WORLD METEOROLOGICAL ORGANIZATION

PROGRAMME ON PHYSICS AND CHEMISTRY OF CLOUDS AND WEATHER MODIFICATION RESEARCH

WMP REPORT NO. 21

REGISTER

OF

NATIONAL WEATHER MODIFICATION PROJECTS

1991

WMO/TD - No. 575

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I. INTRODUCTION

As part of the WMO activities in weather modification, as approved by the World Meteorological Congress, the Secretary-General maintains a Register of experiments and operations in weather modification carried out within Member countries since 1975.

The present publication is the sixteenth 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 1991.

To assist the reader in understanding the content 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 September 1992 is reproduced in Annex A 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 is given in Section IV. Section V provides summaries of completed weather modification 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.

The list of Member countries for which information is included in the Register is given in Section III. The Member countries which replied that no weather modification activities had taken place in their country during 1991 are listed in Section VII.

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

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

(The figure in brackets following the column heading title indicates a similar item in the questionnaire, see Annex A).

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
Ext.	=	Extend wet period	(E)	=	Emergency
Fog	=	Fog dissipation	(R)	=	Routine
Hail	=	Hail suppression	PR	=	Precipitation Redistribution
Inc.	=	Increase during wet period	Res.	=	Research
Op.	=	Operational			

Column 3: Approximate size of project area (3)

Given in square kilometres 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 continuity (6)

Date	--	year project started
Every year	--	indicates project has operated every year
Interrupted	--	indicates project has not operated every year
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	Muni.	=	Municipal
Def.	=	Defense	(P)	=	Private
Enr.	=	Energy	Rec.	=	Recreation
For.	=	Forestry	Res.	=	Research
(G)	=	Government	Trans.	=	Transportation
Hyd.	=	Hydrological	Wea. Serv.	=	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)**

"EIS" indicates that an environmental impact study has been made; "C/B" indicates that a costs and benefits analysis has been made.

III. LIST OF MEMBER COUNTRIES REPORTING WEATHER MODIFICATION PROJECTS IN 1991

Page

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
AUSTRALIA											
AU-1	Res. PE Inc. Water Supply augment-ation	487 km^2 target. 7100 km^2 control.	Melbourne Water Wintertime Cloud Seeding Project	37°43'S 146°15'E (120 km east of Melbourne)	1988 Every year Yes	Water supply (G)	One A/C with acetone burners and dry ice dispersal; cloud top and in-cloud seeding. AgI was seeded near -15°, dry ice seeded at -7°C levels.	AgI 455g/hour dry ice 54.2 kg/hour. Total consumption 25.3 kg of AgI and 726 kg of dry ice for year.	AgI seeding instratiform clouds: top temp. between -7 and -25°C, LWC > 0.1gm^{-3}. Cumulus clouds; top temp. between -12° and -25°C, LWC > 0.5gm^{-3}. Dry ice seeding in orographic clouds: top temp. between -2° and -7°C.	May-Oct 1991 60 days	Evaluation report planned based on randomized experiment. No formal EIS, C/B-Yes
AU-2	Op. PE Inc.	6000 km^2 target	Cloud seeding operations in Tasmania	Central Plateau, Tasmania	1988 Every year Yes	Enr. (G)	One A/C with acetone burner. In-cloud seeding at -10°C level	AgI 480g/hour. Total consumption 31.7 kg	Convective, orographic and stratiform clouds: tops colder than -6°C, LWC > 0.1gm^{-3}	May-Oct 1991 33 days	Evaluation report available based on comparison with historical records. No EIS, C/B-Yes
AU-3	Dev. PE Snow enhance-ment	2050 km	Snowy Precipitation Enhancement Project	36°05'S 148°25'E (Snowy Mountains)	1988 Inter-rupted Yes	Agr. Enr. (G)	16 G/B acetone burners	AgI 20g/hour	Orographic clouds with top temp. between 0°C and -20°C. Seeding was made at temp. ≤-7°C at generator site	Activity was limited	Evaluation based on randomized experiment and chemical analysis of precipitation, report available. EIS is in preparation, C/B-Yes

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
AUSTRIA											
AUS-1	Op. Hail	1800 km²	Styria - Hail Test Program	40°50'N 15°45'E (Weiz-Gleisdorf)	1986 Every year Yes	Agr. (P)	5 A/C with acetone burners and pyrotechnic flares for seeding in cloud base	17 l/hour of AgI. Total consumption 440 kg for year	Convective clouds with bases colder than 10°C and tops colder than -20°C. Seeding criteria: subjective decision of pilots based on obs. of cloud tops, regional forecasts and radar data	May-Sept 1991 42 days	Evaluation based on historical records, crop damage and hail pad data, report planned. EIS-No, C/B-No
AUS-2	Op. Hail	500 km²	Lower Austria - Hail Test Program	48°20'N 15°45'E	1981 Every year Yes	Agr. (P)	2 A/C with acetone burners and pyrotechnic flares for seeding in cloud base	10 l/hour of AgI. Total consumption 500 l or 32 kg for year	Convective clouds with bases colder than 10°C and tops colder than -20°C. Seeding criteria: subjective decision of pilots, supported by regional weather forecasts and radar data	May-Sept 1991 20 days	Evaluation based on historical records, crop damage and hail pad data, report planned. EIS-No, C/B-No
BULGARIA											
BG-1	Op. Res. Hail	13,800 km²	Bulgarian Hail Suppression Project	42°45'N 23°45'E	1969 Every year Yes	Agr. Wea. Ser. (G)	Rockets with pyrotechnic flares into clouds at temp. between -5° and -10°C	500g of PbI_2 per rocket. Total consumption 6970 kg for year	Convective clouds with bases warmer than 10°C and tops colder than -20°C. Seeding criteria based on radar echo top height, hail cell top, reflectivity	May-Aug 1991 34 days	Evaluation based on comparison with historic records and hail pad data, report planned. EIS-No, C/B-No

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
BG-2	Res. PE PR	2,000 km^2	B-2	42°N, 24°E	1991 Every year Yes	Res. Wea. Ser. (G)	Rockets with pyrotechnic flares into clouds at temp. between -3° and -10°C	500g of PbI_2 per rocket. Total consumption 26 kg for year	Convective clouds with bases warmer than 10°C and tops colder than -20°C. Seeding criteria based on radar echo top height, hail cell top height, radar reflectivity	May-July 1991	Evaluation report not available. EIS-No, C/B-Yes
CHILE											
CHI-1	Op. PE Inc. Hail	-	-	Tarapaca Atacama Coquimbo Maule	1987 Every year Yes	Agr. (P) Enr (G, P) For (P) Seeding at cloud base (~-3°C) and at cloud top (~-10 to -15°C)	Acetone burners and pyrotechnic flares on two A/C. Seeding at cloud tops and bases. Seeding in clouds at temp. -10°C, -3°C, -15°C	AgI 20g per flare. Total consumption 12 kg for year	Convective clouds. Presence of super cooled water, instability, turbulence, etc.	Dec-Mar May-Sept May-Sept Apr-Sept	Evaluation based on randomized experiment, historical records, report planned. EIS-No, C/B-Yes
CHINA											
CN-1	Op. PE (E) Water supply augment-ation Hail	2,130 km^2	Precipitation enhancement for two reservoirs in the North	40°40'N 116°E (near Beijing)	1990 Every year Yes	Agr. Reservoir filling (G)	In-cloud seeding with artillery shells at -5°C level. Liquid spray also used	-	Stratiform clouds, more than 1 km deep, with bases colder than 10° and top temp. between 0° and -20°C	May-Oct 1991 6 months	Evaluation report is not planned, EIS-No, C/B Yes
CN-2	Dev. PE Hail	6000 km^2	-	-	-	Agr. (G)	In-cloud seeding with artillery shells and 1 A/C. Explosive generators and solid dispersal used	-	-	Mar-Oct 1991 7 months	Evaluation report planned, based on historical records

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CN-3	Op. PE Inc. Hail	2,940 km^2	-	-	-	Agr. (G)	Seeding with rockets and 1 A/C. Explosive generators used	AgI 44.8g/every time	Convective clouds with bases warmer than 10°C and with top temp. between 0°C and -20°C	May-Sept 1991 4 months	No evaluation planned
CN-4	Res. Op. PE (E) Inc. Hail	29,239 km^2	Precipitation Enhancement, and Hail Suppression	Precipitation enhancement: 38°10'- 38°10'N and 104°20'-107°40'E Hail suppression: 35°00'-37°00'N 105°10'-107°00'E	1974 Every year Yes	Agr.Res (G)	Cloud base and in-cloud seeding with 1 A/C and artillery shells at the levels with temp. less than 0°C	AgI total consumption 7 kg per year. Dry ice total consumption 1000 kg for year	Convective and stratiform clouds with bases colder than 10°C and top temp. within the range of -20°C to 0°C	May-Sept 4 months	Evaluation based on crop damage and hail pad data, report planned. EIS-Yes, C/B Yes
CN-5	Op. Hail	1,333 km^2	Operation of Hail Suppression Tianjin	38°34' - -40°14'N; 116°42' - -118°3'E Tianjin	1974 Every year Yes	Agr. (G)	In-cloud seeding with rockets and artillery shells at temp. lower than 0°C	-	Convective clouds with radar echo ≥ 30 db and top heights ≥ 9 km	Apr-Oct 6 months	Evaluation report planned, based on comparison with historical records and crop damage data
CN-6	Op. PE Hail	320 x 10^6 km^2	-	Inter Mongolia	1960 Every year Yes	Agr. (G) Drought resistance	In-cloud seeding with 3 A/C and artillery shells. Acetone burners and dispersal of dry ice at temp. -4° to -12°C	Dry ice 30 kg/km^2	Stratiform clouds with bases colder than -10°C and top.temp. within the range of -20°C to 0°C	Apr-Sept	No evaluation planned. EIS-No, C/B-Yes

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CN-7	Op. PE (E) Water Supply augment-ation Hail	1,203 km^2	Precipitation Enhancement and Hail Suppression Project in portion of Shandong Province	Precipitation enhancement: Shandong Province Hail suppression: northwest and east of Shandong Province	1987 Every year Yes	Agr. (G)	In-cloud seeding with a A/C, rockets and artillery shells. Acetone burners at temp. -10°C and dry ice dispersal at temp. -5° to -10°C	AgI 0.2g/km and 100 kg during the year. Dry ice 0.4 kg/km and 3590 kg during the year	Convective and stratiform clouds with bases colder than 10°C and top temp. within range of -20°C to 0°C	Mar-Oct	Evaluation based on comparison with historical records and crop damage data. EIS-No, C/B-Yes
CN-8	Op. PE Inc. PR Hail Water Supply augment-ation	-	Research of artificial precipitation in Guangxi	Heng County in Guangxi	1989 Every year Yes	Agr Res. Wea. Serv. (G)	In-cloud seeding with 1 A/C and artillery shells. Acetone burner and explosive generators at temp. below 0°C	AgI total consumption 7 kg. Dry ice total consumption 500 kg	Convective and stratiform clouds with bases warmer than 10°C and top temp. within range -20° to 0°C.	Feb-Nov	Evaluation based on comparison with historical records. crop damage and hail pad data. EIS-Yes, C/B-Yes
CN-9	Op. PE (E) Hail	41,200 km^2	Science and modernization developing design of Heilongjang Province weather modification	Heilongjang Province	1985 Every year Yes	Agr. Wea. Ser. (G)	In-cloud seeding with dry ice and AgI using solid dispersal and aircraft guns from 1 A/C. Dry ice seeding at temp. -10°C, aircraft gun seeding at -4°C level for precipitation enhancement and at -15° to -20°C temp. range for hail suppression	AgI total annual consumption 120 kg. Dry ice total annual consumption 80 kg	Convective and stratiform with bases warmer than 10°C (for aircraft guns) and colder than 10°C (for solid dispersal)	May-Sept 110 days	Evaluation based on comparison with historical records and crop damage data. EIS-yes, C/B No

