUNEI
BURMA
COLOMBIA
COSTA RICA
CZCHOSLOVAKIA
ECUADOR
EGYPT
FIJI
FINLAND
FRENCH POLYNESIA
GHANA
GERMAN DEMOCRATIC REPUBLIC
GUINEA-BISSAU
HAITI
HONG KONG
ICELAND
IRELAND
JAPAN
KENYA
LESOTHO
MALAWI
MALTA
NETHERLANDS
NEW CALEDONIA
PAKISTAN
PERU
POLAND
PORTUGAL
QATAR
ROMANIA
SAUDI ARABIA
SENEGAL
SINGAPORE
SUDAN
SWEDEN
SWITZERLAND
SYRIA
TANZANIA
TRINIDAD AND TOBAGO
TURKEY
UNITED KINGDOM
URUGUAY
VANUATU

APPENDIX B

REGISTER OF NATIONAL WEATHER MODIFICATION PROJECTS

List of Members reporting NO weather modification projects in 1985

BRUNEI
BURMA
COLOMBIA
COSTA RICA
CZCHOSLOVAKIA
ECUADOR
EGYPT
FIJI
FINLAND
FRENCH POLYNESIA
GHANA
GERMAN DEMOCRATIC REPUBLIC
GUINEA-BISSAU
HAITI
HONG KONG
ICELAND
IRELAND
JAPAN
KENYA
LESOTHO
MALAWI
MALTA
NETHERLANDS
NEW CALEDONIA
PAKISTAN
PERU
POLAND
PORTUGAL
QATAR
ROMANIA
SAUDI ARABIA
SENEGAL
SINGAPORE
SPAIN
SUDAN
SWEDEN
SWITZERLAND
SYRIA
TANZANIA
TRINIDAD AND TOBAGO
TURKEY
UNITED KINGDOM
URUGUAY
VANUATU

APPENDIX C, ANNEX A

W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

WEATHER MODIFICATION PROGRAMME

QUESTIONNAIRE

to gather data for the

REGISTER OF NATIONAL WEATHER MODIFICATION PROJECTS

PLEASE MARK APPROPRIATE BOXES

MEMBER OF WMO .....

Reporting activities in the years 1984 /__/ 1985 /__/

No weather modification activities /__/

Member has statutes concerning weather modification /__/

Member has no statutes concerning weather modification /__/

1. TYPE (PURPOSE) OF WEATHER MODIFICATION ACTIVITY OR PROJECT:

a. Precipitation Enhancement /__/

Activity is response to emergency (e.g. droughts) .... /__/

Activity is for routine water supply augmentation .... /__/

b. Precipitation Redistribution ..... /__/

c. Hail Suppression ..... /__/

d. Fog Dispersal ..... /__/

e. Other (please specify) .....

2. This is primarily a (Research ..... /__/) (Development ... /__/) (Operational ... /__/) activity

3. APPROXIMATE SIZE OF THE PROJECT TARGET AREA : ..... km^2

AND OF THE CONTROL AREA (if used) : ..... km^2

4. NAME AND/OR REFERENCE OF PROJECT : .....

.....

5. LOCATION OF AREA IN WHICH PROJECT IS CARRIED OUT :

.....

6. (a) YEAR PROJECT COMMENCED :.....

(b) IS IT EXPECTED TO CONTINUE DURING THE COMING YEAR ?

YES / / NO / / NOT KNOWN / /

7. NATURE OF ORGANIZATION SPONSORING PROJECT (please place x in appropriate box) :

ACTIVITY OF ORGANIZATION	GOVERNMENT	PRIVATE
Agriculture		
Energy		
Forestry		
Hydrology		
Research Foundation		
Transportation		
Weather Service		
Other (please specify)		

8. DESCRIPTION OF WEATHER MODIFICATION APPARATUS, MODIFICATION AGENT AND THEIR DISPERSAL RATES, TECHNIQUES EMPLOYED, ETC. (see instructions)

a. Seeding delivery system :

Ground / / How many generators ? / /

Aircraft / / How many aircrafts ? / /

Rockets / / Artillery shells / /

Other (please specify) .....

b. Type of Generator :

Acetone burner	/__/	Pyrotechnic flare	/__/
Explosive	/__/	Liquid Spray	/__/
Solid dispersal	/__/	Other	

c. Location of release of seeding material :

Ground	/__/	Cloud base	/__/	Cloud top	/__/
In-cloud	/__/	If release is in-cloud, at what temperature or other criterion ?			

Seeding Material	Rate of Consumption (give units)	Total Consumption during this year (kg)
AgI	.....	.....
PbI_2	.....	.....
Dry Ice	.....	.....
NaCl	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

9. CHARACTERISTICS OF CLOUDS TREATED :

a. Convective (cumulus) /__/ Orographic /__/ Synoptic scale disturbances /__/

Layer (stratiform) /__/ Bands organized on mesoscale /__/

b. Predominant cloud base temperature (°C) : .....

c. Criteria used to select days or clouds for treatment :

.....
.....
.....

10. a. DURING THE CURRENT REPORTING YEAR, WHAT MONTHS DID SEEDING OR OTHER WEATHER MODIFICATION ACTIVITY TAKE PLACE ? .....
.....

b. ON HOW MANY DAYS DID THIS ACTIVITY TAKE PLACE ? .....

11. a. WAS A PLANNING DOCUMENT PREPARED? YES /__/ NO /__/

b. IF SO, IS IT AVAILABLE TO WMO? YES /__/ NO /__/

12. a. HAS AN ANALYSIS BEEN MADE OF THE EXPECTED (OR ACTUAL) COSTS AND BENEFITS? YES /__/ NO /__/

b. IF SO, IS IT AVAILABLE TO WMO? YES /__/ NO /__/

13. PROVISIONS FOR EVALUATION? YES /__/ NO /__/

a. Randomized experiment YES /__/ NO /__/

b. Comparison with historical records YES /__/ NO /__/

c. Other .....

d. Is a document on the evaluation available or planned? YES /__/ NO /__/

e. If so, is it available to WMO? YES /__/ NO /__/

14. ORGANIZATION IN CHARGE OF PROJECT :

(a) Name of key technical person : .....

(b) Organization : .....

(c) Postal address : .....
.....
.....

15. OPTIONAL REMARKS :

.....
.....
.....
.....

16. REPORTING AGENCY :

(a) Name of reporting agency : .....

(b) Official title of responsible office : .....

(c) Postal address : .....

.....

.....

Signed : .....

Date : .....

Please complete and return this questionnaire as soon as possible, and in any case not later than 1 July 1986 to :

The Secretary-General
World Meteorological Organization
Case Postale No. 5
CH-1211-GENEVA-20
Switzerland

NOTES FOR COMPLETING REPORT ON WEATHER MODIFICATION ACTIVITIES

Weather modification activities which should be included in the Register

The seeding or dispersing into clouds or fog of any substance with the object of altering drop-size distribution, producing ice crystals or the coagulation of droplets, altering the developing of hail or lightning, or influencing in any way the natural development cycle of clouds or their environment.

Any other activity performed with the intention of producing artificial changes in the composition, behaviour or dynamics of the atmosphere.

For example :

(a) The use of fires or heat sources to influence convective circulation or to evaporate fog;

(b) The modification of the solar radiation exchange of the earth or clouds, through the release of gases, dusts, liquids or aerosols into the atmosphere;

(c) The modification of the characteristics of land or water surfaces by dusting or treating with powders, liquid sprays, dyes, or other materials;

(d) The releasing of electrically charged or radioactive particles, or ions, into the atmosphere;

(e) The application of shock waves, sonic energy sources, or other explosive or acoustic sources to the atmosphere;

(f) The use of aircraft and helicopters to produce downwash for fog dispersal as well as the use of jet engines and other sources of artificial wind generation;

(g) The use of lasers or other sources of electromagnetic radiation;

Weather modification activities which need not be included in the Register

Activities of a purely local nature, such as the use of lightning deflection or static discharge devices in aircraft, boats, or buildings, or the use of small heat sources, fans, fogging devices, aircraft downwash, or sprays to prevent the occurrence of frost in tracts or fields planted with crops susceptible to frost or freeze damage.

One completed copy of this form is requested for each weather modification activity (hereafter referred to as the project).

ADDITIONAL EXPLANATION
of questions for the
REGISTER OF NATIONAL WEATHER MODIFICATION PROJECTS

ITEM 1 - Mark (X) box that corresponds to purpose of activity. By project is meant a related series of weather modification activities having a common objective.

ITEM 2 - Mark (X) box corresponding to goal of the activity:

- research -- investigating scientific questions;
- development -- field work to optimize procedures;
- operational -- field work intended directly for economic benefits.

ITEM 3 - The Target Area is the area over which an effect is sought. The Control Area (or Areas) are areas that are chosen so as to be unaffected by the seeding material and used to evaluate results within the Target Area.

ITEM 4 - Enter the name and/or reference of projects used by operator. If the project was reported in the previous Register, please quote the WMO Register Number which appears in Column 1.

ITEM 5 - Indicate the location of the weather modification project by geographical co-ordinates and name of the region.

ITEM 6 - (a) Enter the year in which the first activities under the present project took place;

(b) Indicate whether the project is expected to continue by marking (X) the appropriate box.

ITEM 7 - Indicate the principal interests of the organization that funds the project by marking (X) the appropriate box (use multiple marks if appropriate).

ITEM 8 - The term "weather modification apparatus" here means any apparatus used with the intention of producing artificial changes in the composition, behaviour or dynamics of the atmosphere. For example: AgI smoke generators, propane devices, flares, rockets, artillery projectiles, jet engines, etc.

(a) Seeding delivery system. Indicate, by marking (X) the appropriate box, the nature of the delivery system, ground based, airborne, etc.;

(b) Indicate the way the seeding material is prepared for dispersal (e.g. by burning an acetone solution of silver iodide complex). Solid dispersal refers to the released pellets (e.g. dry ice), powder (e.g. NaCl), etc.

