



SUMMARY REPORT

ASEAN WORKSHOP ON WEATHER MODIFICATION 2018 (AWS2018)

Thailand, 6 - 9 August 2018

INTRODUCTION

1. The ASEAN Workshop on Weather Modification 2018 (AWS2018) hosted by Department of Royal Rainmaking and Agricultural Aviation (DRRAA) of Thailand. It was held on 6 - 9 August 2018 at Miracle Grand Convention Hotel, Bangkok, Northern Royal Rainmaking Operation Center and Huai Hong Krai Royal Development Study Center, Chiang Mai Province, Thailand. The Workshop comprised 4 sessions as follows:
 - Session I: weather modification activities
 - Session II: technical papers on weather modification
 - Session III: discussion on further cooperation on weather modification
 - Session IV: study visit
2. The Workshop was attended by delegates from Indonesia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam. The invited resource persons from China Meteorological Administration (CMA), Korea Meteorological Administration (KMA) and World Meteorological Organization (WMO) were also in attendance.
3. For Thai delegates, apart from administrators and scientists of DRRAA, there were representatives of 12 Thailand public agencies and 1 private company which are MOU counterparts of DRRAA also attended and provided the presentation on the research supporting the Royal Rainmaking. The list of delegates appears as **ANNEX 1**.

OPENING CEREMONY

4. Dr. Surasri Kidtimonton, Director-General of Department of Royal Rainmaking and Agricultural Aviation expressed his sincere appreciation to the Minister of

Agriculture and Cooperatives for giving the precious time to inaugurate the ASEAN Workshop on Weather Modification 2018.

5. He reported that it had been taken almost 30 years since Thailand organized the first seminar on “Weather Modification and Evaluation Techniques”. This year, Thailand by DRRAA was ready to host the ASEAN workshop on weather modification 2018 with an aim at building up a cumulative knowledge on cloud seeding technology as a wide array of activities that help to improve the solution on the drought. This was also to respond to our 20-year strategic plan to be the ASEAN leader and the World leading organization of weather modification with the use of techniques developed by His Majesty King Bhumibol Adulyadej in the year 2026 and 2036, respectively.
6. He finally invited Minister of Agriculture and Cooperatives of Thailand to open the Workshop.
7. Mr. Grisada Boonrach, Minister of Agriculture and Cooperatives of Thailand, warmly welcomed the participants to the AWS2018. He highlighted that Thailand is lucky country that His Majesty King Bhumibol Adulyadej concerned over the poverty of his people due to climate variation. The Royal Rainmaking project was initiated since 1955, in order to solve drought problem not only in Thailand but also in other countries in the region suffering from severe drought.
8. In his remarks, he addressed that countries in ASEAN member states with three dialogue partners have developed own rainmaking projects to reduce drought and natural disaster, this workshop is the venue to share best practices and find the way of collaboration in weather modification for future sustainable water resources and food security.

SESSION I: WEATHER MODIFICATION ACTIVITIES

9. There were 9 presentations on weather modification activities and country reports from representative(s) of each country/organization.

SESSION II: TECHNICAL PAPERS ON WEATHER MODIFICATION

10. There were 21 presentations on technical papers on weather modification divided into 3 subsessions as follows:
 - 10.1) DRRAA’s Research and Development Activities to Support Weather Modification
 - 10.2) Weather Modification Research of WMO, Indonesia, Philippines, China, and South Korea
 - 10.3) Research and Development on Rainmaking Technology to Support Royal Rainmaking Operation by MOU Counterparts of DRRAA

The presentation titles and presenters’ names in **SESSION I** and **SESSION II** appears in **ANNEX 2**.

SESSION III: DISCUSSION ON FURTHER COOPERATION ON WEATHER MODIFICATION

11. AGENDA ITEM 1: ADOPTION OF THE AGENDA

- 11.1) The Meeting adopted the agenda, which appears as **ANNEX 3**.