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CN-10	Op. PE (E) Water supply Hail	30,336 km^2	Regional Weather Modification Project	Xinjang	1978 Every year Yes	Agr. Enr. Wea. Ser. (G)	In-cloud seeding with rockets, artillery shells and 2 A/C equipped with acetone burners. Temp. range -5° to -20°C	AgI 30 to 500g per operation	Convective orographic and stratiform clouds with bases colder than 10°C and tops within temp. range of 0° to -20°C. Seeding criteria: supercooled liquid water in clouds for precipitation enhancement and radar reflectivity exceeding 40 dBz for hail suppression	Jan, Apr-Sept, Nov-Dec	Evaluation based on comparison with historical records and crop damage data. EIS-No, C/B-Yes
CUBA											
CU-1	Res. PE Inc.	10.000 km^2	Cuban Weather Modification Project	21°25'N 77°10'W (Camaguey)	1982 Every year Yes	Wea. Ser. (G)	In-cloud one aircraft seeding with pyrotechnic flares at the altitude of 6 km and temp. -6 to -9°C	AgI 19g per cell. Total annual consumption 0.4 kg	Convective clouds with bases warmer than 10°C and tops in temp. range of 0° to -20°C and top heights between 6 and 8 km	July-Aug 14 days	Evaluation based on randomized experiment. EIS-yes, C/B-Yes
FRANCE											
FR-1	Op. Hail	7,900 km^2 target 421,000 km^2 control	ANELFA Fr-1	11 depts. in southwest, 1 dept. in central and 1 dept in central-east	1952 Every year Yes	Agr. (P)	Ground-based seeding with 591 acetone burners	AgI 8g/hour per generator	Convective clouds with base temp. exceeding 10°C and top temp. lower than -20°C. Seeding criteria: hail stone diameter exceeding 15 mm	15 Apr-15 Oct 50 days	Estimation based on crop damage and hail pad data. EIS-Yes, C/B-Yes

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
GERMANY											
GE-1	Res. Op. Hail	2,400 km²	Hagelabwehr Versuch der Landkreise Rosenheim und Miesbach	Mountainous to hilly terrain on northern side of Alps	1975 Every year Yes	County (G)	Ground-based and airborne seeding with acetone burners. 2 A/C were seeding at cloud base level	AgI 0.8 kg/hour. Total annual consumption 21.2 kg	Convective clouds with base temp. > 10°C and top temp. < -20°C. Seeding criteria: radar echo parameters	1 May-30 Sept 11 days	Estimation based on comparison with historical records and crop damage data. EIS-No, C/B-No
GE-2	(E) Hail	200 km² target 400 km² control	Hail suppression Mühldorf-Altötting	Bavaria	1983 Every year Yes	Agr. (G)	1 A/C with acetone burner and pyrotechnic flare seeding at cloud base	AgI 4l/hour. Total annual consumption 120 l	Convective clouds with bases warmer than 10°C	May-Sept	No evaluation. EIS-No, C/B-No
GE-3	Op. Hail	2,500 km² target 7,600 km² control	Hail suppression within Stutgart area	48°N 10°E	1980 Every year Yes	Agr (G, P)	2 A/C with acetone burners seeding cloud base	AgI 1.4 kg/hour. Total annual consumption 7.0 kg	Convective clouds with bases warmer than 10°C and tops colder than -20°C seeding criteria: convective instability and radar echo thresholds	25 Apr-15 Oct 20 days	Evaluation based on crop damage, hail pad and precipitation amount data. EIS-Yes, C/B-Yes
ISRAEL											
IL-1	Op. Res. PE Water supply augument-ation	8,000 km² target 3,000 km² control	Israel Rainfall Enhancement Project	Northern and central part of Israel	1961 Yes	Govern-ment Agriculture Water Commis-sion	60 ground generators and 4 A/C all with acetone burners. A/C seeding at cloud base	AgI 600 g/hr from A/C; 10 g/hr from ground generators	Convective clouds with bases <10°C. Cloud tops must be colder than -8°C and cloud systems appropriately located relative to the seeding tracks and generators.	Nov 1990-April 1991 59 days	Evaluation based on randomized experment and comparisons with historical record EIS-Yes, C/B-Yes

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
JAMAICA											
JAM-1	Res. (E) Water supply augment-ation	11,500 km^2	Drought Monitoring	Jamaica	1989 Every year Yes	(G)	-	-	-	Monthly	Evaluation based on comparison with historical records. EIS-No, C/B-No
JORDAN											
JOR-1	Op. PE Inc.	7,500 km^2	Precipitation Enhancement Project in Jordan		1986 Every year except 1989 Yes	Wea. Ser. (G)	20 generators and pyrotechnic ejectable flares from 1 A/C when cloud top temperature was between -10°C and -20°C	AgI 126g/hour per generator. Total consumption 6.6 kg	Orographic clouds. Cloud top temp. between -10°C and -20°C cloud base temp. lower than 10°C	Jan-Apr 14 days	Evaluation based on comparison with historical records. EIS-No, C/B-Yes
LIBYAN ARAB JAMAHIRYA											
LI-1	Res. Op. PE Inc.	69,000 km^2	Cloud Seeding Project	Jafara Plain, Sirt area and Elmarej	1980 Every year Yes	Trans. (G)	Cloud top, base and in-cloud seeding from 3 A/C. In-cloud temp. in the range -5°C to -20°C	AgI. Total consumption 5.14 kg	Convective and orographic clouds. LWC > $0.5gm^{-3}$	Jan-Mar 19 days	Evaluation based on comparison with historical records. EIS-No, C/B-No

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
MONGOLIA											
MON-1	Op. Res. PE Inc. Hail	6,000 km^2	Rain Hail	Central Mongolia	1990 Every year (?)	Agr. Wea. Ser. (G)	Cloud top and in-cloud seeding with pyrotechnic flares from 1 A/C and artillery shells. In-cloud temp. in the range -5°C to -20°C	AgI. Total consumption 4.5 kg	Convective clouds with base temp. lower than 10°C and top temp. < -20°C	June-Aug 30 days	Evaluation based on comparison with historical records, crop damage and hail pad data. EIS-No, C/B-Yes
MOROCCO											
MO-I	Precip. increase Drought Water Aug. (R) Res.	6,000 km^2 for control	Programme Al-Ghait	Haut Atlas Central. Bassin Oued El Abid	1984 Every year Yes	Wea. Serv.	Acetone burners: 7 on ground and A/C (2) seeding at cloud top and in-cloud	AgI 20 g/h (solution) 375 g/h (A/C) Total consumption. 35 kg. AgI/NaI solution 6 g/h 115 g/h (A/C) 2 kg/h Total consumption 8.75 kg; 2 kg/h propane	LWC > 0.5 g/m^3 in the cumulus. Convective clouds. Orographic clouds base < +10°C top < 0°C but > -20°C. Seeding criteria: temp. of summit ≥ -5°C; LWC > 0.1 g/m^3 for 10 km, > 0.3 g/m^3 for less distance	1 Nov 91-30 April 92 17 days	Evaluation based on target control multiple regression procedure

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
RUSSIAN FEDERATION											
RF-1	Op. Hail	1,706 target 7,706 control	Hail suppression	Krasnodar district	1967 Every year Yes	Agr. Wea. Ser. (G)	In-cloud seeding with pyrotechnic flares and explosive generators using rockets and artillery shells. Temp. in the range -6°C to -10°C	AgI	Convective clouds with bases warmer than 10°C and tops colder than -20°C. Seeding criteria: prob. of hail > 0.4 and ratio of radar reflectivities at 3.2 cm and 10 cm wave lengths < 1	Apr-Sept 51 days	Evaluation based on historical records. EIS-yes, C/B-Yes
RF-2	Op. Hail	11,450 km^2	Hail suppression	Northern Caucasas	1967 Every year Yes	Agr. Wea. Ser. (G)	In-cloud seeding with rockets with pyrotechnic flares. Temp. in the range -3° to -15°C	AgI	Convective clouds with bases colder than 10° and top temp. in the range of 0 to -20°C. Seeding criteria as for RF-1	Apr-Sept 58 days	Evaluation based on historical records, EIS-Yes, C/B-Yes
RF-3	Res. Hail	2,500 km^2 target 3,000 km control	Comprehensive Hail Experiment	Kalardino Balkariya (Northern Caucasus)	1983 Every year Yes	Res. Wes. Ser. (G)	Rockets with pyrotechnic flares seeding in clouds at temp. in the range -6°C to -10°C	AgI	Convective clouds with bases colder than 10°C and tops colder than -20°C. Seeding criteria: as for RF-1	May-Aug	Evaluation based on historical records, hail pad data and physical effects of seeding. EIS-Yes, C/B-Yes
RF-4	Op. PE (E)	30,000 km^2	Cloud seeding for precipitation enhancement	Omsk area	1990 (?) (?)	Agr. Wea. Ser. (G)	Cloud top seeding with pyrotechnic flares from 2 A/C	AgI. Total consumption 4.1 kg	Convective and stratiform clouds with bases warmer than 10°C and top temp. in the range of 0°C to -20°C	June-July 17 days	Evaluation based on historical records and radar data. EIS-Yes, C/B-Yes

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
RF-5	Op. PE (E)	32,000 km²	Cloud seeding for precipitation enhancement	Novosibirsk area	1990 Inter-rupted (?)	Agr. Wea. Ser. (G)	Cloud top seeding with pyrotechnic flares from 2 A/C	AgI. Total consumption 3.8 kg	Convective and stratoform clouds with bases warmer than 10°C and top temp. between 0°C and -20°C	June-July 15 days	Estimation based on comparison with historical records. EIS-Yes, C/B-No
RF-6	Op. cold fog dispersal	84 km²	Cold fog dispersal at airports	Sheremetyevo International A/P, Moscow	1989 Every year Yes	Trans. Wea. Ser. (G)	G/B generators with liquid spray seeding fog at temp. between 0°C and -20°C	Liquid nitrogen	Presence of super cooled water in fog	Nov-Mar 5 days	Estimation based on visibility measurements. In seeded and un-seeded areas. EIS-Yes, C/B-Yes
RF-7	Op. PE (E)	25.000 km²	Cloud seeding for precipitation enhancement	Stavropol area	1986 Every year Yes	Agr. Wea. Ser. (G)	Cloud top seeding with pyrotechnic flares from 4 A/C	AgI. Total consumption 8.4 kg	Convective and stratiform clouds with bases warmer than 10° and top temp. between 0°C and -20°C	Apr-June, Sept-Oct 27 days	Estimation based on comparison with historical records and radar data. EIS-Yes, C/B-Yes
RF-8	Op. PE (E)	30.000 km²	Cloud seeding for precipitation enhancement	Northern Kazahstan	1991 No	Agr. Wea. Ser. (G)	2 A/C seeding cloud tops with pyrotechnic flares	AgI. Total consumption 10.5 kg	Convective and stratiform clouds with bases warmer than 10°C and top temp. between 0° and -20°C	June-July 15 days	Evaluation based on historical records and radar data. EIS-Yes, C/B Yes