(c) Indicate the location at which seeding material is dispersed by marking (X) appropriate box.

(d) Indicate what seeding material is used and the rate of dissemination (mass per unit of time, mass per cloud, etc.). Indicate total amount of material dispensed during the reporting period in kilograms.

ITEM 9 - (a) Indicate, by marking (X) box, the general characteristics of the clouds that are selected for treatment;

(b) Indicate the predominate or general range of cloud base temperatures;

(c) What are the characteristics that distinguish days or clouds that are treated from those that are not treated?

ITEM 10 - During what months did the project operate in the field and how many days did operations take place ? Any other information related to the scope of the activity would be helpful.

ITEM 11 - A planning document might contain information on the objectives, expectations and means to achieve these.

ITEM 12 - This question relates to the economic benefits expected or achieved.

ITEM 13 - This question relates to the evaluation of the effectiveness of the project. More information on the means used to judge the merit of the project are welcomed and can be described under item 15 or on a separate page.

ITEM 14 - Please supply the name and address of the agency to which any request for further information should be directed.

ITEM 15 - This item is to permit the reporting person to include any information not covered by items 1 through 13, which is considered significant or of interest such as references to published reports describing results of the weather modification operation or experiment. Any information not previously reported, definite plans for a new project, information that is sought, etc. may be outlined under item 15.

ITEM 16 - Please supply the name and address of the agency that is transmitting this information to WMO.

APPENDIX C, ANNEX B

W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

REPORT ON COMPLETED WEATHER MODIFICATION PROJECT

(Please mark X in box or boxes which apply)

MEMBER OF WMO: . . . . . .

1. Description of project

1.1 Project identification (name/location/organization) . . . . . .

. . . . . .

. . . . . .

1.2 Purpose(s) of project:

Precipitation augmentation - rainfall ☐ snow ☐

Hail suppression ☐

Lightning suppression ☐

Other (please specify) . . . . . .

. . . . . .

1.3 Major cloud type involved:

Orographic ☐ Cumulus ☐ Stratiform ☐ Frontal ☐

2. Duration of project

2.1 Project duration in years: . . . . . .

2.2 Operational period within each year: from . . . . . .

to . . . . . inclusive.

3. Seeding operation

3.1 Seeding agent: AgI ☐ CO_2 ☐ NaCl ☐

Other (please specify) . . . . . .

3.2 Generator(s): On ground ☐ Airborne ☐

If on ground, please give number of generators: . . . . . .

3.3 Procedure for airborne seeding:

Altitude of seeding . . . . . m

Length of seeding track . . . . . m or km

Seeding rate . . . . . Kg h^{-1}

4. Project design

4.1 Basic design: Target only /__/ Target + control /__/

Cross-over /__/

4.2 Distance between areas: . . . . . km

4.3 Area definition: Fixed /__/ Variable /__/

If variable, give basis for definition . . . . . .

4.4 Area subdivisions, if any (give number and nature) . . . . . .

. . . . . .

5. Project site

5.1 Project terrain: Mountainous /__/ Hilly /__/ Flat /__/

5.2 Size of target area: . . . . . km^2

5.3 Size of control area: . . . . . km^2

5.4 Number of precipitation gauges:

5.4.1 All types of precipitation gauges: in target area . . . . . .

in control area . . . . . .

5.4.2 Recording precipitation gauges: in target area . . . . . .

in control area . . . . . .

5.5 Other verification quantities (e.g., radar reflectivity, aircraft cloud measurements, hailpads, etc.):

. . . . . .

6. Experimental unit

6.1 Duration of unit in hours or days: . . . . . .

6.2 Conditions determining whether unit is seedable or not: . . . . . .

. . . . . .

6.3 Total number of units seeded and not seeded (in case of cross-over design this applies to each area):

. . . . . .

6.4 Randomization of experimental units:

Unrestricted /__/ Restricted /__/

If restricted, give nature of restriction: . . . . . .

. . . . . .

6.5 Standard seeding period: . . . . . hours

7. Overall project results (no stratification or partitioning)

7.1 Name of statistical test(s) and/or analysis (analyses): . . . . . .

. . . . . .

7.2 Transformation(s) for each test: . . . . . .

7.3 Results for each test and/or analysis: . . . . . .

7.3.1 Qualitative:

No difference /__/ More precipitation /__/ Less precipitation /__/

Less hail mass /__/

Other qualitative results: . . . . . .

. . . . . .

7.3.2 Quantitative:

Seed/no-seed ratio: . . . . . Statistical significance: . . . . . .

8. Basis for assessment of results

8.1 Analytical specifications fixed before the project

8.1.1 Nature of stratification(s), if any

8.1.2 Sample size for each stratification (No. of seed/no-seed units)

8.1.3 Test(s) and/or analysis (analyses) for each stratification:

8.1.4 Transformation(s) for each stratification and each test:

8.1.5 Results for each stratification, test and transformation:

8.1.5.1 Qualitative:

8.1.5.2 Quantitative:

8.2 Analytical specifications chosen after the project

8.2.1 Nature of partitioning(s):

8.2.2 Sample size for each partition (No. of seed/no-seed units):

8.2.3 Test(s) and/or analysis (analyses) for each partition:

8.2.4 Transformation(s) for each partition and each test:

8.2.5 Results for each partition, test and transformation:

8.2.5.1 Qualitative:

8.2.5.2 Quantitative:

9. Extended area effects (i.e., outside the target area)

9.1 Sign of effect:

9.2 Maximum distance observed:

9.3 Statistical significance (size of area and probability):

10. Comments

11. Principal references to published results (where details of above may be found):

APPENDIX C, ANNEX A
(FRENCH)

ORGANISATION METEOROLOGIQUE MONDIALE

PROGRAMME DE MODIFICATION ARTIFICIELLE DU TEMPS

QUESTIONNAIRE A REMPLIR
afin de fournir des données pour
L'INVENTAIRE DES PROJETS NATIONAUX DE MODIFICATION ARTIFICIELLE DU TEMPS

COCHER LA CASE CORRESPONDANTE

MEMBRE DE L'OMM .....

Renseignements sur les activités déployées en 1984 /___/ 1985 /___/

Le Membre n'a pas déployé d'activité de modification artificielle du temps /___/

Le Membre a une réglementation concernant la modification artificielle du temps /___/

Le Membre n'a pas de réglementation concernant la modification artificielle du temps /___/

1. TYPE (OBJECTIF) D'ACTIVITE OU DE PROJET DE MODIFICATION ARTIFICIELLE DU TEMPS :

   a) Augmentation des précipitations /___/

      Activité déployée à la suite d'une situation d'exception (par exemple, sécheresse) /___/

      Activité déployée en prévision d'une augmentation régulière de l'approvisionnement en eau /___/

   b) Redistribution des précipitations /___/

   c) Suppression de la grêle /___/

   d) Dispersion du brouillard /___/

   e) Divers (veuillez préciser) .....

2. Il s'agit principalement d'une activité (de recherche /___/
   (de développement /___/
   (d'exploitation /___/

APPENDIX C, ANNEX A, p. 2
(FRENCH)

3. SUPERFICIE APPROXIMATIVE DE LA ZONE CIBLE DU PROJET : ..... km^2

DE LA ZONE TEMOIN (le cas échéant) : ..... km^2

4. TITRE ET/OU NUMERO DE REFERENCE DU PROJET : .....

.....

5. REPERAGE DE LA ZONE DANS LAQUELLE LE PROJET EST EXECUTE :

.....

6. a) ANNEE DURANT LAQUELLE LE PROJET A ETE ENTREPRIS : .....

b) EST-IL PREVU DE POURSUIVRE LE PROJET AU COURS DE L'ANNEE PROCHAINE ?

OUI ☐ NON ☐ INDETERMINE ☐

7. CARACTERE DE L'ORGANISME QUI PATRONNE LE PROJET (veuillez cocher la case appropriée) :

ACTIVITE DE L'ORGANISME	ORGANISME GOUVERNEMENTAL	ORGANISME PRIVE
Agriculture		
Energie		
Sylviculture		
Hydrologie		
Fondation de recherche		
Transports		
Service météorologique		
Divers (veuillez préciser)		

8. DESCRIPTION DES APPAREILS UTILISES POUR LA MODIFICATION DU TEMPS, DES AGENTS DE MODIFICATION ET DE LEUR VITESSE DE DISPERSION, DES METHODES EMPLOYEES, ETC. (voir les instructions)

a) Système de dispersion de la substance d'ensemencement :

au sol ☐ Nombre de générateurs ☐

Aéronef ☐ Nombre d'appareils ☐

Fusées ☐ Projectiles d'artillerie ☐

Divers (veuillez préciser) .....

b) Type de générateur :

Brûleur à acétone ☐ Fusée pyrotechnique ☐

Explosif ☐ Vaporisation de liquide ☐

Dispersion de solide ☐ Divers .....

c) Lieu de dispersion de la substance d'ensemencement :

Au sol ☐ A la base du nuage ☐ Au sommet du nuage ☐

Dans le nuage ☐

Si la dispersion est effectuée dans le nuage, à quelle température ou en fonction de quel autre critère ? .....

.....

Substance d'ensemencement	Vitesse de consommation (indiquer les unités)	Consommation totale durant l'année (kg)
AgI	.....	.....
PbI_2	.....	.....
Neige carbonique	.....	.....
NaCl	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

APPENDIX C, ANNEX A, p. 4
(FRENCH)

9. CARACTERISTIQUES DES NUAGES ENSEMENCES :

a) Convectifs (cumulus) /___/ Orographiques /___/ Perturbations d'échelle synoptique /___/

Couche (stratiforme) /___/ Bandes organisées à moyenne échelle /___/

b) Température prédominante à la base des nuages (°C) : .....

c) Critères de sélection des jours d'ensemencement ou des nuages ensemencés :

.....

.....

.....

10. a. QUELS SONT LES MOIS DE L'ANNEE CONSIDEREE PENDANT LESQUELS ONT EU LIEU DES OPERATIONS D'ENSEMENCEMENT OU D'AUTRES ACTIVITES DE MODIFICATION ARTIFICIELLE DU TEMPS ?

.....

.....

b. NOMBRE DE JOURS DE L'ANNEE DURANT LESQUELS ONT EU LIEU CES ACTIVITES ? .....

11. a. UN DOCUMENT DE PLANIFICATION A-T-IL ETE ELABORE ? OUI /___/ NON /___/

b. LE CAS ECHEANT, EST-IL POSSIBLE DE LE METTRE A LA DISPOSITION DE L'OMM ? OUI /___/ NON /___/

12. a. LES COUTS ET LES AVANTAGES ESCOMPTES (OU REELS) ONT-ILS ETE ANALYSES ? OUI /___/ NON /___/

b. LE CAS ECHEANT, EST-IL POSSIBLE DE METTRE CETTE ANALYSE A LA DISPOSITION DE L'OMM ? OUI /___/ NON /___/

13. DES DISPOSITIONS ONT-ELLES ETE PRISES EN VUE D'UNE EVALUATION ? OUI /___/ NON /___/

a) Expérience aléatoire OUI /___/ NON /___/

b) Comparaison avec des relevés anciens OUI ☐ NON ☐

c) Divers .....

d) Existe-t-il ou est-il prévu d'élaborer un document sur l'évaluation de l'activité OUI ☐ NON ☐

e) Le cas échéant, est-il possible de le mettre à la disposition de l'OMM OUI ☐ NON ☐

14. ORGANISME RESPONSABLE DU PROJET :

a) Nom du responsable technique : .....

b) Organisme : .....

c) Adresse : .....

.....

.....

15. REMARQUES FACULTATIVES :

.....

.....

16. ORGANISME QUI FOURNIT LES RENSEIGNEMENTS

a) Nom de l'organisme : .....

b) Titre officiel du bureau responsable : .....

c) Adresse : .....

.....

.....

Signature : .....

Date : .....

Veuillez remplir ce questionnaire et le renvoyer dès que possible, et dans tous les cas avant le 1er juillet 1986, à l'adresse suivante :

Monsieur le Secrétaire général
Organisation météorologique mondiale
Case postale N° 5
CH-1211 GENEVE 20
Suisse

APPENDIX C, ANNEX A, p. 6
(FRENCH)

NOTES EXPLICATIVES POUR REMPLIR LE QUESTIONNAIRE SUR LES ACTIVITES DE MODIFICATION ARTIFICIELLE DU TEMPS

Activités de modification artificielle du temps qui devraient figurer dans l'inventaire

L'ensemencent ou la dispersion dans les nuages ou dans le brouillard de toute substance visant à modifier la distribution de la dimension des gouttes, à produire des cristaux de glace ou à coaguler les gouttelettes, à modifier l'évolution de la grêle ou de la foudre ou à influencer d'une manière ou d'une autre le cycle naturel de l'évolution des nuages ou leur environnement.

Toute autre activité déployée dans l'intention de produire des modifications artificielles de la composition, du comportement ou de la dynamique de l'atmosphère.

Par exemple :

a) L'utilisation de feux ou de sources de chaleur pour influencer la circulation convective ou pour évaporer le brouillard.

b) La modification du bilan du rayonnement solaire de la Terre ou des nuages par la libération, dans l'atmosphère, du gaz, de poussières, de liquides ou d'aérosols.

c) La modification des caractéristiques des surfaces terrestres ou aquatiques par poudrage ou par des traitements ayant recours à des poudres, des arrosages, des colorants ou d'autres substances.

d) La libération dans l'atmosphère de particules radioactives ou électriquement chargées ou bien d'ions.

e) L'application à l'atmosphère d'ondes de choc, de sources d'énergie acoustique ou d'autres sources explosives ou acoustiques.

f) L'utilisation du souffle des aéronefs et des hélicoptères pour dissiper le brouillard, ainsi que l'utilisation de réacteurs et d'autres sources de vent artificiel.

g) L'utilisation de lasers ou d'autres sources de rayonnement électromagnétique.

Activités de modification artificielle du temps qu'il n'est pas nécessaire d'inclure dans l'inventaire

Activités de caractère purement local, par exemple, l'utilisation de parafoudres ou de dispositifs de décharge statique sur des aéronefs, des bateaux ou des bâtiments, ou bien l'utilisation de petites sources de chaleur, de ventilateurs, de dispositifs fumigènes, de souffles d'aéronefs ou d'arrosages pour éviter les gelées dans les régions ou les champs plantés de cultures que le gel risque d'endommager.

Il convient de fournir un exemplaire dûment rempli de ce formulaire pour chaque activité de modification artificielle du temps (dénommée ci-après le projet).

APPENDIX C, ANNEX A, p. 8
(FRENCH)

EXPLICATIONS COMPLEMENTAIRES
concernant le questionnaire à remplir pour
L'INVENTAIRE DES PROJETS NATIONAUX DE MODIFICATION ARTIFICIELLE DU TEMPS

QUESTION 1 - Marquer d'une croix (x) la case qui correspond à l'objectif de l'activité. Par projet on entend une suite d'activités de modification du temps ayant un objectif commun.

QUESTION 2 - Marquer d'une croix (x) la case correspondant au but de l'activité :

- recherche -- portant sur des questions scientifiques;
- développement -- activités pratiques déployées à des fins d'optimisation des procédures;
- exploitation -- activités pratiques directement axées sur des avantages économiques.

QUESTION 3 - La zone cible est la zone dans laquelle on cherche à obtenir une réaction. La ou les zones témoins sont choisies de manière à ne pas être touchées par la substance d'ensemencement et utilisées pour évaluer les résultats obtenus dans la zone cible.

QUESTION 4 - Inscrire le titre et/ou le numéro de référence du projet utilisé par l'exécutant. Si le projet a été mentionné dans l'inventaire précédent, veuillez indiquer le numéro d'inventaire de l'OMM qui figure dans la colonne 1.

QUESTION 5 - Repérer l'emplacement où est exécuté le projet de modification du temps en indiquant les coordonnées géographiques et le nom de la région.

QUESTION 6 - a) Indiquer l'année au cours de laquelle ont été déployées les premières activités du projet;

b) Indiquer s'il est prévu de poursuivre le projet en marquant une croix (x) dans la case appropriée.

QUESTION 7 - Indiquer les principales activités de l'organisme qui finance le projet en marquant une croix (x) dans la case appropriée (marquer plusieurs croix, le cas échéant).

QUESTION 8 - L'expression "appareil utilisé pour la modification artificielle du temps" désigne ici tout appareil utilisé dans l'intention de produire des modificiations artificielles de la composition du comportement ou de la dynamique de l'atmosphère. Par exemple, générateurs de fumées d'AgI, dispositifs à propane, torches, fusées, projectiles d'artillerie, moteurs à réaction, etc.

a) Système de dispersion de la substance d'ensemencement. Indiquer en marquant une croix (x) dans la case appropriée, la nature du système de dispersion au sol ou aéroporté, etc.

b) Indiquer comment la substance d'ensemencement est préparée en vue de sa dispersion (par exemple, par combustion d'une solution d'iodure d'argent dans l'acétone). Par dispersion solide, on entend le dégagement de granulés (par exemple de neige carbonique), de poudre - par exemple de NaCl, etc.).

c) Indiquer le lieu de dispersion de la substance d'ensemencement en marquant une croix (x) dans la case appropriée.

d) Indiquer la substance d'ensemencement qui est utilisée et la vitesse de dispersion (masse par unité de temps, masse par nuage, etc.). Indiquer, en kilogrammes, la quantité totale de substance dispersée durant toute la période à l'étude.

QUESTION 9 - a) Indiquer, en marquant une croix dans la case appropriée les caractéristiques générales des nuages qui ont été choisis pour traitement.

b) Indiquer la température prédominante ou un intervalle général de températures à la base des nuages.

c) Quelles sont les caractéristiques qui permettent de distinguer les jours d'ensemencement ou les nuages ensemencés des autres.

QUESTION 10 - Indiquer les mois de l'année pendant lesquels des activités ont été déployées sur le terrain dans le cadre du projet et le nombre de jours d'activité. Tout autre renseignement sur le champ d'application de l'activité serait utile.

QUESTION 11 - Un document de planification peut fournir des renseignements sur les objectifs, les résultats escomptés et les moyens mis en oeuvre pour y parvenir.

QUESTION 12 - Cette question porte sur les avantages économiques escomptés ou obtenus.

QUESTION 13 - Cette question se rapporte à l'évaluation de l'efficacité du projet. Il sera fait grand cas de tous les renseignements portant sur les moyens utilisés pour juger les avantages et les inconvénients du projet qui pourraient être donnés en liaison avec la question 15 ou sur une feuille distincte.

QUESTION 14 - Veuillez indiquer le nom et l'adresse de l'organisme auquel il faut adresser toute demande de renseignements complémentaires.

APPENDIX C, ANNEX A, p. 10
(FRENCH)

QUESTION 15 - Cette question doit permettre à la personne qui remplit le questionnaire de fournir tous les renseignements qui ne sont pas couverts par les questions 1 à 13 comprise et qui sont jugés significatifs ou intéressants, notamment les références à des publications sur les résultats de l'opération ou de l'expérience de modification artificielle du temps. Tout renseignement qui ne figure pas dans les questions qui précèdent, plans définitifs concernant un nouveau projet, renseignement recherché, etc. peut être exposé en liaison avec la question 15.

QUESTION 16 - Veuillez indiquer le nom et l'adresse de l'organisme qui fournit ces renseignements à l'OMM.