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
SPAIN											
SP-1	Op. Res. PE (during wet period)	1,250 km²	Precipitation Enhancement Study - Canary Islands	Canary Islands	1989 Inter-rupted No	Hydrology Govern-ment	A/C using liquid sprayers, seeding at cloud base 20μm droplets	Water solution of ammonium nitrate and urea	Convective and orographic clouds with bases colder than 10°C and tops warmer than 0°C. Clouds with updrafts and LWC > 2g	Oct-Mar	No provision for evaluation
SP-2	Op. Hail	10.000 km²	Hail suppression project	Provinces of Alava, Rioja and Navarra	1969 Every year Yes	Govern-ment Agriculture	110 G/B acetone generators releasing seeding material at ground	AgI 318 kg total consumption	Seeding based on synoptic information from Met. Service	15 May-30 Sept 139 days	Evaluations based on crop damage EIS-No C/B-No
SP-3	Op. Hail	Various fruit plantations of 50 and 200 Ha	Hail protection for fruit trees	Various plantations centred on 30° 45'N, 6° 45'W	1982 Every year Un-known	Private Agriculture	Rockets with explosives	AgI amounts not known	Convective clouds with bases > 10°C and tops generally warmer than -20°C but occasionally colder. Decision to seed based on visual observations	Apr-Sept	No evaluation EIS-No C/B-No
SYRIAN ARAB REPUBLIC											
SYR-1	Op. PE Inc.	175,000 km²	Rain Enhancement Project	Territory of Syrian Arab Republic (except step desert)	1991 Yes	Agr. Wea. Ser. (G)	Cloud top seeding with pyrotechnic flares from 3 A/C at temp. ≤ -8°	AgI	Convective orographic and stratiform clouds with bases colder than 10°C and top temp. between 0 and -20°C. Radar, satellite and synoptic data used to select days with treatment	Mar-Apr, Dec 52 days	Evaluation based on historic records. EIS-No, C/B-No

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
THAILAND											
TH-1	Res. PE Inc. PR	About 2,000 km^2 floating target and 2,000 km control	Applied Atmospheric Resources Research Program (AARRP)	Bhumibol catchment area (Northern part of Thailand)	1987 No Yes	Agr. (G)	Cloud top and in-cloud seeding with pyrotechnic flares from 1 A/C. In-cloud temp. between -6 and -12°C	AgI 100 to 300g per cloud tower	Convective and orographic-clouds with bases lower than 10°C and top temp. between 0°C and -20°C. Seeding criteria: LWC $\geq$ 1gm^{-1}, updraft velocity $\geq$ 1,000 ft min^{-1}, echo top heights $\leq$ 10 km, no Cb clouds within 40 km radius	Apr-Oct 200 days	Estimation based on randomized experiment. EIS-Yes, C/B-Yes
TURKEY											
TUR-1	Op. PE Inc.	-	Iski Rain Enhancement Program	Instanbul watersheds	1990 Every year (?)	Water supply (G)	In-cloud seeding with acetone burners and pyrotechnic flares from 1 A/C at temp. -5°C	AgI 4g/min per burner. Total consumption 10,458 kg	Convective and stratiform clouds with top temp. between 0°C and -20°C	winter months	Evaluation based on comparison with historical records. EIS-No, C/B-No
UKRAINE											
UK-1	Op. Hail	5,070 km^2	-	Crimea area of Ukraine	1968 Every year Yes	Agr. (G)	In-cloud seeding with pyrotechnic flares, using rockets at temp. $\leq$ -7°C	AgI. Total consumption during the year 10.8 kg	Convective clouds with base temp. < 10°C and top temp. between 0° and -20°C. Seeding criteria: liquid or mixed clouds more than 400 m deep with in-cloud temp. $\leq$ -7°C	Sept	-

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UK-2	Op. Hail	4,015 km	Hail suppression	30°N 46°E Odessa area	1980 Every year Yes	Agr. (G)	As UK-1	AgI. Total consumption during the year 25.15 kg	As UK-1	May-Sept 30 days	Evaluation can be made (but not available at present) based on comparison with historical records. EIS-Yes. C/B-No
UK-3	Res. Dev. PE Water Supply Enhance-ment Ext.	50 km² target 11,000 km² control	Precipitation enhancement for agricultural production	44°30'N 33°30'E Crimea	1990 Every year Yes	Agr. Res. Muni. (G)	Cloud top and in-cloud seeding with pyrotechnic flares and dry ice from 1 A/C. In-cloud seeding temp. ≤ -4°C for dry ice and ≤ -7°C for AgI	AgI. Dry ice 0.5-0.6 kg/km in stratiform clouds and 10-12 kg per convective cell	Convective, orographic and stratiform clouds with bases colder than 10°C and tops colder than 0°C. Seeding criteria: as UK-1 except depth of Cucong and Cb clouds must exceed 2,000 m	Jan-June 25 days	Evaluation-Yes. EIS-Yes. B/C-Yes
UK-4	Op. PE Water Supply Enhance-ment Ext.	5,000 km² target 11,000 km² control	As UK-3	47°45'N 33°10'E Dnepropet-rovsk area	1990 Every year Yes	Agr. Res. (G)	As UK-3 except 2 A/C were used	As UK-3	Convective and stratiform clouds with bases colder than 10°C and tops colder than 0°C. Seeding criteria: as UK-1	Jan-Mar. Oct-Dec 12 days	Evaluation based on comparison of precipitation in-seeded and and un-seeded areas. EIS-Yes. B/C-Yes

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UNITED ARAB EMIRATES											
UAE-1	Op. PE Inc. PR	83,000 km^2	UAE Rain Enhancement	Abu Dhabi Emirates	1982 Every year (?)	Def. (G)	In-cloud seeding with 2 generators and pyrotechnic flares from 1 A/C	AgI 53g/hour. Total consumption 725 kg SNOMAX 135g/hour. Total consumption 1821 kg	Convective and orographic clouds with bases colder than 10°C and cloud top temp. between 0°C and -20°C	Nov-Apr 165 days	Evaluation based on comparison with historical records and on comparison of radar parameters of seeded and unseeded clouds. EIS-No. C/B-Yes
UNITED STATES OF AMERICA											
US-1	Cold fog dispersed	162 km^2	FAIRCHILD AFB cold fog dispersal system NOAA 90-699 91-756	Fairchild AFB. Washington	-	Def. (G)	23 G/B propane dispensers	Propane, 37,8 l per hour per dispenser	-	Jan-Mar. Oct-Dec 16 days	EIS-Yes
US-2	PE	2.916 km^2	Nevada Ruby Mountains Project NOAA 90-701 91-739	Western Ruby Mountains Watershed	-	Res. (G)	6 G/B acetone burners	AgI. Total consumption 10,528g	-	Jan-Apr, Nov-Dec 46 days	EIS-No
US-3	PE	9.720 km^2	Nevada Carson-Walker Project NOAA 90-702. 91-740	Walker and Carson Watershed, Nevada	-	Res (G)	A/C with pyrotechnic flares and wing tip burners 3 G/B acetone burners	AgI. Total consumption 15,089g	-	Jan-Apr, Oct-Dec 61 days	EIS-No
US-4	PE	5,410 km^2	Nevada Truckee-Tahoe Project NOAA 90-703 91-741	Truckee river watershed, Nevada	-	Res (G)	7 G/B acetone burners and 1 A/C with pyrotechnic flares or burners	AgI. Total consumption 67,519g	-	Jan-May, Oct-Dec 48 days	EIS-No

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
US-5	PE	765 km^2 target 3,240 km^2 control	NOAA 90-704 91-738	American river watershed, California	-	Muni. (G)	8 G/B acetone burners	AgI 20g/hour per burner. Total consumption 10,817g	-	Jan-Dec 16 days	EIS-Yes
US-6	Snow-pack augment-ation	2,430 km^2 target 2,000 km^2 control	NOAA 90-705 91-750	Box Elder, Cache and Rich counties, Utah	-	Water resources (P)	30 G/B acetone burners	AgI 6g/hour per burner. Total consumption 18,826g	-	Jan-Mar, Dec 17 days	EIS-No
US-7	Mountain snow-pack augment-ation	36,930 km^2 target 24,300 km^2 control	Central and southern Utah cloud seeding NOAA 90-706 91-751	Central and southern Utah	-	Water resources (P)	80 G/B acetone burners	AgI 6g/hour per burner. Total consumption 73,340g	-	Jan-Apr. Nov-Dec 40 days	EIS-No
US-8	Mountain snow-pack increase. Water supply increase	810 km^2 target	Mokelumne NOAA 90-707 91-746	Central Sierra Nevada Mountains, California	-	Enr. (P)	5 G/B acetone burners	AgI 25g/hour per burner. Total consumption 43,075g	-	Jan-May, Nov-Dec 63 days	Evaluation planned based on comparison of precipitation amounts in target and control areas. EIS-No
US-9	Mountain snow-pack increase. Water supply increase	1,620 km^2 target 454 km control	Lake Almanor NOAA 90-708 91-747	Northern Sierra Nevada Mountains, California	-	Enr. (P)	9 G/B acetone burners	AgI 25g/hour per burner. Total consumption 74,075g	-	Jan-May Nov-Dec, 60 days	As US-8
US-10	Mountain snow-pack augment-ation	650 km^2 target 490 km^2 control	WASATCH FRONT (mountains) NOAA 90-709 91-752	Utah	-	Muni. (G)	14 G/B acetone burners	AgI 6g/hour per burner. Total consumption 20,238g	-	Jan-Mar Nov-Dec, 34 days	EIS-No

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
US-11	PE	11,340 km²	Santa Barbara NOAA 90-710 90-742	Santa Barbara County, California	-	Muni. (G)	6 G/B generators. A/C with wing tip generators	AgI 9g/hour per G/B generator and > 80g/hour A/C generators. Total consumption 19,729g	-	Jan-Mar, Dec 15 days	EIS-Yes
US-12	Snow-pack and water supply increase	583 km²	Wind River Weather Modification Project NOAA 90-714 90-737	Big Sandy River Drainage. Wyoming	-	Hyd (G)	G/B generators	AgI. Total consumption 5,946g	-	Jan-Apr, Nov 19 days	EIS-No
US-13	Mountain snow-pack augment-ation	1,944 km²	West Uintas NOAA 90-715 91-755	Northern Utah	-	Water Resources (P)	13 G/B acetone burners	AgI 6g/hour per burner. Total consumption 11,194g	-	Jan-Mar, Dec 19 days	EIS-No
US-14	Winter snow-pack augment-ation PE	325 km² target 2,590 km² control	Central Colorado Program NOAA 90-717 91-748	Vail and Beaver Creek areas, Colorado	-	Water Resources (P, G)	10 G/B acetone burners	AgI 5g/hour to 20g/hour per burner. Total consumption 17,638g	-	Jan-Mar, Nov-Dec. 57 days	EIS-Yes
US-15	Fog dispersal	3:5 km² target 16.2 km² control	Fog Dispersal NOAA 90-717A	Salt Lake City International A/P	-	Trans. (P)	G/B dry ice dispersal	Dry ice. Total consumption 9,800 kg	-	Jan-Feb, Dec 17 days	EIS-Yes
US-16	PE	3,564 km² target 1,040 km² control	Upper San Joaquin Project NOAA 90-717B 91-744	Upper San Joaquin River Basin, California	-	Enr. (P)	19 G/B generators, 1 A/C with 2 acetone burners and pyrotechnic flares	AgI 6g/hour per G/B generator, and 120g/hour per A/B generator. Pyrotechnic flares generated 100-200g/hour. Total consumption 35,577g	-	Jan-Sept, Oct-Dec 80 days	EIS-No

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
US-17	PE	7,210 km²	Kings River California NOAA 90-717C 91-756A	Kings River Basin, California	-	(G) Local	10 G/B generators, 1 A/C with 2 wing tip generators	AgI 6 to 9g/hour per G/B generator and 120 to 180 g/hour by A/C generators. Total consumption 21,925g	-	Jan-May, Dec 53 days	EIS-Yes
US-18	Fog dispersal	32.5 km²	NOAA 90-717D 91-753	Medford A/P, Oregon	-	Trans. (P)	A/C	Dry ice. Total consumption 6,254 kg	-	Jan, Nov-Dec 10 days	EIS-No
US-19	Snow-pack augment-ation	1,300 km²	Ogden River NOAA 91-718 91-754	Upper Ogden River and Lost Creek Drainages	-	Water Resources (P)	5 G/B acetone burners	AgI 6g/hour per burner. Total consumption 6,038g	-	Jan-Mar, Dec 23 days	EIS-No
US-20	PE	11,340 km²	NOAA 91-719	Colorado River Basin, West Texas	-	Muni. (G)	Cloud base seeding with pyrotechnic flares from 1 A/C	AgI 180g/hour. Total consumption 3,980g	-	May-Sept 28 days	EIS-No
US-21	Winter snow-pack augment-ation PE	325 km² target 2,590 km² control	Aspen, Colorado Program NOAA 91-720 91-749	Vicinity of Aspen, Colorado	-	Rec. (P)	9 G/B acetone burners	AgI 5 to 20g/hour. Total consumption 9,546g	-	Jan-Mar, Nov-Dec 50 days	EIS-No
US-22	PE	50 km² target 650 km control	HOMESTAKE PROJECT NOAA 91-721	Upper Davis Creek Drainage Basin, California	-	(P)	Pyrotechnic devices from 1 A/C. Seeding at temp. between 0°C and -10°C	AgI 2 to 200g/min. Total consumption 1,640g	-	Feb-Mar 10 days	EIS-No
US-23	PE	1,620 km² target 1,620 km² target	Salano County NOAA 91-722	Salano-Lake Berryessa watershed, California	-	Hyd. (G) Local	As US-21	AgI. Total consumption 5,040g	-	Feb-Mar 13 days	EIS-Yes

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
US-24	PE	1,135 km² target 3,240 km² control	Calavaras River Project NOAA 91-723	Calavaras river basin, California	-	Hyd. (G) Local	A/C	AgI 50 to 500g/hour. Total consumption 3,800g	-	Jan-Mar, Dec 16 days	EIS-No
US-25	PE	3.900 km² target 7.780 km² control	Tuolumne River Project NOAA 91-724	Tuolumne County, California	-	Hyd. (G) Local	1 A/C seeding with pyrotechnic devices and liquid fuel generators. In cloud and cloud top seeding	AgI 60 to 10,000g/hour. Total consumption 6,380g	-	Jan-Apr, Nov-Dec 21 days	EIS-Yes
US-26	PE	1.500 km² target 3.240 km² control	Eastern Sierra Program NOAA 91-725	Eastern Sierra Mountains, California	-	Hyd. Enr. (G) Local	Cloud-top seeding with pyrotechnics from 1 A/C	AgI 60 to 6,000g/hour. Total consumption 11,400g	-	Jan-July 33 days	EIS-Yes
US-27	PE	2,592 km² target 3.900 km² control	Monterey Project NOAA 91-726	Monterey County, California	-	Hyd (G) Local	In-cloud and cloud-top seeding with pyrotechnics and airborne liquid fuel generators from 1 A/C	AgI 60 to 10,000g/hour. Total consumption 6,877g	-	Jan-Apr Nov-Dec 24 days	EIS-Yes
US-28	PE	1,620 km² target 3.240 km² control	Kaweah River Project NOAA 91-727	Kaweah river basin, California	-	Hyd. (G) Local	In-cloud and cloud top seeding with 6 G/B generators and pyrotechnics from 1 A/C	AgI. Total consumption 9,264g	-	Jan-Apr, Oct-Dec 23 days	EIS-Yes
US-29	PE	3,800 km² target 16,200 km² control	Kern River Project NOAA 91-728	Kern river basin, California	-	Hyd. (G) Local	As US-26	AgI. Total consumption 5,280g	-	Jan-Apr, Oct-Dec 15 days	EIS-Yes

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
US-30	PE	1,620 km² target 3,240 km² control	San Luis Obispo NOAA 91-729	California	-	Hyd. (G) Local	As US-26 but 7 G/B generators used	AgI. Total consumption 5,716g	-	Feb-Apr, Dec	EIS-Yes
US-31	PE	325 km² target 1,620 km² control	Catalina Project NOAA 91-730	Catalina Island, California	-	Enr. (P)	A/C seeding at -10°C level	AgI total consumption 1,700g. Dry ice total consumption 2,061 kg	-	Jan-Mar 14 days	EIS-No
US-32	PE	1,620 km² target 3,240 km² control	San Diego Project NOAA 91-731	East of San Diego, California	-	Muni. (G) Local	A/C	AgI. Total consumption 3,269g dry ice	-	Jan-Mar, Dec 14 days	EIS-Yes
US-33	PE snow-pack augment-ation	2,270 km2 target 7,450 km² control	Grand Mesa/West Elks NOAA 91-732	Western and Central Colorado	-	Hyd. (G) LOCAL	14 G/B generators	AgI 6g/hour per generator. Total consumption 6,480g	-	Mar-May 19 days	EIS-No
US-34	PE Hail	7,740 km²	North Dakota Weather Modification Program District I NOAA 91-733	Western North Dakota	-	(G) Local	Cloud base and in-cloud seeding with acetone burners and pyrotechnics from 2 A/C at temp. -2°C to -12.5°C	AgI total consumption 42,723g. Dry ice total consumption 1,990 lbs	Orographic and convective clouds	June-Aug 26 days	EIS-No
US-35	PE Hail	-	North Dakota Weather Modification Program District II NOAA 91-734	Western North Dakota	-	(G) Local	As US-34	AgI total consumption 88,921g. Dry ice total consumption 2,504 lbs	-	June-Aug 44 days	EIS-No
US-36	PE	11,340 km²	Colorado River Municipal Water District NOAA 91-735	Colorado River basin, Texas	-	(G) Local	Cloud-base seeding from 1 A/C	AgI 3.3g/min. Total consumption 3,980g	-	May-Sept 26 days	EIS-No

IV. REGISTER OF 1991 PROJECTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
US-37	PE Hail	38,880 km^2	Western Kansas Weather Modification NOAA 91-736	West Central and Southwest Kansas	-	(G) Local	Cloud base seeding with wing tip generators from 3/AC. Cloud top seeding from 1 A/C	AgI. Total consumption 78,718g dry ice	-	May-Sept 66 days	-
US-38	PE	1,300 km^2	San Gabriel Mountains NOAA 91-743	Pacoima Drainage. Big Tujunga Drainage and San Gabriel Drainage Basins	-	(G) Local	G/B seeding with 10 acetone burners	AgI. Total consumption 3,008g	-	Oct-Dec 5 days	EIS-No
US-39	Mountain snow-pack augment-ation water supply increase	840 km^2 target 3.2 km^2 control	Lake Oroville Runoff Enhancement Program NOAA 91-756B	Middle Fork Feather River	-	Hyd. (G) Local	10 g/b liquid propane dispensers	Propane. Total consumption 33571	-	Nov-Dec 4 days	EIS-Yes
ZIMBABWE											
ZM-1	Op. PE Inc.	-	National Cloud Seeding Organization (NACSO)	Harare. Chirendzi and Bulawayo	1968 Every year Yes	Wea. Ser. (G)	3 A/C seeding cloud tops at temp. between -10°C and -15°C in the region of maximum updraughts	AgI. Total consumption 1976 cartridges	Convective clouds with top temp. between 0°C and -20°C and top heights between 5.8 km and 6.7 km	Nov 1991-Apr 1992 85 days	Evaluation report planned. C/B-Yes

V. INFORMATION ON COMPLETED PROJECTS

LOCATION AND TERRAIN	PURPOSE AND DURATION	AGENT AND ALTITUDE OF SEEDING	REFERENCES TO PUBLISHED RESULTS	CONTACT FOR INFORMATION
AUSTRALIA				
Operational cloud seeding project over the hydro-electric storages of Tasmania, mountainous terrain. Target area 6,000 km^2	Rainfall augmentation orographic, convective, stratiform and frontal clouds 3 years May-Oct	Airborne seeding with AgI at altitudes of 3.0-3.5 km. Seeding rate 0.48 kg/hour	Operational cloud seeding only. No assessment of results	Hydro-electric Commission Water Resources Department P.O. Box 355D HOBART, Tasmania 7001 Australia
CHILE				
Programa de Estimulacion de las Precipitaciones mediante la siembra aerea de nubes con AGI. Regions I. III, IV and VII, a portion of Region V mountainous terrain	Rainfall and snowfall augmentation, hail suppression. Convective, stratiform and frontal clouds 5 years May-Sept in Regions III, IV and V Jan-Mar in Region I	Airborne seeding with AgI	-	CEPRISER Centro Privado de Servicios Aereos Casilla 126 Correo Los Cerrillos - Cerrillos SANTIGO Chile South America
CHINA				
Klamayi Orographic Cloud Seeding Project, Baiyang River basin in Xinjiang, mountainous terrain. Target area: 2,116 km^2. Control area: 252 km^2	Snowfall augmentation 5 years Oct-Jan	Seeding of orographic clouds with AgI using aircraft and ground generators at altitudes 2.5-4.0 km. Seeding rate: 0.125 kg/hour	Gaoziyi, Liu Guangzhoug, Jiang Yi, 1989, The orographic cloud seeding over the Baiyang River basin in Klamaji, Xinjiang, China. Preprints 5th WMO Scientific Conference on Weather Modification and Appl. Cloud Physics, Beijing, China, pp. 539-542	Xinjiang Weather Modification Office and Xinjiang Petroleum Administration XINJIANG China
CUBA				
Proyecto Cubano de Modificasion Artificial del Tiempo, Camaguey, flat terrain. Target area: 20,000 km^2	Rainfall augmentation 10 years Convective clouds July-Sept	Airborne seeding with AgI at altitudes of 6 km	M. Valdes et. al. Aumento artificial de les precipitaciones en nubes convectivas tropicales. Submitted to publication in "La Meteorologia en el Mundo Iberoamericano, Spain	Instituto de Meteorologia HABANA Cuba