APPENDIX C, ANNEX B
(FRENCH)

ORGANISATION METEOROLOGIQUE MONDIALE

RAPPORT SUR UN PROJET DE MODIFICATION ARTIFICIELLE DU TEMPS DEJA REALISE

(veuillez cocher x dans la ou les cases appropriées)

MEMBRE DE L'OMM : .....

1. Description du projet

1.1 Identification du projet (titre/zone d'exécution/organisation) .....
.....
.....

1.2 But(s) du projet :
augmentation des précipitations - pluie [ ] neige [ ]
suppression de la grêle [ ]
suppression de la foudre [ ]
autres modifications (veuillez préciser) .....
.....

1.3 Principaux types de nuages traités :
Orographiques [ ] Cumulus [ ] Stratiformes [ ] Système frontal [ ]

2. Durée du projet

2.1 Durée du projet, en années :

2.2 Période opérationnelle au cours de chaque année : du ..... au .....inclusivement.

3. Opérations d'ensemencement

3.1 Agent d'ensemencement : AgI [ ] CO_2 [ ] NaCl [ ]

Autres (veuillez préciser)

3.2 Générateur(s) Au sol ☐ Aéroporté ☐

Dans le cas de générateurs au sol, veuillez indiquer le nombre de générateurs utilisés .....

3.3 Méthode d'ensemencement par appareil aéroporté

Altitude de l'ensemencement ..... m

Longueur de la trajectoire suivie pour l'ensemencement ..... m ou km

Taux d'ensemencement ..... kg h^{-1}

4. Conception du projet

4.1 Conception de base : Zone cible seulement ☐

Zone cible et zone témoin ☐ Zone cible et/ou zone témoin sans distinction ☐

4.2 Distance entre les zones ..... km

4.3 Définition d'une zone : Fixe ☐ Variable ☐

Si elle est variable, veuillez indiquer les critères de définition .....

.....

4.4 Subdivisions des zones, le cas échéant (indiquer le nombre et la nature)

.....

5. Site du projet

5.1 Terrain : montagneux ☐ accidenté ☐ plat ☐

5.2 Superficie de la zone cible ..... km^2

5.3 Superficie de la zone témoin ..... km^2

5.4 Nombre de pluviomètres :

5.4.1 Tous types de pluviomètres : Dans la zone cible .....
Dans la zone témoin .....

5.4.2 Pluviographes : Dans la zone cible .....
Dans la zone témoin .....

5.5 Autres mesures de vérification (par exemple, réflectivité radar, mesure des nuages par aéronefs, coussins à grêle, etc.) : .....

.....

6. Unité expérimentale

6.1 Durée de l'unité en heures ou en jours .....

6.2 Conditions permettant de déterminer si une unité est ensemençable ou pas :

.....

6.3 Nombre total d'unités ensemencées et non ensemencées (dans le cas de la conception avec zone cible et/ou zone témoin, sans distinction, ceci s'applique à chaque zone ; .....

6.4 Répartition aléatoire des unités expérimentales :

illimitée ☐ limitée ☐

Dans ce dernier cas, indiquer la nature des limites fixées .....

.....

6.5 Période standard d'ensemencement : ..... heures

7. Résultats d'ensemble du projet (pas de stratification ou de division)

7.1 Test(s) statistique(s) et/ou analyses : .....

.....

7.2 Transformation(s) pour chaque test .....

7.3 Résultats de chaque test et/ou analyses :

7.3.1 Qualitatifs :

Pas de différence ☐ augmentation des précipitations ☐

Diminution des précipitations ☐

Diminution de la masse de grêle ☐

Autres résultats qualitatifs : .....

.....

7.3.2 Quantitatifs :

Rapport ensemencement/pas d'ensemencement : .....

Signification statistique .....

8. Critères choisis pour l'évaluation des résultats

8.1 Spécifications analytiques fixées avant le projet

8.1.1 Nature de la ou des stratifications(s), le cas échéant

8.1.2 Dimension de l'échantillon pour chaque stratification (nombre d'unités ensemencement/pas d'ensemencement)

8.1.3 Test(s) et/ou analyse(s) pour chaque stratification :

8.1.4 Transformation(s) pour chaque stratification et pour chaque test :

8.1.5 Résultats pour chaque stratification, test et transformation :

8.1.5.1 Qualitatifs :

8.1.5.2 Quantitatifs :

8.2 Spécifications analytiques choisies <u>après</u> le projet

8.2.1 Nature de la ou des subdivision(s) :

8.2.2 Dimension de l'échantillon pour chaque subdivision (nombre d'unité ensemencement/pas d'ensemencement) :

8.2.3 Test(s) et/ou analyse(s) pour chaque subdivision :

8.2.4 Transformation(s) pour chaque subdivision et chaque test :

8.2.5 Résultats pour chaque subdivision, test et transformation

8.2.5.1 Qualitatifs :

8.2.5.2 Quantitatifs :

9. Effets observés (c'est-à-dire à l'extérieur de la zone cible)

9.1 Indice de l'effet :

9.2 Distance maximale observée :

9.3 Signification statistique (superficie de la zone et probabilité)

10. Commentaires

11. Principales références à des résultats publiés (dans lesquels sont indiqués les détails des procédures ci-dessus)

APPENDIX C, ANNEX A
(RUSSIAN)

ВСЕМИРНАЯ МЕТЕОРОЛОГИЧЕСКАЯ ОРГАНИЗАЦИЯ

ПРОГРАММА ПО АКТИВНЫМ ВОЗДЕЙСТВИЯМ НА ПОГОДУ

ВОПРОСНИК
по сбору данных для РЕЕСТРА НАЦИОНАЛЬНЫХ ПРОЕКТОВ ПО АКТИВНЫМ ВОЗДЕЙСТВИЯМ НА ПОГОДУ

ПРОСЬБА ЗАПОЛНИТЬ СООТВЕТСТВУЮЩИЕ КВАДРАТЫ

ЧЛЕН ВМО .....

Отчет о деятельности в 1984 г. ☐ / 1985 г. ☐

Деятельность по активному воздействию на погоду не проводится ☐

Член имеет законы, касающиеся активного воздействия на погоду ☐

Член не имеет законов, касающихся активного воздействия на погоду ☐

1. ВИД (ЦЕЛЬ) ДЕЯТЕЛЬНОСТИ ИЛИ ПРОЕКТА ПО АКТИВНЫМ ВОЗДЕЙСТВИЯМ НА ПОГОДУ:

   a. Увеличение осадков ☐

      Деятельность вызвана чрезвычайными обстоятельствами (например, засухи) ..... ☐

      Деятельность осуществляется в целях обычного увеличения водоснабжения ..... ☐

   b. Перераспределение осадков ..... ☐

   c. Предотвращение града ..... ☐

   d. Рассеивание тумана ..... ☐

   e. Другие виды (просьба указать)..... ☐

2. Эта деятельность носит главным образом характер

(Исследований ..... _____)
(_____)
( )
(_____)
(Развития ..... _____)
(_____)
( )
( )
(Оперативного _____)
(свойства ..... _____)

3. ПРИБЛИЗИТЕЛЬНЫЙ РАЗМЕР РАЙОНА ЦЕЛИ ПРОЕКТА: ..... км^2

И КОНТРОЛЬНОГО РАЙОНА (если используется):..... км^2

4. НАЗВАНИЕ И/ИЛИ ОБОЗНАЧЕНИЕ ПРОЕКТА: .....

.....

5. МЕСТОНАХОЖДЕНИЕ РАЙОНА, ГДЕ ОСУЩЕСТВЛЯЕТСЯ ПРОЕКТ:

.....

6. a) ГОД НАЧАЛА ПРОЕКТА: .....

b) ПРЕДПОЛАГАЕТСЯ ЛИ ПРОДОЛЖЕНИЕ ПРОЕКТА В НОВОМ ГОДУ?

ДА ☐ НЕТ ☐ НЕИЗВЕСТНО ☐

7. ХАРАКТЕР ОРГАНИЗАЦИИ, ЗАКАЗАВШЕЙ ПРОЕКТ (просьба поставить x в соответствующем месте):

ДЕЯТЕЛЬНОСТЬ ОРГАНИЗАЦИИ	ПРАВИТЕЛЬСТВЕННАЯ	ЧАСТНАЯ
Сельское хозяйство		
Энергетика		
Лесное хозяйство		
Гидрология		
Научно-исследовательская		
Транспорт		
Служба погоды		
Прочие (просьба указать)		

8. ОПИСАНИЕ УСТРОЙСТВА АКТИВНОГО ВОЗДЕЙСТВИЯ НА ПОГОДУ, РЕАГЕНТОВ АКТИВНОГО ВОЗДЕЙСТВИЯ И СКОРОСТИ ИХ РАСПЫЛЕНИЯ, ИСПОЛЬЗУЕМЫХ МЕТОДОВ И Т.Д. (см. указания)

a. Система доставки материала для засева:

Наземная ☐ Сколько генераторов? ☐

Самолет ☐ Сколько самолетов? ☐

Ракеты ☐ Артиллерийские снаряды ☐

Прочая (просьба указать) .....

b. Тип генератора:

Ацетоновая горелка ☐ Пиротехническая ракета ☐

Взрывчатое вещество ☐ Разбрызгиватель жидкости ☐

Распылитель твердых частиц ☐ Прочее .....

c. Расположение выпуска засеивающего вещества:

Наземное ☐ Нижняя граница облаков ☐ Верхняя граница облаков ☐

В облаках ☐ Если выпуск осуществляется в облаке, то при какой температуре или другом критерии? ....
.....

Реагент засева	Расход (указать единицы измерения)	Общий расход в течение года (кг)
AgI	.....	.....
PbI_2	.....	.....
Сухой лед	.....	.....
NaCl	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

APPENDIX C, ANNEX A, p. 4
(RUSSIAN)

9. ХАРАКТЕРИСТИКА ОБРАБАТЫВАЕМЫХ ОБЛАКОВ:

a. Конвективные (кучевые) ☐ Орографические ☐ Возмущенные в синоптическом масштабе ☐

Слой (слоисто-образные) ☐ Мезомасштабные полосы ☐

b. Преобладающая температура в нижней части облака (C^{o}): .....

c. Критерии, используемые при выборе дней или облаков для работы:
.....
.....
.....

10. a. В КАКИЕ МЕСЯЦЫ ОТЧЕТНОГО ГОДА ПРОВОДИЛОСЬ ЗАСЕИВАНИЕ ИЛИ ДРУГАЯ ДЕЯТЕЛЬНОСТЬ ПО АКТИВНЫМ ВОЗДЕЙСТВИЯМ? .....
.....

b. СКОЛЬКО ДНЕЙ ПРОВОДИЛАСЬ ЭТА ДЕЯТЕЛЬНОСТЬ? .....

11. a. ГОТОВИЛСЯ ЛИ ПЛАН РАБОТЫ? ДА ☐ НЕТ ☐

b. ЕСЛИ ДА, ТО МОЖНО ЛИ НАПРАВИТЬ ЕГО В ВМО, ДА ☐ НЕТ ☐

12. a. ДЕЛАЛСЯ ЛИ АНАЛИЗ ОЖИДАЕМОЙ (ИЛИ ФАКТИЧЕСКОЙ) ЭФФЕКТИВНОСТИ? ДА ☐ НЕТ ☐

b. ЕСЛИ ДА, ТО МОЖНО ЛИ ЕГО НАПРАВИТЬ В ВМО? ДА ☐ НЕТ ☐

13. ОБОСНОВАНИЯ ДЛЯ ОЦЕНКИ? ДА ☐ НЕТ ☐

a. Рандомизированный эксперимент ДА ☐ НЕТ ☐

b. Сравнение с историческими данными ДА ☐ НЕТ ☐

c. Прочие .....

d. Имеется ли документ по оценке или планируется таковой? ДА ☐ НЕТ ☐

d. Если да, то можно ли его направить в ВМО? ДА ☐ НЕТ ☐

14. НАЗВАНИЕ ОРГАНИЗАЦИИ, ОТВЕТСТВЕННОЙ ЗА ПРОЕКТ:

a) Фамилия главного технического лица:.....

b) Организация: .....

c) Почтовый адрес: .....
.....
.....

15. ЛЮБЫЕ ЗАМЕЧАНИЯ:

.....
.....
.....
.....

16. ОРГАНИЗАЦИЯ, НАПРАВЛЯЮЩАЯ ОТЧЕТ:

a) Название организации, направляющей отчет .....

b) Официальное название ответственного подразделения: .....
.....

c) Почтовый адрес: .....
.....
.....

Подпись: .....

Дата: .....

Просьба заполнить и вернуть этот вопросник по возможности скорее и в любом случае не позднее, чем 1 июля 1986 г. по адресу:

The Secretary-General
World Meteorological Organization
Case Postale No. 5
CH-1211-GENEVA-20
Switzerland

APPENDIX C, ANNEX A, p. 6
(RUSSIAN)

ПРИМЕЧАНИЯ ПО СОСТАВЛЕНИЮ ОТЧЕТА О ДЕЯТЕЛЬНОСТИ ПО АКТИВНЫМ ВОЗДЕЙСТВИЯМ НА ПОГОДУ

Деятельность по активным воздействиям на погоду, которую следует включить в Реестр

Засеивание или распространение в облачности или тумане какого-либо вещества с целью изменения распределения размера капель, образования кристаллов льда или коагуляции капелек, изменение развития града или молний или осуществление какого-либо воздействия на естественное развитие цикла облаков или их окружения.

Любая другая деятельность, осуществляемая с целью вызывания искусственных изменений в составе, поведении или динамике атмосферы.

Например:

a) Использование огня или источников тепла для оказания влияния на конвективную циркуляцию или для испарения тумана;

b) Активное воздействие на обмен солнечной радиации земли или облаков посредством выделения в атмосферу газов, пыли, жидкостей или аэрозолей;

c) Активное воздействие на характеристики поверхностей земли или воды при помощи опыления или обработки порошками, жидкими распылителями, красителями или другими веществами;

d) Выделение в атмосферу электрически заряженных или радиоактивных частиц, или ионов;

e) Применение в атмосфере ударных волн, источников звуковой энергии или других взрывных или акустических источников;

f) Использование самолетов и вертолетов для создания нисходящих потоков в целях рассеивания тумана, а также использование реактивных двигателей и других источников создания искусственного ветра;

g). Использование лазеров или других источников электромагнитной радиации.

Деятельность по активным воздействиям на погоду, которую не следует включать в Реестр

Деятельность, носящую чисто локальный характер, такую как использование отражателей молний или статистических разрядников на самолетах, судах или зданиях, или использование небольших источников тепла, ветров, противотуманных устройств, создание нисходящего воздушного потока воздушными судами или распылителями для предотвращения заморозков на участках или полях с посевом культур, которым наносят ущерб заморозки или морозы.

Просьба заполнить один экземпляр этой формы для каждого вида деятельности по активным воздействиям на погоду (в дальнейшем именуемого как проект).

APPENDIX A, ANNEX A, p. 8
(RUSSIAN)

ДОПОЛНИТЕЛЬНЫЕ ПОЯСНЕНИЯ
к вопросам для
РЕЕСТРА НАЦИОНАЛЬНЫХ ПРОЕКТОВ ПО АКТИВНЫМ ВОЗДЕЙСТВИЯМ НА ПОГОДУ

ПУНКТ 1 - Укажите значком (X) ячейку, которая соответствует целям деятельности. Под проектом подразумевается связанная серия действий по активным воздействиям на погоду, имеющих общую цель.

ПУНКТ 2 - Укажите значком (X) ячейку, соответствующую цели деятельности:

- исследовательская -- вопросы научных исследований;

- развитие -- полевая работа по оптимизации процедур;

- оперативная -- полевая работа, направленная непосредственно на достижение экономических выгод.

ПУНКТ 3 - Под районом цели подразумевается район, в пределах которого предполагается обнаружить последствия деятельности по активному воздействию на погоду. Подконтрольным районом (или районами) понимаются районы, которые выбраны так, чтобы они не подвергались воздействиям засевающих веществ; они используются для оценки результатов в пределах района цели.

ПУНКТ 4 - Впишите название и/или обозначение проектов, используемых оператором. Если проект был зарегистрован в предыдущем Реестре, просьба указать номер Реестра ВМО, который стоит в колонке 1.

ПУНКТ 5 - С помощью географических координат и названия районов укажите место осуществления проекта по активным воздействиям на погоду.

ПУНКТ 6 - a) Укажите год осуществления первоначальной деятельности по настоящему проекту;

b) Укажите, предполагается ли продолжить проект в будущем, поставив значок (X) в соответствующей ячейке.

ПУНКТ 7 - Укажите основной род занятий организации, которая финансирует проект, обозначив значком (X) соответствующую ячейку (при необходимости используйте несколько значков).

ПУНКТ 8 - Под устройством активного воздействия на погоду подразумеваются любые устройства, используемые с целью намеренного вызывания искусственных изменений в составе, поведении или динамике атмосферы. Например: генераторы засеивания йодистым серебром, пропановые устройства, пиротехнические устройства, ракеты, артиллерийские снаряды, реактивные двигатели и т.д.

a) Система доставки засеивающих веществ. Укажите, обозначив значком (X) соответствующую ячейку, характер системы доставки - наземная, воздушная, и т.д.;

b) Укажите способ подготовки засеивающего вещества для распыления (например путем сжигания ацетонового раствора соединения йодистого серебра). Распыление твердых частий относится к рассеиванию пеллеток (например сухой лед), порошка (например, NaCl) и т.д.;

c) Укажите, обозначив значком (X) соответствующую ячейку, место рассеивания засеивающего реагента;

d) Укажите, какие засеивающие реагенты используются и скорость рассеивания (масса на единицу времени, масса на облако и т.д.). Укажите в килограммах общее количество реагента, рассеянного в течение отчетного периода.

ПУНКТ 9 - a) Укажите, обозначив значком (X), ячейку, общую характеристики облаков, которые выбраны для обработки;

b) Укажите господствующий или общий диапазон температур основы облака;

c) По каким характеристикам отличают дни или облака для засева?

ПУНКТ 10 - В какие месяцы и сколько дней осуществлялась оперативная полевая фаза проекта? Была бы полезна любая другая информация, касающаяся целей деятельности?

APPENDIX C, ANNEX A, p. 10
(RUSSIAN)

ПУНКТ 11 - Документ по планированию может содержать сведения по задачам, ожидаемым результатам и средствам их достижения.

ПУНКТ 12 - Этот вопрос относится к экономической эффективности, которую ожидается достичь.

ПУНКТ 13 - Этот вопрос относится к оценке эффективности проекта. Предоставление большего объема информации по средствам, используемым для оценки положительных сторон проекта, только приветствуется, и эта информация может быть представлена под пунктом 15 или на отдельной странице.

ПУНКТ 14 - Сообщите название и адрес организации, которой необходимо направлять запросы о последующей информации.

ПУНКТ 15 - Этот пункт позволит лицу, представляющему отчет, включить любую информацию, которая не вошла в пункты с 1 по 13, но которую он считает важной или представляющей интерес, такую, например как ссылку на опубликованные отчеты, представляющие результаты осуществления активного воздействия на погоду или эксперимента. Любая, не сообщавшаяся ранее информация, определенные планы на новый проект, поиск информации и т.д. может быть отражена под пунктом 15.

ПУНКТ 16 - Просьба сообщить название и адрес учреждения, которое передает эту информацию ВМО.