V. INFORMATION ON COMPLETED PROJECTS

LOCATION AND TERRAIN	PURPOSE AND DURATION	AGENT AND ALTITUDE OF SEEDING	REFERENCES TO PUBLISHED RESULTS	CONTACT FOR INFORMATION
FRANCE				
Southwest part of France, flat and hilly terrain. Target area: 79,000 km^2. Control area: 421,000 km^2	Hail suppression. Convective and frontal clouds 40 years Apr-Oct	AgI. 591 ground-based generators	Dessens, T. 1986, "Hail in Southwestern France. II: Results of a 30-year Hail Prevention Project with Silver Iodide Seeding from the Ground." "Journal of Climate and Appl. Meteorology", vol. 25, 48-58. Dessens, T. 1992, "Hailstone Size Distributions in Southwestern France" - 11th International Conference on Clouds and Precipitation - Montreal, August 1992, 662-665	ANELFA 52, rue Alfred Duméril 31400 TOULOUSE France
GERMANY				
Hail suppression within Stuttgart area, hilly terrain. Target area: 2500 km^2. Control area 7600 km^2	Hail suppression. Convective clouds 10 years Apr-Oct	AgI. Airborne seeding at 1.5-2.0 km levels (cloud bases). Seeding rate: 1.4-5 kg/h	Stuttgarter Hagelprojekt 1980-89-Schlussbericht, Feb. 1990, Univ. Hoheheim, Inst. 320, D7000 Stuttgart 70, 99p	University Hohenheim Institute 320 FG Ecoclimatology D-7000 STUTTGART 70 Germany
ISRAEL				
Northern and central Israel	Two randomized experiments 1960-67 and 1969-75. Since 1975 operational seeding in northern Israel, experimental seeding in central Israel. Seeded clouds cumulo-form. Operational period Nov through Apr. Basic design: target only; target - control; and cross-over targets and control are fixed. Target area 8,000 km^2; control area 3,000 km^2, 300 rain gauges in target areas, 60 of which are	60 ground base AgI generators plus AgI seeding from aircraft at altitude of cloud bases along 50 km tracks (7) seeding rate 0.6 kg/h	1. "Assessment of Runoff Enhancement by Randomized Cloud Seeding in case of a Carry-over Flow 1993", Arie Ben Zvi and Margarita Lougerman, Journal of Hydrology , 142 (1993) 391-408 2. Gabriel K.R. and Rosenfeld, 1989 "The Second Israeli Rainfall Stimulation Experiment Analysis of Precipitation on Both Targets", Tech. Rept. 89, Dept. of Statistics, University of Rochester, NY	EMS Rain Stimulation Branch P.O. Box 20 BEN GURION 70100 Israel

V. INFORMATION ON COMPLETED PROJECTS

LOCATION AND TERRAIN	PURPOSE AND DURATION	AGENT AND ALTITUDE OF SEEDING	REFERENCES TO PUBLISHED RESULTS	CONTACT FOR INFORMATION
Northern and central Israel (continued)	recording gauges. 150 in control areas, 20 of which are recording gauges. The experimental unit 24 hours a day cloud top temperature, location of cloud bands and wind direction determine seeding decisions. Seeding period 24 hours if conditions met. 50%-50% restricted randomization of experimental units. Terrain is hilly and mountainous. Radar and airborne measurements. 59 seeded units, 121 not seeded units. Double ratio, cross over, control-target test. Results +10-20% precipitation at 95% statistical significance. Basis for assessment of results. Specified before project began: sub-areas within target, cloud top temperatures (4 categories) rain amount in control area (3 categories). Sample size for each stratification: seed/no-seed units 425/425. Tests double radir statistics on permutation tests. No transformation used (experiment not completed). Presence or lact of dust (2 categories), Seeding duration per rain amount in control area (3 categores), Latitudinal bands (2 categories)		3. Gagin A. and J. Neuman, 1981 The Second Israeli Randomized Cloud Seeding Experiment: Evaluation of the Results", J. Appl. Meteor., 20 pp. 1301-1311 4. Rosenfeld D. 1989 "The Divergent Effects of Cloud Seeding under Different Physical Conditions in Israeli-1 and Israeli-2 Experiments" Tech. Rep, Hebrew University Jerusalem, 42 pp. 5. Rosenfeld D. and H. Farbstein (1992), "Possible Influence of Desert Dust on Seedability of Clouds in Israel", J. Appl. Meteor., 31 pp. 722-731 6. Ben-Zvi A., "Springflow Enhancement in Northern Israel due to Cloud Seeding", Isr. J. Earth Sci. 39 pp, 1992, 103-117 7. Gagin A., "Precipitation Enhancement - A Scientific Challenge", Meteorological Monographs No. 43, American Meteorological Society, 1986, Chapter 7, pp. 63-76	
JORDAN				
Precipitation enhancement project in Jordan, mountainous terrain. Target area: 7,500 km^2	Rainfall enhancement 6 years with interruption during 1989/90 Nov-Apr	AgI, $(NH_4)_2CO_3$ 20 ground-based generators and aircraft at altitudes $\geq$ 2.5 km. Seeding rate: 0.126 kg/hour per generator	-	Jordan Meteorological Department Amman Civil Airport Marka, AMMAN Jordan

V. INFORMATION ON COMPLETED PROJECTS

LOCATION AND TERRAIN	PURPOSE AND DURATION	AGENT AND ALTITUDE OF SEEDING	REFERENCES TO PUBLISHED RESULTS	CONTACT FOR INFORMATION
MONGOLIA				
Central Mongolia, mountainous terrain. Target area: 6,000 km^2	Rainfall enhancement. Hail suppression 2 years June-Sept	AgI. Airborne seeding at altitudes 5-8 km. Convective and stratiform clouds	-	Centre for Weather Modification Ministry of Environment ULAANBAATOR Mongolia
MOROCCO				
Programme Al-Ghait Haut-Atlas Central	Rain and snow augmentation from orographic, cumulus and stratiform clouds. 10 years Nov-Apr	7 AgI ground based generators, broadcast seeding from A/C track 60 km long, 0.375 kg/h AgI seeding rate. Fixed target/control design.	Report WMO/TD No. 269, Papers Submitted to the Fifth WMO Scientific Conference on Weather Modification, Beijing, China 1989	Direction de la Météorologie National Centre National du Climat et de Recherches Météorologiques (CNRM) Aéroport CASA-ANFA CASABLANCA-02 Morocco
SYRIAN ARAB REPUBLIC				
Mountainous, hilly and flat terrain. Target area: 175,000 km^2	Rainfall enhancement 4 months Orographic, convective, stratiform and frontal clouds	AgI. Airborne seeding at altitudes of 6-8 km	There is a report assessing the results of the experiments of the rain enhancement project which took place during 1990-1992	Mr. Alli Abbas Rain Enhancement Project Ministry of Agriculture and Performance DAMASCUS Syrian Arab Republic
TURKEY				
Instanbul Rain Enhancement Project, hilly terrain. Target area: 2100 km^2	Rainfall enhancement 8 months Convective, stratiform and frontal clouds	AgI. Airborne seeding with the rate of 0.24 kg/hour	Journal of Water, N5, 1991, ISKI, Istanbul, pp. 36-42	Istanbul Teknik Universitest Ucak ve uzay Bilimlery Fakultest Maslak 80626 ISTANBUL Turkey

V. INFORMATION ON COMPLETED PROJECTS

LOCATION AND TERRAIN	PURPOSE AND DURATION	AGENT AND ALTITUDE OF SEEDING	REFERENCES TO PUBLISHED RESULTS	CONTACT FOR INFORMATION
UKRAINE				
Precipitation enhancement for water accumulation in reservoirs of the mountainous Cremea. Target area: 50 km^2	Precipitation and snow-pack enhancement 7 months Dec-June	Airborne seeding with AgI and dry ice at 3-6 km. Seeding rates: AgI 1 kg/hour. Dry ice 240 kg/hour. Orographic, convective and frontal clouds	Proceedings of the All-Union conference on artificial modification of hydrometeorological processes. Nalchi, 1991	Ukrainean Hydrometeorological Research Institute Department of Cloud Physics and Weather Modification 37 Prospekt Nauki KIEV 252650 Ukraine
UNITED ARAB EMIRATES				
Rain enhancement, flat and mountainous terrain	Increase in irrigation sources 5.5 months Nov-Apr	Orographic and convective clouds. Airborne seeding with AgI and SNOMAX above 0°C level (about 4.5 km)	-	UAE Armed Forces HQ Air Force and Air Defense P.O. Box 906 (A-3) ABU DHABI United Arab Emirates

VI. ADDRESSES OF REPORTING AGENCIES

AUSTRALIA	Bureau of Meteorology GPO Box 1289K MELBOURNE, Victoria 3001 Australia
AUSTRIA	Central Institute for Meteorology and Geodynamics Postfach 342 Hohe Warte 38 A-1191 WIEN Austria
BULGARIA	National Institute of Meteorology and Hydrology 66, blvd. Tsarigradsko chaussee 1184 SOFIA Bulgaria
CHILE	Direccion General de Auronautica Civil Direccion Meteorologica de Chile Casilla 717 SANTIAGO Chile
CHINA	State Meteorological Administration 46 Baishiqiaolu 100081 BEIJING China
CUBA	Institute de Meteorologia Apartado Postal 17032 CP 11700 HABANA 17 Cuba
FRANCE	ANELFA 52, rue Alfred Duméril 31400 TOULOUSE France
GERMANY	Deutscher Wetterdienst 135 Frankfurterstr. 6050 OFFENBACH AM MAIN Germany
ISRAEL	Ems Rain Stimulation Branch P.O. Box 20 Ben Gurion Airport 70100 Israel
JAMAICA	Meteorological Service Norman Manley International Airport Jamaica
JORDAN	Meteorological Department Marka/P.O. Box 341011 AMMAN Jordan

LIBYAN ARAB JAMAHIRIYA	Libyan Cloud Seeding Project P.B. 14616 TRIPOLI Libyan Arab Jamahiriya
MONGOLIA	State Committee for Environment Control Khudaldaany gudamj 5 ULAANBATOR 11 Mongolia
MOROCCO	Direction de la Météorologie Nationale Centre National de Climat et de Recherche Météorologique Aéroport Casa-Anfa CASABLANCA Morocco
RUSSIAN FEDERATION	Committee for Hydrometeorology and Environment Monitoring of Russian Federation 12 Novovagankovskay str. 123376 MOSCOW Russian Federation
SPAIN	Centro Meteorologico Territorial de Extrenadura Jose Rebello Lopez ZI 06071 BADAJOZ Spain
	Servico Interprovincial Antigranizo c/o Milicie No. 4-10 26003 LOGRONO (La Rioja) Spain
SYRIAN ARAB REPUBLIC	Ministry of Defence Meteorological Department Joul Jammal str. P.O. Box 4211 DAMASCUS Syrian Arab Republic
THAILAND	Meteorological Department 4353 Sukumvit Road 10260 BANGKOK Thailand
TURKEY	Istanbul Teknik Universitest UCAK VE UZAY BILIMLERT FAKÜLTEST MASLAK 80626 ISTANBUL Turkey
UKRAINE	Ukrainian Hydrometeorological Research Institute 37, Prospekt Nauki 252650 KIEV Ukraine

UNITED ARAB EMIRATES	UAE Ministry of Communications Directorate General of Civil Aviation P.O. Box 900 ABU DHABI United Arab Emirates
UNITED STATES OF AMERICA	NOAA National Weather Service SILVER SPRINGS, MD 20910 USA
ZIMBABWE	Department of Meteorological Services P.O. Box 150, Belvedere HARARE Zimbabwe

VII. MEMBER COUNTRIES REPORTING *NO* WEATHER MODIFICATION PROJECTS IN 1991

Algeria
Angola
Argentina
Barbados
Belarus
Bolivia
Botswana
Cameroon
Canada
Colombia
Congo
Costa Rica
Cyprus
Czech Republic
Denmark
Dominican Republic
Ecuador
Egypt
Ethiopia
Fiji
Finland
Greece
Honduras
Hong Kong
Hungary
India
Islamic Republic of Iran
Kenya
Republic of Korea
Kuwait
Latvia
Lithuania
Madagascar
Malawi
Myanmar
Netherlands
Sultanate of Oman
Pakistan
Romania
Rwanda
Saudi Arabia
Seychelles
Sierra Leone
Singapore
Slovakia
Sudan
Switzerland
Sweden
Togo
Trinidad and Tobago
Tunisia
United Kingdom
Uruguay
Vanuata
Zambia

QUESTIONNAIRE CIRCULATED TO OBTAIN INFORMATION FROM MEMBER COUNTRIES

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 A
FORM (1 JANUARY 1991)

CLOUD PHYSICS AND WEATHER MODIFICATION RESEARCH PROGRAMME

QUESTIONNAIRE
TO GATHER DATA FOR THE 1991
REGISTER OF NATIONAL WEATHER MODIFICATION PROJECTS

PLEASE MARK APPROPRIATE BOXES

MEMBER OF WMO .....