APPENDIX C, ANNEX B
(RUSSIAN)

ВСЕМИРНАЯ МЕТЕОРОЛОГИЧЕСКАЯ ОРГАНИЗАЦИЯ

ОТЧЕТ О ЗАВЕРШЕННОМ ПРОЕКТЕ ПО АКТИВНОМУ ВОЗДЕЙСТВИЮ НА ПОГОДУ

(Просьба поставить X в соответствующем квадрате)

Член ВМО: .....

1. Описание проекта

1.1 Обозначение проекта (название/местонахождение/организация) .....
.....
.....

1.2 Цель(и) проекта:

Увеличение осадков - дождя ☐ снега ☐

Предотвращение града ☐

Предотвращение молний ☐

Другие (просьба указать) .....
.....

1.3 Основной тип облаков:

Орографические ☐ Кучевые ☐ Слоисто-образные ☐ Фронтальные ☐

2. Продолжительность проекта

2.1 Продолжительность проекта по годам: .....

2.2 Оперативный период в каждом году: с .....
до ..... включительно

3. Засев

3.1 Реагент засева: AgI ☐ CO_2 ☐ NaCl ☐

Другие (просьба указать) .....

APPENDIX C, ANNEX B, p. 2
(RUSSIAN)

3.2 Генератор(ы): Наземные ☐ Воздушные ☐

Если генератор наземный, указать количество .....

3.3 Процедура засева с воздуха:

Высота засева ..... м

Длина трассы засева ..... м или км

Норма засева ..... кг $ч^{-1}$

4. Построение проекта

4.1 Основная схема: Целевые ☐ Целевые + контрольные ☐

Перекрестные ☐

4.2 Расстояние между районами: ..... км

4.3 Определение района: Постоянный ☐ Переменный ☐

Если переменный, указать основу определения .....

4.4 Подразделение района, если имеется (указать число и характер)

.....

5. Площадка

5.1 Местность: Горная ☐ Холмистая ☐ Ровная ☐

5.2 Размер целевого района: ..... $км^2$

5.3 Размер контрольного района: ..... $км^2$

5.4 Количество осадкомеров:

5.4.1 Все виды осадкомеров: в целевом районе .....
в контрольном районе .....

5.4.2 Осадкомеры-самописцы: в целевом районе .....
в контрольном районе .....

5.5 Другие средства проверки (например, отражательная способность радиолокаторов, измерения облаков с самолетов, градомеры и т.д.):

.....

6. Экспериментальная единица

6.1 Продолжительность единицы в часах или днях: .....

6.2 Условия для определения, подлежит ли единица засеву или нет: ....

.....

6.3 Общее количество засеянных и незасеянных единиц (при перекрестном построении это относится к каждому району): .....

6.4 Рандомизация экспериментальных единиц:

Неограниченная ☐ Ограниченная ☐

Если ограниченная, то дать характер ограничения .....

.....

6.5 Стандартный период засева: ..... часов

7. Общие результаты проекта (без стратификации и деления)

7.1 Название статистического испытания(ий) и/или анализа (анализов)

.....

7.2 Трансформация(ии) для каждого испытания: .....

7.3 Результаты каждого испытания и/или анализа:

7.3.1 Качественные

Различий нет ☐ Больше осадков ☐ Меньше осадков ☐

Меньше града по массе ☐

Другие качественные результаты: .....

7.3.2 Количественные

Соотношение засев/нет засева ..... Статистическая значимость .....

8. Обоснование для оценки результатов

8.1 Аналитические спецификации, установленные до проекта

8.1.1 Характер стратификации(ий), если имеется

8.1.2 Объем выборки для каждой стратификации (число единиц засев/нет засева)

8.1.3 Испытание(я) и/или анализ (анализы) для каждой стратификации:

8.1.4 Трансформация(ии) для каждой стратификации и каждого испытания:

8.1.5 Результаты для каждой стратификации, испытания или трансформации:

8.1.5.1 Качественные:

8.1.5.2 Количественные:

8.2 Аналитические спецификации, выбранные после проекта

8.2.1 Характер деления(ий):

8.2.2 Объем выборки для каждого деления (число единиц засев/нет засева):

8.2.3 Испытание(я) и/или анализ (анализы) для каждого деления:

8.2.4 Трансформация(ии) для каждого деления и каждого испытания:

8.2.5 Результаты для каждого деления, испытания или трансформации:

8.2.5.1 Качественные:

8.2.5.2 Количественные:

9. Воздействие на другие районы (т.е. за пределами целевого района)

9.1 Признак воздействия:

9.2 Максимальное расстояние:

9.3 Статистическая значимость (размер района и вероятность)

10. Замечания

11. Ссылки на опубликованные результаты (в которых можно найти более детальную информацию):

APPENDIX C, ANNEX A
(SPANISH)

ORGANIZACION METEOROLOGICA MUNDIAL

PROGRAMA DE MODIFICACION ARTIFICIAL DEL TIEMPO

CUESTIONARIO

para recopilar datos destinados al

INVENTARIO DE PROYECTOS NACIONALES DE MODIFICACION ARTIFICIAL DEL TIEMPO

SEÑALAR EN LA CASILLA CORRESPONDIENTE:

MIEMBRO DE LA OMM .....

Informe de las actividades realizadas en los años 1984 ☐ 1985 ☐

No se llevan a cabo actividades de modificación ☐

El Miembro tiene sometido a reglamentación la modificación artificial del tiempo ☐

El Miembro no tiene sometido a reglamentación la modificación artificial del tiempo ☐

1. TIPO (FINALIDAD) DE LA ACTIVIDAD O DEL PROYECTO DE MODIFICACION ARTIFICIAL DEL TIEMPO:

a. Intensificación de la precipitación ☐

Esta actividad es la respuesta a una situación de urgencia (por ejemplo sequías) ..... ☐

Esta actividad tiene por objeto lograr un aumento del abastecimiento normal de agua ..... ☐

b. Redistribución de la precipitación ☐

c. Supresión del granizo ..... ☐

d. Dispersión de la niebla ..... ☐

e. Otros (especifíquese) .....

2. Se trata principalmente de una actividad

(de investigación ..... ☐

(de desarrollo ..... ☐

(operativa ..... ☐

3. SUPERFICIE APROXIMADA DE LA ZONA DEL BLANCO: ..... km^2

Y DE LA ZONA DE CONTROL (si se utiliza): ..... km^2

4. NOMBRE Y/O REFERENCIA DEL PROYECTO: .....

.....

5. SITUACION DE LA ZONA EN LA QUE SE EJECUTA EL PROYECTO:

.....

6. a) AÑO DEL COMIENZO DEL PROYECTO: .....

b) ¿SE HA PREVISTO QUE CONTINUE EL PROYECTO DURANTE EL AÑO PROXIMO?

SI ☐ NO ☐ NO SE SABE ☐

7. NATURALEZA DE LA ORGANIZACION QUE PATROCINA EL PROYECTO (colóquese una x en la casilla que corresponda

ACTIVIDAD DE LA ORGANIZACION	GUBERNAMENTAL		PRIVADA
Agricultura			
Energía			
Silvicultura			
Hidrología			
Fundación de investigación			
Transporte			
Servicio meteorológico			
Otras actividades (especifíquense)			

8. DESCRIPCION DE LOS APARATOS DE MODIFICACION ARTIFICIAL DEL TIEMPO, E INDICACION DE LOS AGENTES DE MODIFICACION Y SUS INDICES DE DISPERSION, TECNICAS EMPLEADAS, ETC. (véanse instrucciones)

a. Procedimiento de siembra:

Desde tierra ☐ ¿Cuántos generadores? ☐

Desde aeronaves ☐ ¿Cuántas aeronaves? ☐

Mediante cohetes ☐ Proyectiles de artillería ☐

Otros (especifíquense) .....

b. Tipo de generador:

Quemador de acetona	☐	Fulguración pirotécnica	☐
Explosivo	☐	Neutralizador líquido	☐
Dispersión de sustancias sólidas	☐	Otros	

c. Lugar de lanzamiento del material de siembra:

En tierra	☐	Base de las nubes	☐	Cima de las nubes	☐
Interior de las nubes	☐	Si el lanzamiento se hace en el interior de una nube, ¿a qué temperatura o cuál otro criterio?			

Material de siembra	Cantidad de material consumido (dar unidades)	Consumo total durante este año (kg)
AgI	.....	.....
PbI_2	.....	.....
Hielo seco	.....	.....
NaCl	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

9. CARACTERISTICAS DE LAS NUBES TRATADAS:

a.

Convectivas (cúmulos)	☐	Orográficas	☐	Perturbaciones a escala sinóptica	☐
Capa de nubes (estratiforme)	☐			Bandas dispuestas a mesoescala	☐

b. Temperatura predominante de la base de las nubes (°C): .....

c. Criterios utilizados para seleccionar los días o las nubes para el tratamiento:

.....

.....

.....

APPENDIX C, ANNEX A, p. 4
(SPANISH)

10. a. MESES DEL AÑO A QUE SE REFIERE EL PRESENTE CUESTIONARIO, DURANTE LOS CUALES SE HAN LLEVADO A CABO OPERACIONES DE SIEMBRA U OTRAS ACTIVIDADES DE MODIFICACION ARTIFICIAL DEL TIEMPO .....
.....

b. ¿EN CUANTOS DIAS SE REALIZO ESTA ACTIVIDAD? .....

11. a. ¿SE HABIA PREPARADO UN DOCUMENTO DE PLANIFICACION? SI ☐ NO ☐

b. DE SER ASI, ¿PUEDE PONERSE A DISPOSICION DE LA OMM? SI ☐ NO ☐

12. a. ¿SE HA REALIZADO UN ANALISIS DE LOS COSTOS Y BENEFICIOS PREVISTOS (O REALES)? SI ☐ NO ☐

b. DE SER ASI, ¿PUEDE PONERSE A DISPOSICION DE LA OMM? SI ☐ NO ☐

13. ¿DISPOSICIONES PARA LA EVALUACION? SI ☐ NO ☐

a. Experimento de selección aleatoria SI ☐ NO ☐

b. Comparación con los registros históricos SI ☐ NO ☐

c. Otros .....

d. ¿Se dispone de un documento sobre la evaluación o se ha previsto elaborarlo? SI ☐ NO ☐

e. De ser así, ¿puede ponerse a disposición de la OMM? SI ☐ NO ☐

14. ORGANIZACION ENCARGADA DEL PROYECTO:

a) Nombre del principal miembro del personal técnico: .....
.....

b) Organización: .....

c) Señas postales: .....
.....
.....