No weather modification activities in 1991 /__/

(Please return this form even if no weather modification activities have taken place this year).

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 ..... /__/

Goal is to extend wet period ..... /__/

Goal is to increase precipitation during wet period ..... /__/

(b) Precipitation redistribution ..... /__/

(c) Hail suppression ..... /__/

(d) Fog dispersal ..... /__/

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

2. THIS IS PRIMARILY A (Research ..... /__/ / Development ... /__/ / Operational ... /__/) ACTIVITY

3. PROJECT AREA

(a) Approximate size of the project target area (km^2): .....

(b) Approximate size of the control area (if used) (km^2): .....

(POOLE 5229)

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

.....

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

.....

6. PROJECT HISTORY

(a) Year project started: .....

(b) Has project been implemented each year since it was started?

Yes /__/ No /__/ Not known /__/

(c) 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. PROJECT ACTIVITY THIS YEAR

(a) During the current reporting year, what months did seeding or other weather modification activity take place?

.....

(Note: if reporting period extends over two years, as it might if a project spanning December and January is being reported, please indicate the years being reported, one example might be: December 1990, January-February 1991; another might be: January-February 1991, December 1991).

(b) On how many days did this activity take place? .....

9. 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	.....	.....
Propane	.....	.....
.....		
.....		
.....		

10. CHARACTERISTICS OF CLOUDS TREATED:

(a) Convective (cumulus) /__/ Orographic /__/ Layer (stratiform) /__/

(b) Generally, the cloud base temperatures (°C) are:

Warmer than +10°C /__/ Colder than +10°C /__/

(c) Generally, the cloud top temperatures are:

Warmer than 0°C /__/

Colder than 0°C but warmer than -20°C /__/

Colder than -20°C /__/

(d) Criteria used to select days or clouds for treatment:

.....

.....

.....

11. PROVISIONS FOR EVALUATION

(a) None /__/

(b) Randomized experiment /__/

(c) Comparison with historical records /__/

(d) Crop damage /__/ Hail pads /__/

(e) Other: .....

(f) Is a document on the evaluation available or planned? YES /__/ NO /__/

(g) If so, is it available to WMO? YES /__/ NO /__/

12. MISCELLANEOUS

(a) Was an environmental impact study prepared for this project? YES /__/ NO /__/

(b) Has an analysis been made of the expected (or actual) costs and benefits? YES /__/ NO /__/

13. ORGANIZATION IN CHARGE OF PROJECT:

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

(b) Organization: .....

(c) Postal address: .....

.....

.....

14. OPTIONAL REMARKS:

.....

.....

.....

.....

15. REPORTING AGENCY:

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

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

.....

(c) Postal address: .....

.....

.....

.....

.....

....
(Signature) (Date)

Please complete and return this questionnaire as soon as possible, and in any case not later than 31 October 1992

The Secretary-General
World Meteorological Organization
41, Avenue Giuseppe-Motta
Case postale 2300
1211 GENEVA 2
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 development 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.

Note: 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) in the box that corresponds to purpose of activity. By project is meant a related series of weather modification activities having a common objective and conducted at a particular location.

ITEM 2 - Mark (X) in the 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 if there were breaks in activities or if activities took place each year since it was started;

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

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

ITEM 8 - During what months did the project operate in the field and on how many days did operations take place? Any other information related to the scope of the activity would be helpful. In some cases projects span two years. It is desirable that the portion conducted only within the reporting year be included in the Register for a particular year. If this is not practical, please indicate the years in which the activities took place, for example, December 1990, January-February 1991.

ITEM 9 - By weather modification apparatus is meant 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) in 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 release of pellets (e.g., dry ice), powder (e.g., NaCl), etc.;

(c) Indicate the location at which seeding material is dispersed;

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

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

(c) Indicate the predominate range of cloud top temperatures;

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

ITEM 11 - 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 14 or on a separate page.

ITEM 12 - This question relates to any analysis that has been made to predict and/or measure the total change in the environment that is affected by the activity and, separately, the economic benefits expected or achieved.

ITEM 13 - Please supply the name and address of agency to which any request for further information should be directed.

ITEM 14 - This item is to permit the reporting person to include any information not covered by items 1 through 13 but which he feels is 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 14.

ITEM 15 - Please supply the name and address of the agency that is transmitting this information to WMO.

(POOLE 5229)

2. IL S'AGIT PRINCIPALEMENT D'UNE ACTIVITE

(de recherche ..... /__/
(de développement .. /__/
(d'exploitation .... /__/

3. ZONE COUVERTE PAR LE PROJET

a) Superficie approximative de la zone cible du projet (km^2) : ....

b) Superficie approximative de la zone témoin (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. HISTORIQUE DU PROJET

a) Année durant laquelle le projet a été entrepris : .....

b) Les activités d'exécution du projet ont-elles eu lieu chaque année depuis le début des travaux ?

Oui /__/ Non /__/ Indéterminé /__/

c) Est-il prévu de poursuivre le projet au cours de l'année prochaine ?

Oui /__/ Non /__/ Indéterminé /__/

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. ACTIVITES RELATIVES AU PROJET EN 1991

a) Quels sont les mois de l'année considérée pendant lesquels ont eu lieu des opérations d'ensemencement ou d'autres activités de modification artificielle du temps ?

.....

.....

(Note : Si la période considérée porte sur deux ans, comme ce pourrait être le cas pour un projet s'étendant sur les mois de décembre et de janvier, veuillez indiquer les années faisant l'objet du rapport; exemples possibles : décembre 1990, janvier-février 1991, ou janvier-février 1991, décembre 1991.

b) Nombre de jours de l'année durant lesquels ont eu lieu ces activités ?

.....

9. 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'ANNEE (kg)
AgI	.....	.....
PbI_2	.....	.....
Neige carbonique	.....	.....
NaCl	.....	.....
Propane	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

10. CARACTERISTIQUES DES NUAGES ENSEMENCES :

a) Convectifs (cumulus) /__/ Orographiques /__/ Couche (stratiforme) /__/

b) En règle générale, les températures à la base des nuages (°C) sont :

supérieures à +10°C /__/ inférieures à +10°C /__/

c) En règle générale, les températures au sommet des nuages sont :

supérieures à 0°C /__/

inférieures à 0°C mais supérieures à -20°C /__/

inférieures à -20°C /__/

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

.....

.....

.....

11. DISPOSITIONS PRISES EN VUE D'UNE EVALUATION

a) Aucune /__/

b) Expérience aléatoire /__/

c) Comparaison avec des relevés anciens /__/

d) Dégâts aux récoltes /__/ Coussins à grêle /__/

e) Divers : .....

f) Existe-t-il ou est-il prévu d'élaborer un document sur l'évaluation de l'activité ? Oui /__/ Non /__/

g) Le cas échéant, est-il possible de le mettre à la disposition de l'OMM ? Oui /__/ Non /__/

12. DIVERS

a) Une étude concernant les effets de ce projet sur l'environnement a-t-elle été préparée ? Oui /__/ Non /__/

b) Les coûts et les avantages escomptés (ou réels) ont-ils été analysés ? Oui /__/ Non /__/

13. ORGANISME RESPONSABLE DU PROJET :

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

b) Organisme : .....

c) Adresse : .....

.....

.....

14. REMARQUES FACULTATIVES :

.....

.....

.....

15. 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 31 octobre 1992, à l'adresse suivante :

Monsieur le Secrétaire général
Organisation météorologique mondiale
41, Avenue Giuseppe-Motta
Case postale 2300
1211 GENEVE 2
Suisse

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'ensemencement 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 et des nuages par la libération, dans l'atmosphère, de 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 laser 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 et 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.

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

EXPLICATIONS COMPLEMENTAIRES
CONCERNANT LE QUESTIONNAIRE A 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 et se déroulant à un endroit donné.

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

- o recherche - portant sur des questions scientifiques;
- o développement - activités pratiques déployées à des fins d'optimisation des procédures;
- o 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 si les activités ont subi des interruptions ou si elles ont eu lieu chaque année depuis le début du projet;

c) 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 - Indiquer les mois de l'année pendant lesquels les 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. Dans certains cas, le projet peut s'étendre sur deux ans. Il est souhaitable que seule la partie du projet exécutée pendant l'année considérée figure dans l'inventaire pour l'année en question. Si cela n'était pas possible, veuillez préciser les années pendant lesquelles les activités ont été déployées (par exemple, décembre 1990, janvier-février 1991).

QUESTION 9 - L'expression "appareil utilisé pour la modification artificielle du temps" désigne ici tout appareil utilisé dans l'intention de produire des modifications 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.

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

b) Indiquer l'intervalle prédominant de températures à la base des nuages.

c) Indiquer l'intervalle prédominant de températures au sommet des nuages.

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

QUESTION 11 - 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 14 ou sur une feuille distincte.

QUESTION 12 - Cette question se rapporte à toute analyse effectuée pour prévoir et/ou mesurer l'ensemble des modifications subies par l'environnement du fait de cette activité, ainsi que toute analyse distincte concernant les avantages économiques escomptés ou obtenus.

QUESTION 13 - Veuillez indiquer le nom et l'adresse de l'organisme auquel il faut adresser toute demande de renseignements complémentaires.

QUESTION 14 - 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 qu'elle juge 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 14.

QUESTION 15 - Veuillez indiquer le nom et l'adresse de l'organisme qui fournit ces renseignements à l'OMM.

R/CLA/4, ANEXO A
FORMULARIO (1 DE ENERO DE 1991)

PROGRAMA DE INVESTIGACION SOBRE LA FISICA DE NUBES
Y LA MODIFICACION ARTIFICIAL DEL TIEMPO

CUESTIONARIO
PARA RECOPILAR DATOS DESTINADOS AL INVENTARIO DE 1991 DE PROYECTOS NACIONALES DE MODIFICACION ARTIFICIAL DEL TIEMPO

SEÑALAR EN LA CASILLA CORRESPONDIENTE

MIEMBRO DE LA OMM .....

El Miembro no ha llevado a cabo actividades de modificación en 1991 /__/

(Sírvase devolver este formulario aunque no se haya llevado a cabo ninguna actividad de modificación artificial del tiempo este año.)

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 ..... /__/

Se trata de prolongar el período húmedo ..... /__/

Se trata de aumentar la precipitación durante el período húmedo ..... /__/

b) Redistribución de la precipitación ..... /__/

c) Supresión del granizo ..... /__/

d) Dispersión de la niebla ..... /__/

e) Otros (especifíquense): .....