15. COMENTARIOS FACULTATIVOS:

.....
.....
.....
.....

16. ORGANISMO QUE PRESENTA LA INFORMACION:

a) Nombre del organismo que presenta la información: .....

.....

b) Título oficial de la dependencia responsable: .....

.....

c) Señas postales: .....

.....

.....

Firmado: .....

Fecha: .....

Rogamos se rellene el presente cuestionario y se devuelva lo antes posible, y en todo caso antes del 1 de julio de 1986 al:

Señor Secretario General
Organización Meteorológica Mundial
Case postal Nº 5
CH-1211 GENEVE 20
Suiza

NOTAS ACLARATORIAS PARA RELLENAR EL INFORME SOBRE ACTIVIDADES DE MODIFICACION ARTIFICIAL DEL TIEMPO

Actividades de modificación artificial del tiempo que deberán consignarse en el inventario

La siembra o dispersión, en las nubes o en la niebla, de cualquier sustancia inyectada con objeto de alterar la distribución de las dimensiones de las gotas, que produzcan cristales de hielo o la coagulación de gotas minúsculas, que altere el proceso de formación de granizo o de descargas eléctricas, o que influya de un modo u otro en el desarrollo natural del ciclo de formación de nubes o en el medio que las rodea.

Cualquier otra actividad, realizada con intención de producir por medios artificiales cambios en la composición, el comportamiento o la dinámica de la atmósfera.

Por ejemplo:

a) la utilización de fuegos o de focos de calor con miras a influir en la circulación convectiva o a provocar la evaporación de la niebla;

b) la modificación del intercambio de la radiación solar de la tierra o de las nubes, mediante la emisión de gases, polvos, líquidos o aerosoles en la atmósfera;

c) la modificación de las características de las superficies terrestres o líquidas espolvoreándolas o tratándolas con sustancias pulverizadas, o con líquidos nebulizados, materias colorantes u otros materiales;

d) la emisión en la atmósfera de partículas cargadas eléctricamente o de partículas radiativas, o bien de iones;

e) la aplicación a la atmósfera de ondas de choque, fuentes de energía sónica u otras fuentes explosivas o acústicas;

f) la utilización de aviones y helicópteros para la dispersión de la niebla mediante la corriente de aire provocada por las palas o hélices de los mismos, así como la utilización de reactores y de otros generadores artificiales de viento;

g) la utilización de lasers u otras fuentes de radiación electromagnética.

Actividades de modificación artificial del tiempo que no deberán consignarse en el inventario

Actividades de índole puramente local, tales como la utilización de pararrayos o dispositivos de descargas estáticas a bordo de los aviones, buques o edificios; o la utilización de pequeños focos caloríferos, de ventiladores, de generadores de humo; o el empleo de aeronaves con miras a aprovechar la corriente de aire provocada por las palas de los rotores o las hélices, o de riesgos para evitar la formación de hielo en zonas o terrenos en los que los cultivos son susceptibles de sufrir daños por causa de las heladas.

Se solicita el envío de un ejemplar rellenado de este formulario para cada actividad de modificación artificial de tiempo (en adelante denominado proyecto).

APPENDIX C, ANNEX A, p. 7
(SPANISH)

EXPLICACION ADICIONAL
de las preguntas que figuran en el formulario para el
INVENTARIO DE PROYECTOS NACIONALES DE MODIFICACION ARTIFICIAL DEL TIEMPO

PREGUNTA 1 - Escríbase una (X) en la casilla que corresponda a la finalidad de la actividad. Se entiende por proyecto una serie relacionada de actividades de modificación artificial del tiempo que tienen un objetivo común.

PREGUNTA 2 - Escríbase una (X) en la casilla correspondiente a la finalidad de la actividad:

- investigación - investigación de cuestiones científicas;
- desarrollo - trabajos sobre el terreno para optimizar los procedimientos;
- operativa - trabajos sobre el terreno con la intención directa de obtener beneficios económicos.

PREGUNTA 3 - La zona del blanco es aquella en la que se trata de obtener un efecto. La zona (o zonas) de control es aquella que se escoge para que no sea afectada por el material de siembra y se utiliza para evaluar los resultados dentro de la zona del blanco.

PREGUNTA 4 - Consígnese el nombre y/o referencia de los proyectos que ejecuta el realizador. Si el proyecto fue comunicado ya en el inventario anterior, rogamos cite el número de inventario de la OMM que aparece en la Columna 1.

PREGUNTA 5 - Indíquese el lugar donde se ejecuta el proyecto de modificación artificial del tiempo mediante coordenadas geográficas y el nombre de la región.

PREGUNTA 6 - a) Consígnese el año en que tuvieron lugar las primeras actividades en el marco del presente proyecto.

b) Indíquese si está previsto que el proyecto continúe, señalando con una (X) la casilla adecuada.

PREGUNTA 7 - Indíquense los principales intereses de la organización que financia el proyecto, señalando con una (X) la casilla apropiada (utilícense varias señales si es necesario).

PREGUNTA 8 - Se entiende por aparato para la modificación artificial del tiempo cualquier aparato utilizado con la intención de producir cambios artificiales en la composición, comportamiento o dinámica de la atmósfera. Por ejemplo, generadores de humo de AgI, dispositivos de propano, fulguraciones, cohetes, proyectiles de artillería, reactores, etc.

a) Procedimiento de siembra, indíquese, señalando con una (X) la casilla adecuada, el carácter del sistema de emisión, con base en tierra, aerotransportado, etc.

b) Indíquese el modo en que se prepara el material de siembra para su dispersión (por ejemplo, quemando una solución de yoduro de plata en acetona). La dispersión de sustancias sólidas se refiere al lanzamiento de gránulos (por ejemplo hielo seco), polvo (por ejemplo, NaCl), etc.

c) Indíquese el lugar en el que se dispersa el material de siembra señalando con una (X) la casilla adecuada.

d) Indíquese qué material de siembra se utiliza y su índice de dispersión (masa por unidad de tiempo, masa por nube, etc.). Indíquese la cantidad total de material empleado durante el período de este informe en kilos.

PREGUNTA 9 - a) Indíquese, señalando con una (X) la casilla adecuada, las características generales de las nubes que se seleccionan para el tratamiento.

b) Indíquese la gama predominante o general de las temperaturas de la base de las nubes.

c) ¿Cuáles son las características distintivas de las nubes en los días en que se han sometido a tratamiento y de las nubes no tratadas?

PREGUNTA 10 - ¿Durante qué meses se desarrolló el proyecto sobre el terreno y en cuántos días se realizaron las operaciones? Sería útil cualquier otra información relativa a la duración de la actividad.

PREGUNTA 11 - Un documento de planificación podría contener información relativa a los objetivos y espectativas y a los medios de alcanzarlos.

PREGUNTA 12 - Esta pregunta se refiere a las ventajas económicas previstas o alcanzadas.

PREGUNTA 13 - Esta pregunta se refiere a la evaluación de la eficacia del proyecto. Se acogerá con satisfacción mayor información sobre los medios utilizados para juzgar los méritos del proyecto, y ello puede describirse bajo el punto 15 o en una página aparte.

PREGUNTA 14 - Rogamos proporcionen el nombre y dirección del organismo al que ha de dirigirse toda petición de mayor información.

PREGUNTA 15 - Esta pregunta tiene por finalidad permitir que la persona que presenta el informe incluya toda información no tratada por las preguntas 1 a 13 pero que estime importante o de interés, como pueden ser las referencias a informes publicados en los que se describen los resultados de la operación o experimento de modificación artificial del tiempo. Toda información no consignada anteriormente, planes concretos para un nuevo proyecto, información que se solicita, etc. puede exponerse en la pregunta 15.

PREGUNTA 16 - Rogamos proporcione el nombre y dirección del organismo que transmite esta información a la OMM.

APPENDIX C, ANNEX B
(SPANISH)

ORGANIZACION METEOROLOGICA MUNDIAL

INFORME SOBRE PROYECTOS TERMINADOS DE MODIFICACION ARTIFICIAL DEL CLIMA

(Colóquese una X en la casilla o casillas que corresponde)

MIEMBRO DE LA OMM: .....

1. Descripción del proyecto

1.1 Identificación del proyecto (nombre/lugar/organización): .....

.....

.....

1.2 Finalidad(es) del proyecto:

Aumento de las precipitaciones - lluvia ☐ nieve ☐

Supresión del granizo ☐

Supresión de los relámpagos ☐

Otros (sírvase especificar) .....

.....

1.3 Principales tipos de nubes de que se trata:

Orográfica ☐ Cumulus ☐ Estratiforme ☐ Frontal ☐

2. Duración del proyecto

2.1 Duración del proyecto en años .....

2.2 Período en que se han llevado a cabo las operaciones durante cada año:

del ..... al ..... inclusive.

3. Operaciones de siembra

3.1 Reactivo químico de siembra: AgI ☐ CO_2 ☐ NaCl ☐

Otras (sírvase especificar) .....

3.2 Generador(es): Terrestre ☐ Aerotransportado ☐

Si es terrestre, sírvase dar el número de generadores .....