2. SE TRATA PRINCIPALMENTE DE UNA ACTIVIDAD

(de investigación .... /__/
(de desarrollo ..... /__/
(operativa ..... /__/

3. ZONA QUE CUBRE EL PROYECTO

a) Superficie aproximada de la zona del blanco (km^2): .....

b) Superficie aproximada de la zona de control (si procede) (km^2): .....

4. NOMBRE Y/O REFERENCIA DEL PROYECTO: .....

.....

5. SITUACION DE LA ZONA EN LA QUE SE EJECUTA EL PROYECTO:

.....

6. HISTORIAL DEL PROYECTO

a) Año del comienzo del proyecto: .....

b) Indique si el proyecto se ha realizado cada año desde el principio de los trabajos

Sí /__/ No /__/ No se sabe /__/

c) ¿Se ha previsto que continúe el proyecto durante el año próximo?

Sí /__/ 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. ACTIVIDADES RELATIVAS AL PROYECTO EN 1986

a) ¿Cuáles son los meses del año durante los cuales se han realizado operaciones de siembra u otras actividades de modificación artificial del tiempo?

.....

(Nota: Si el período abarca más de dos años, como podría ocurrir si un proyecto se realiza durante los meses de diciembre y enero, sírvase indicar los años de que trata el informe; ejemplos posibles: diciembre de 1990, enero-febrero de 1991 o enero-febrero de 1991 diciembre de 1991).

b) Número de días durante los cuales se han llevado a cabo estas actividades .....

9. 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 que temperatura o cuál criterio?

.....

.....

Material de siembra	Cantidad de material consumido (dar unidades)	Consumo total durante este año (kg)
AgI	.....	.....
PbI_2	.....	.....
Hielo Seco	.....	.....
NaCl	.....	.....
Propano	.....	.....
.....		
.....		
.....		

10. CARACTERISTICAS DE LAS NUBES TRATADAS:

a) Convectivas (cúmulos) /__/ Orográficas /__/ Capa de nubes (estratiforme) /__/

b) En general las temperaturas de la base de las nubes (°C) son:

Superiores a +10°C /__/ Inferiores a +10°C /__/

c) En general, las temperaturas en la cima de las nubes son:

Superiores a 0°C /__/

Inferiores a 0°C pero superiores a -20°C /__/

Inferiores a -20°C /__/

d) Criterios de selección de los días de siembra o de las nubes sembradas:

.....

.....

.....

11. DISPOSICIONES QUE SE HAN TOMADO PARA REALIZAR LA EVALUACION

a) Ninguna /__/

b) Experimento aleatorio /__/

c) Comparación con registros históricos /__/

d) Daños causados a las cosechas /__/ Paquetes de granizo /__/

e) Demás: .....

f) Indíque si existe o si se ha previsto preparar un documento sobre la evaluación de la actividad SI /__/ NO /__/

g) Si procede indíque si es posible facilitarlo a la OMM SI /__/ NO /__/

12. DIVERSOS

a) Indique si se ha preparado un estudio sobre los efectos de este proyecto para el medio ambiente SI /__/ NO /__/

b) Indique si se han analizado los costos y las ventajas previstos SI /__/ NO /__/

13. ORGANIZACION ENCARGADA DEL PROYECTO

a) Nombre de la persona encargada de los aspectos técnicos .....

.....

b) organización .....

c) dirección .....

.....

.....

14. DEMAS OBSERVACIONES:

.....

.....

.....

.....

15. ORGANISMO QUE PRESENTA LA INFORMACION:

a) Nombre del organismo:.....

b) Título oficial de la dependencia responsable: .....

.....

c) Dirección: .....

.....

.....

.....

.....

....

(Firmado) (Fecha)

Sírvase rellenar el presente cuestionario y devolverlo lo antes posible, y en todo caso antes del 31 de octubre de 1992 a la dirección siguiente:

Señor Secretario General
Organización Meteorológica Mundial
41, Avenue Giuseppe-Motta
Case postale 2300
1211 GINEBRA 2
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 incluya 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.

Nota: Se solicita el envío de un ejemplar rellenado de este formulario para cada actividad de modificación artificial de tiempo (en adelante denominado proyecto).

EXPLICACION ADICIONAL
DE LAS PREGUNTAS QUE FIGURAN EN EL FORMULARIO PARA EL
INVENTARIO DE PROYECTOS NACIONALES DE MODIFICACION ATIFICIAL 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 tiene un objetivo común y que se realiza en un lugar determinado.

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 se han interrumpido las actividades o si se han realizado cada año desde el principio del proyecto;

c) 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 - Indíquense los meses del año durante los cuales se han realizado actividades sobre el terreno en el marco del proyecto y el número de días de actividad. Cualquier otra información sobre el campo de apliación de la actividad. Convendría que sólo se mencione en el inventario la parte del proyecto realizada durante el año de que se trata. Si esto no es posible, sírvase especificar los años durante los cuales se han realizado las actividades (por ejemplo: diciembre de 1990, enero-febrero de 1991).

PREGUNTA 9 - Se entiende por aparato para la modificación artificial del tiempo cualquier apartato 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;

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 10 - a) Indíquese, señalando con una (X) la casilla adecuada, las caraterísticas generales de las nubes que se seleccionan para el tratamiento;

b) indíquese el intervalo predominante de las temperaturas en la base de las nubes;

c) indíquese el intervalo predominante de las temperaturas en la cima de las nubes;

d) ¿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 11 - 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 14 o en una página aparte.

PREGUNTA 12 - Esta pregunta se refiere a cualquier análisis realizado para prever y/o medir el conjunto de las modificaciones del medio ambiente como consecuencia de esta actividad así como a cualquier análisis sobre las ventajas económicas previstas o alcanzadas.

PREGUNTA 13 - Rogamos proporcione el nombre y dirección del organismo al que ha de dirigirse toda petición de mayor información.

PREGUNTA 14 - 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 14.

PREGUNTA 15 - Rogamos proporcione el nombre y dirección del organismo que transmite esta información a la OMM.

ВСЕМИРНАЯ МЕТЕОРОЛОГИЧЕСКАЯ ОРГАНИЗАЦИЯ

R/CLA/4, ПРИЛОЖЕНИЕ A
ФОРМА (1 ЯНВАРЯ 1991 г.)

ПРОГРАММА НАУЧНЫХ ИССЛЕДОВАНИЙ ПО ФИЗИКЕ ОБЛАКОВ И АКТИВНЫМ ВОЗДЕЙСТВИЯМ НА ПОГОДУ

ВОПРОСНИК ПО СБОРУ ДАННЫХ ДЛЯ РЕЕСТРА НАЦИОНАЛЬНЫХ ПРОЕКТОВ ПО АКТИВНЫМ ВОЗДЕЙСТВИЯМ НА ПОГОДУ ЗА 1991 г.

ПРОСЬБА ПОМЕТИТЬ СООТВЕТСТВУЮЩИЕ КВАДРАТЫ

ЧЛЕН ВМО .....

Деятельность по активным воздействиям на погоду в 1991 г. не проводилась ☐

(Просьба прислать эту форму, даже если деятельность по активным воздействиям на погоду в этом году не проводилась).

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

a) Увеличение осадков ..... ☐

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

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

С целью продления влажного периода ..... ☐

С целью увеличения осадков в течение влажного периода .. ☐

b) Перераспределение осадков ..... ☐

c) Подавление града ..... ☐

d) Рассеивание тумана ..... ☐

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

2. ЭТА ДЕЯТЕЛЬНОСТЬ НОСИТ ПРЕЖДЕ ВСЕГО ХАРАКТЕР

(исследований ..... ☐)
(разработок ..... ☐)
(оперативных применений ..... ☐)

3. РАЙОН, ОХВАТЫВАЕМЫЙ ПРОЕКТОМ

a) Приблизительный размер целевого района, где осуществляются воздействия, предусмотренные проектом ($км^2$): .....

b) Приблизительный размер контрольного района (если используется) ($км^2$): .....

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

.....

5. МЕСТОНАХОЖДЕНИЕ РАЙОНА, ГДЕ ОСУЩЕСТВЛЯЕТСЯ ПРОЕКТ:

.....

6. ИСТОРИЯ ПРОЕКТА

a) Год начала проекта: .....

b) Осуществлялся ли проект каждый год после его начала?

Да ☐ Нет ☐ Неизвестно ☐

c) Предполагается ли продолжение проекта в течение следующего года?

Да ☐ Нет ☐ Неизвестно ☐

7. ХАРАКТЕР ОРГАНИЗАЦИИ-СПОНСОРА ПРОЕКТА
(просьба поставить X в соответствующем месте)

ОБЛАСТЬ ДЕЯТЕЛЬНОСТИ ОРГАНИЗАЦИИ	ПРАВИТЕЛЬСТВЕННАЯ	ЧАСТНАЯ
Сельское хозяйство		
Энергетика		
Лесное хозяйство		
Гидрология		
Фонд для научных исследований		
Транспорт		
Метеорологическая служба		
Прочие (просьба указать)		

8. ДЕЯТЕЛЬНОСТЬ ПО ПРОЕКТУ В ЭТОМ ГОДУ

a) В какие месяцы текущего отчетного года производился засев или проводилась другая деятельность по активному воздействию на погоду?

. . . . . .

(Примечание: Если отчетный период охватывает два года, например при сообщении информации о проекте, осуществляемом в течение декабря и января, то просьба указать годы. Пример: декабрь 1990 г., январь-февраль 1991 г.; другой пример: январь-февраль 1991 г., декабрь 1991 г.).

b) Сколько дней проводилась эта деятельность? . . . . . .

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

a) *Система доставки засеивающих веществ:*

Наземная ☐ . . . . . Сколько генераторов? ☐

Самолет ☐ . . . . . Сколько самолетов? ☐

Ракеты ☐ . . . . . Артиллерийские снаряды ☐

Другие (просьба указать): . . . . . .

b) *Тип генератора:*

Ацетоновая горелка ☐ Пиротехническая ракета ☐

Взрывчатое вещество ☐ Разбрызгиватель жидкости ☐

Распылитель твердых частиц ☐ Другие: .....

c) *Расположение выпуска засеивающего вещества:*

Наземное ☐ Нижняя граница облаков ☐

Верхняя граница облаков ☐ В облаках ☐

Если выпуск осуществляется в облаке, то при какой температуре или по каким другим критериям?

.....

.....

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

10. ХАРАКТЕРИСТИКИ ОБРАБАТЫВАЕМЫХ ОБЛАКОВ

a) Конвективные (кучевые) ☐ Орографические ☐ Слой (слоистообразные) ☐

b) Преобладающая температура в основании облака (°C):

Выше 10°C ☐ Ниже 10°C ☐

c) Преобладающая температура в вершине облака:

Выше 0°C ☐

Ниже 0°C, но выше -20°C ☐

Ниже -20°C ☐

d) Критерии, используемые при выборе дней или облаков для их обработки:

. . . . . .

. . . . . .

. . . . . .

11. ОБОСНОВАНИЯ ДЛЯ ОЦЕНКИ

a) Не имеются ☐

b) Рандомизированный эксперимент ☐

c) Сравнение с историческими данными ☐

d) Ущерб урожаю ☐ Градомеры ☐

e) Прочие: . . . . . .

f) Имеется ли документ по оценке или планируется таковой? ДА ☐ НЕТ ☐

g) Если да, то можно ли его направить в ВМО? ДА ☐ НЕТ ☐

12. РАЗНОЕ

a) Была ли подготовлена для этого проекта оценка влияния на окружающую среду? ДА ☐ НЕТ ☐

b) Проведен ли анализ предполагаемых (или фактических) затрат и выгод? ДА ☐ НЕТ ☐

13. НАЗВАНИЕ ОРГАНИЗАЦИИ, ОТВЕТСТВЕННОЙ ЗА ПРОЕКТ

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

b) Организация: . . . . . .

c) Почтовый адрес: . . . . . .