3.3 Procedimiento de siembra mediante aeronaves:

Altitud de la siembra ..... m

Longitud de la trayectoria de siembra ..... m o km

Indice de siembra ..... Kg h^{-1}

4. Concepción del proyecto

4.1 Concepción básica: Sólo en la zona del blanco ☐ En la zona del blanco y zona de control ☐ En la zona del blanco y/o zona de control ☐

4.2 Distancia entre las zonas: ..... km

4.3 Determinación de la zona: Fija ☐ Variable ☐

Si es variable, sírvase dar la base para la definición .....

.....

4.4 Subdivisiones de la zona, en caso de que hubiera (sírvase dar el número y la naturaleza) .....

.....

5. Ubicación del proyecto

5.1 Terreno donde se lleva a cabo el proyecto: Montañoso ☐ Accidentado ☐ Llano ☐

5.2 Tamaño de la zona del blanco: ..... km^2

5.3 Tamaño de la zona de control: ..... km^2

5.4 Número de pluviómetros: .....

5.4.1 Todos los tipos de pluviómetros: en la zona del blanco .....

en la zona de control .....

5.4.2 Registro de los pluviómetros: en la zona del blanco .....

en la zona de control .....

5.5 Otra serie de verificaciones (por ejemplo reflectividad del radar, medida de las nubes mediante una aeronave, paquetes de granizo, etc.): .....

.....

6. Unidad experimental

6.1 Duración de la unidad en horas o días: .....

6.2 Condiciones que determinan si una unidad puede ser sembrada o no: .....

.....

.....

6.3 Número total de unidades sembradas y no sembradas (en el caso de que el diseño sea de una zona del blanco y/o de control indistintamente esto se aplica a cada zona): .....

.....

6.4 Selección aleatoria de las unidades experimentales:

No limitada ☐ Limitada ☐

Si es limitada, sírvase dar el carácter de la limitación .....

.....

6.5 Período de siembra normalizado: ..... horas .....

7. Resultados de los proyectos generales (no estratificación o partición)

7.1 Nombre de la(s) prueba(s) estadística(s) y/o análisis: .....

.....

7.2 Transformación(es) para cada prueba: .....

7.3 Resultados de cada prueba y/o análisis:

7.3.1 Cualitativo

No hay diferencia ☐ Más precipitación ☐

Menos precipitación ☐ Menos masa de granizo ☐

Otros resultados cualitativos: .....

.....

7.3.2 Cuantitativo:

Relación de la semilla/no semilla: .....

Significado estadístico: .....

8. Base para la evaluación de los resultados

8.1 Especificaciones analíticas fijadas antes de que se haya llevado a cabo el proyecto

8.1.1 Carácter de la estratificación(es), en caso de que hubiere

8.1.2 Tamaño de muestra para cada estratificación (número de unidades de semillas/o no semillas):

8.1.3 Prueba(s) y/o análisis para cada estratificación:

8.1.4 Transformación(es) para cada estratificación y cada prueba:

8.1.5 Resultados para cada estratificación, prueba y transformación:

8.1.5.1 Cualitativo:

8.1.5.2 Cuantitativo:

8.2 Especificaciones analíticas seleccionadas después de revisarse el proyecto:

8.2.1 Carácter de la partición(es):

8.2.2 Tamaño de muestra para cada partición (número de unidades de semilla/no semilla):

8.2.3 Prueba(s) y/o análisis para cada partición:

8.2.4 Transformación(es) para cada partición y cada prueba:

8.2.5 Resultados para cada partición, prueba y transformación:

8.2.5.1 Cualitativo:

8.2.5.2 Cuantitativo:

9. Efectos que tiene fuera de la zona (por ejemplo fuera de la zona del blanco)

9.1 Indicio del efecto:

9.2 Distancia máxima observada:

9.3 Significado estadístico (tamaño de la zona y probabilidad):

10. Comentarios

11. Principales referencias para que se publiquen los resultados (lugar en el que se pueden encontrar los detalles antes mencionados):

LIST OF CLOUD PHYSICS AND WEATHER MODIFICATION RESEARCH PROGRAMME REPORTS

WMP-No. 1	Review of Warm Cloud Modification by Bh. V. Ramana Murty (September 1984)	WMO/TD-No. 5
WMP-No. 2	Papers Presented at the Fourth WMO Scientific Conference on Weather Modification (Honolulu, Hawaii, 12-14 August 1985)	WMO/TD-No. 53
WMP-No. 3	Notes for the International Cloud Modelling Workshop/Conference (Irsee, Federal Republic of Germany, 15-19 July 1985). (Out of print)	WMO/TD-No. 57
WMP-No. 4	Register of National Weather Modification Projects 1983 (November 1985)	WMO/TD-No. 78
WMP-No. 5.	The Evaluation of Hail Suppression Experiments - Report of Meeting of Experts (March 1986)	WMO/TD-No. 97
WMP-No. 6	Information Concerning Weather Modification Directed to Government Decision-Makers (June 1986)	WMO/TD-No. 123
WMP-No. 7	Trends in Weather Modification - 1975-1983 (L.R. Koenig, Geneva, November 1986)	-
WMP-No. 8	Report of the International Cloud Modelling Workshop (Irsee, Federal Republic of Germany, 15-19 July 1985)	WMO/TD-No. 139
WMP-No. 9	Register of National Weather Modification Projects - 1984 and 1985 (Geneva, July 1987)	WMO/TD-No. 182

LIST OF PRECIPITATION ENHANCEMENT PROJECT REPORTS

Report No. 1	Report of the First Session of the Interim Precipitation Enhancement Project Board (Geneva, November 1976)
Report No. 2	Position Papers Used in the Preparation of the Plan for PEP (Geneva, November 1976)
Report No. 3	Plan for the Precipitation Enhancement Project (Geneva, November 1976)
Report No. 4	A Review of the Hydrological Aspect of Evaluation of Precipitation Enhancement (Geneva, May 1977)
Report No. 5	Cloud Seeding Reagents (Sofia, Bulgaria, October 1977) (Geneva, November 1977)
Report No. 6	Areal Extent of Seeding Effects in Relation to the Precipitation Enhancement Project (Charlottsville, VA, USA, November 1977) - (Geneva, December 1977)
Report No. 7	Aircraft Instrumentation for Cloud Physics Research and Weather Modification Programmes (Boulder, CO, USA, February 1978) - (Geneva, March 1978)
Report No. 8	Report of the Second Session of the Interim Precipitation Enhancement Project Board - (Geneva, April 1978)
Report No. 9	PEP Design Document - (Geneva, April 1978)
Report No. 10	Survey of the Climatology and Synoptic Weather Patterns at the Proposed PEP Site in Spain - (Geneva, November 1978)
Report No. 11	Operations Plan for Site-Selection Phase-3 (Geneva, November 1978)
Report No. 12	Preliminary Environmental Impact Study of the Site Proposed for PEP (Geneva, December 1978) - (Geneva, August 1979)
Report No. 13	WMO Training Workshop on Weather Modification for Meteorologists - Lecture Notes - (Geneva, December 1979)
Report No. 14	The Dispersion of Cloud Seeding Reagents (Valladolid, Spain, March 1979) - (Geneva, April 1980)
Report No. 15	PEP Site Selection Phase-3, 1979 Field Programme - Overview and Data Catalogue - (Geneva, February 1980)
Report No. 16	Report of the Third Session of the Precipitation Enhancement Project Board (Geneva, September 1979) (Geneva, November 1979)

LIST OF PEP PROJECT REPORTS (Contd.)

Report No. 17	Statistical Design Considerations for Precipitation Enhancement Projects (Moscow, USSR, 29 October to 2 November 1979) - (Geneva, February 1980)
Report No. 18	PEP Site Selection Phase-3, 1979 Field Programme - General Weather Conditions and Rainfall Characteristics (Geneva, March 1980)
Report No. 19	PEP Site Selection Phase-3, 1979 Field Programme - Two Studies of Precipitation Patterns - (Geneva, March 1980)
Report No. 20	Report of the Fourth Session of the Precipitation Enhancement Project Board (Valladolid, Spain, May 1980) (Geneva, May 1980)
Report No. 21	PEP Site Selection Phase-3, 1980 Field Season - Overview and Data Catalogue - (Geneva, October 1980)
Report No. 22	PEP Site Selection Phase-3, 1980 Field Season - General Weather Conditions and Cloud Structures (Geneva, November 1980)
Report No. 23	Rainstorms, Synoptic Background and Radar-Seen Clouds During the 1980 PEP Season - (Geneva, November 1980)
Report No. 24	The Uses of Numerical Models in Weather Modification Research and Operations (Toronto, Montreal, Canada, December 1980) - (Geneva, April 1981)
Report No. 25	Report of the Fifth Session of the Precipitation Enhancement Project Board (Geneva, May 1981) - (Geneva, May 1981)
Report No. 26	PEP Site Selection Phase-3, 1981 Field Season - Data Catalogue Weather Conditions and Cloud Structures (Geneva, September 1981)
Report No. 27	Report of the Sixth Session of the Precipitation Enhancement Project Board (Geneva, March 1982) - (Geneva, April 1982)
Report No. 28	Preliminary Assessment Report of the Site Selection Phase-3 of the Precipitation Enhancement Project (Geneva, April 1982)
Report No. 29	PEP Site Selection Phase-3 - Studies Based on Data Acquired by Radar (Geneva, January 1983)
Report No. 30	PEP Site Selection Phase-3, Supplementary Report on Analysis of Duero River Basin Data (Geneva, February 1984)
Report No. 31	Modification of Precipitation from Cumulus Clouds (Geneva, February 1984)
Report No. 32	Numerical Simulation of Cloud Behavior Based on Duero River Basin Data (Geneva, June 1984)

LIST OF PEP PROJECT REPORTS (Contd.)

Report No. 33	PEP Site Selection Phase-3, Descriptions of Regions of Potential Identified by Aerial Reconnaissance (Geneva, May 1985)
Report No. 34	Synopsis of the Precipitation Enhancement Project - 1985 (Geneva, August 1986)