. . . . . .

. . . . . .

14. ЛЮБЫЕ ЗАМЕЧАНИЯ

.....

.....

.....

.....

15. 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 31 октября 1991 г. по адресу:

The Secretary-General
World Meteorological Organization
41, Avenue Giuseppe-Motta
Case postale 2300
1211 GENEVA 2
Switzerland

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 окружение.

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, вентиляторов, 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.

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

ДОПОЛНИТЕЛЬНЫЕ ПОЯСНЕНИЯ К ВОПРОСАМ ДЛЯ РЕЕСТРА НАЦИОНАЛЬНЫХ ПРОЕКТОВ ПО АКТИВНЫМ ВОЗДЕЙСТВИЯМ НА ПОГОДУ

ПУНКТ 1 - Укажите значком (X) квадрат, который соответствует целям деятельности. Под проектом подразумевается связанная серия действий по активным воздействиям на погоду, имеющих общую цель и проводимых в конкретном месте.

ПУНКТ 2 - Укажите значком (X) квадрат, соответствующий цели деятельности:

- исследования	- вопросы научных исследований;
- разработки	- полевая работа по оптимизации процедур;
- оперативные применения	- полевая работа, направленная непосредственно на достижение экономических выгод.

ПУНКТ 3 - Под целевым районом осуществления воздействий подразумевается район, в пределах которого предполагается обнаружить последствия деятельности по активному воздействию на погоду. Под контрольным районом (или районами) понимается территория, которая выбрана так, чтобы она не подвергалась воздействиям засевающих веществ; она используется для оценки результатов в пределах целевого района.

ПУНКТ 4 - Впишите название и/или обозначение проектов, используемых оператором. Если проект был зарегистрирован в предыдущем Реестре, просьба указать номер по Реестру 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, были ли перерывы в деятельности, или же она проводилась каждый год со времени начала;

c) Укажите, предполагается ли продолжить проект в будущем, поставив значок (X) в соответствующем квадрате.

ПУНКТ 7 - Укажите основную область деятельности организации, которая финансирует проект, обозначив значком (X) соответствующий квадрат (при необходимости используйте несколько значков).

ПУНКТ 8 - В какие месяцы и сколько дней осуществлялась оперативная полевая фаза проекта? Была бы полезна любая информация, касающаяся целей деятельности. В некоторых случаях проекты охватывают два года. Желательно включить в Реестр за конкретный год только ту часть, которая проводилась в отчетный период. Если это невозможно, просьба указать годы, в которые проводилась деятельность, например декабрь 1989 г., январь-февраль 1990 г.

ПУНКТ 9 - Под оборудованием для 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) соответствующий квадрат, 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 частиц относится к рассеиванию ледяных крупинок (например, сухой лед), порошка (например, NaCl) и т.д.;

c) Укажите, обозначив значком (X), соответствующий квадрат, место рассеивания реагента;

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

ПУНКТ 10 - a) Укажите, обозначив значком (X) квадрат, общую характеристику облаков, которые выбраны для обработки;

b) Укажите преобладающий диапазон температур на нижней границе облаков;

c) Укажите преобладающий диапазон температур на верхней границе облаков;

d) По каким характеристикам отличают дни или облака, подвергнутые воздействию, от тех, которые не были подвергнуты воздействию.

ПУНКТ 11 - Этот вопрос относится к оценке эффективности проекта. Предоставление большего объема информации о средствах, используемых для оценки положительных сторон проекта, только приветствуется, и эта информация может быть представлена под пунктом 14 или на отдельной странице.

ПУНКТ 12 - Этот вопрос относится к любому анализу, проведенному с целью расчета и/или измерения общего изменения окружающей среды, подвергнутой воздействию, и отдельный вопрос касается предполагаемых или полученных экономических выгод.

ПУНКТ 13 - Сообщите название и адрес организации, в которую можно направлять запросы о дополнительной информации.

ПУНКТ 14 - Этот пункт предназначен для того, чтобы позволить 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 ссылка 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. могут быть отражены под пунктом 14.

ПУНКТ 15 - Просьба сообщить название и адрес учреждения, которое передает эту информацию ВМО.

FORM USED FOR REPORTING COMPLETED WEATHER MODIFICATION PROJECTS

WORLD METEOROLOGICAL ORGANIZATION

R/CLA/4, ANNEX B

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: .....

All types of precipitation gauges in control area: .....

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

Recording precipitation gauges 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 began

8.1.1 Nature of stratification(s), if any: .....

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

Seed: ..... No seed: .....

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:

Qualitative: .....

Quantitative: .....

8.2 Analytical specifications chosen AFTER the project began

8.2.1 Nature of partitioning(s): .....

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

Seed: ..... No seed: .....

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:

Qualitative: .....

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

.....

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11. PRINCIPAL REFERENCES TO PUBLISHED RESULTS (where details of above may be found):

.....

.....

.....

.....

.....

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. DUREE DU PROJET

2.1 Durée du projet, en années : .....

2.2 Période opérationnelle au cours de chaque année :

du ..... au ..... (inclusivement)

3. OPERATIONS D'ENSEMENCEMENT

3.1 Agents d'ensemencement : AgI /__/ CO_2 /__/ NaCl /__/

Autres (veuillez préciser) : .....

3.2 Générateur(s) : Au sol /__/ Aéroporté(s) /__/

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 : .....

Tous types de pluviomètres dans la zone témoin : .....

5.4.2 Pluviographes dans la zone cible : .....

Pluviographes dans la zone témoin : ....

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

.....

.....

6. UNITE EXPERIMENTALE

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. RESULTATS D'ENSEMBLE DU PROJET (pas de stratification ni de division)

7.1 Test(s) statistique(s) et/ou analyse(s) :

.....

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

7.3 Résultats de chaque test et/ou analyse : .....

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. CRITERES CHOISIS POUR L'EVALUATION DES RESULTATS

8.1 Spécifications analytiques fixées AVANT le projet

8.1.1 Nature de la (des) stratification(s), le cas échéant :

.....

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

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 :

Qualitatifs : .....

Quantitatifs : .....

8.2 Spécifications analytiques choisies APRES le projet

8.2.1 Nature de la (des) subdivision(s) :

.....

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

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 :

Qualitatifs : .....

Quantitatifs : .....

9. EFFETS OBSERVES (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 REFERENCES A DES RESULTATS PUBLIES (dans lesquels sont indiqués les détails des procédures ci-dessus) :

.....

.....

.....

.....

.....

INFORME SOBRE PROYECTOS TERMINADOS DE MODIFICACION ARTIFICIAL DEL CLIMA

(Colóquese una X en la casilla o casillas que corresponde)

MIEMBRO DE LA OMM: .....

1. DESCRIPCION 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. DURACION 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 /__/

Otros (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 la siembra (Kg h^{-1}) .....

4. CONCEPCION 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 hubieran (sírvase dar el número y la naturaleza) .....

.....

5. UBICACION 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: .....

Todos los tipos de pluviómetros en la zona de control: .....

5.4.2 Registro de los pluviómetros en la zona del blanco: .....

Registro de los pluviómetros 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 siembra/no siembra: .....

Significado estadístico: .....

8. BASE PARA LA EVALUACION 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 siembra/o sin siembra):

Siembra: ..... Sin siembra: .....

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:

Cualitativo : .....

Cuantitativo : .....

8.2 Especificaciones analíticas seleccionadas DESPUES 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 siembra/ sin siembra):

Siembra: ..... Sin siembra: .....

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 tranformación:

Cualitativa: .....

Cuantitativa: .....

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):

.....

.....

.....

.....

.....

ВСЕМИРНАЯ МЕТЕОРОЛОГИЧЕСКАЯ ОРГАНИЗАЦИЯ

R/CLA/4, ПРИЛОЖЕНИЕ B

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 ☐

Подавление града ☐

Предотвращение молний ☐

Другие (просьба указать): .....

.....

1.3 Основной тип облаков:

Орографические ☐ Кучевые ☐ Слоистообразные ☐ Фронтальные ☐

2. ПРОДОЛЖИТЕЛЬНОСТЬ ПРОЕКТА

2.1 Продолжительность проекта, в годах: .....

2.2 Оперативный период в каждом году:

С: ..... До: ..... включительно.

3. ЗАСЕВ

3.1 Реагент, используемый для засева: AgI ☐ CO_2 ☐ NaCl ☐

Другие (просьба указать): .....

3.2 Генератор(ы): Наземные ☐ Воздушные ☐

Если генератор наземный, то просьба указать количество: .....

3.3 Процедура засева с воздуха:

Высота засева (м): .....

Длина трассы засева (м или км): .....

Норма засева (кг/час.): .....

4. СХЕМА 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:* .....

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

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

Осадкомеры-самописцы 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: .....

7. ОБЩИЕ РЕЗУЛЬТАТЫ ПРОЕКТА (без стратификации или деления)

7.1 Название статистического испытания(ий) и/или анализа(ов):

.....

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):

Засев: ..... Нет засева: .....

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

.....

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

.....

8.1.5 Результаты для каждой стратификации, испытания или трансформации:

Качественные: .....

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):

Засев: ..... Нет засева: .....

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

.....

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

.....

8.2.5 Результаты для каждого деления, испытания или трансформации:

Качественные: .....

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):

.....

.....

.....

.....

.....

WEATHER MODIFICATION 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
WMP-No. 10	Register of National Weather Modification Projects - 1986 (Geneva, December 1988)	WMO/TD-No. 208
WMP-No. 11	Report of the Second International Cloud Modelling Workshop (Toulouse, 8-12 August 1988)	WMO/TD-No. 268
WMP-No. 12	Proceedings for the Fifth WMO Scientific Conference on Weather Modification and Applied Cloud Physics (Beijing, China, 8-12 May 1989)	WMO/TD-No. 269
WMP-No. 13	Register of National Weather Modification Projects - 1987-1988	WMO/TD-No. 330
WMP-No. 14	Register of National Weather Modification Projects - 1989 (Geneva, May 1991)	WMO/TD-No. 417
WMP-No. 15	Report of a Meeting of Experts to Review Findings and Make Recommendations on the Saudi Arabia Cloud Physics Experiment (SACPEX) (Geneva, 14-16 November 1990)	-
WMP-No. 16	Report of the Seventeenth Session of the Executive Council Panel of Experts/CAS Working Group on Physics and Chemistry of Clouds and Weather Modification Research (Geneva, 19-23 November 1990)	-
WMP-No. 17	WMO Meeting of Experts on the Role of Clouds in the Chemistry, Transport, Transformation and Deposition of Pollutants (Obninsk, 30 September-4 October 1991)	WMO/TD-No. 448
WMP-No. 18	Register of National Weather Modification Projects 1990	WMO/TD-No. 449

WMP-No. 19	Proceedings - WMO Workshop on Cloud Microphysics and Applications to Global Change (Toronto, Canada, 10-14 August 1992)	WMO/TD-No. 537
WMP-No. 20	Report of the Third International Cloud Modelling Workshop (Toronto, Canada, 10-14 August 1992	WMO/TD-No. 565
WMP-No. 21	Register of National Weather Modification Projects 1991	WMO/TD-No. 575