12. AGENDA ITEM 2: SUMMARY OF TECHNICAL WORKSHOP ON WEATHER MODIFICATION 2018

- 12.1) The information of the presentations in Session I: weather modification activities, and Session II: technical papers on weather modification were summarized into 2 tables namely Summary of Operational Activities in ASEAN and 3 Dialogue Partners, which appears as **ANNEX 4**; and Summary of Research Activities in ASEAN and 3 Dialogue Partners, which appears as **ANNEX 5**.

13) AGENDA ITEM 3: PROPOSED COLLABORATIVE ACTIVITIES ON WEATHER MODIFICATION

The Meeting agreed to consider this Agenda together with the AGENDA ITEM 4

14) AGENDA ITEM 4: DISCUSSION ON PATTERN AND MANAGEMENT OF ASEAN WEATHER MODIFICATION

- 14.1) Discussion on technology exchange among ASEAN Member States and Dialogue Partners
 - 14.1.1) The Meeting were interested in the Royal Rainmaking technology and weather modification management of DRRAA. They were ready to support Thailand to be the Center of ASEAN Weather Modification.
 - 14.1.2) Thailand by DRRAA accepted to consider the possibility to host a training course on weather modification in 2019.
 - 14.1.3) The Meeting agreed to have the workshop on weather modification every 2 years, which Indonesai accepted to host the next one in 2020.
- 14.2) Discussion on collaborative research among ASEAN Member States and Dialogue Partners
 - 14.2.1) The Meeting finalized the Draft Agreement on ASEAN Cooperative Weather Modification concerning the collaboration in various aspects, which appears as **ANNEX 6**.

15) AGENDA ITEM 5: DISCUSSION ON REPRESENTATIVE OF ASEAN MEMBER STATES IN WMO EXPERT TEAM ON WEATHER MODIFICATION

- 15.1) The Meeting agreed on sending the nominee's registration form to DRRAA for collecting and further submission to WMO via Dr. Thara Prabhakaran, in order to emphasis the unity and

collaboration of ASEAN Member States on weather modification aspect.

SESSION IV: STUDY VISIT

- 16) DRRAA organized the study visit to the delegates of Indonesia, Myanmar, the Philippines, Singapore, Veit Nam, CMA, KMA, and WMO as follows:
 - 16.1) Northern Royal Rainmaking Operation Center, Chiang Mai Province
 - 16.1.1) Dr. Surasri Kidtimonton, Director-General of DRRAA and executives welcomed the delegates.
 - 16.1.2) Ms. Nuenghathai Tantiplubthong, Director of the center delivered a welcome speech.
 - 16.1.3) Presentation on Duties and Responsibilities of the Center, and Daily Rainmaking Operation by Ms. Sumamas Chaiwong, Scientist
 - 16.1.4) Presentation on Flight Planning by Mr. Watana Sukarnjanaset, Expert on Weather Modification Techniques and Information Technology System
 - 16.1.5) Presentation on DRRAA's Cloud Seeding Aircrafts by Captain Bancha Palee, Cloud Seeding Pilot
 - 16.1.6) In-Flight Observation on Daily Royal Rainmaking Operation which some of the delegates observed the cloud seeding operation in the Fattening step
 - 16.1.7) Wrap-up on ASEAN Workshop on Weather Modification 2018 by Mr. Watana Sukarnjanaset
- 17) Huai Hong Khrai Royal Development Study Centre Initiated by H. M. King Bhumibol Adulyadej
 - 17.1) Presentation on the Background, Duties and Responsibilities of the Center by Dr. Noppadon Khoasuwan, Chief of Acedemic Division.
 - 17.2) Site observation on wet fire break, new theory on agriculture, hydro-orchard technique, and paddy growing using a new method of Rice Ratooning that could increase crop yields by fifty percent.

ACKNOWLEDGEMENT

18. The Workshop was held in the traditional spirit of ASEAN cordiality and solidarity. It was successfully completed with the participation and contribution of all delegates.

**ANNEX 1
LIST OF DELEGATES**

**ASEAN WORKSHOP ON WEATHER MODIFICATION 2018 (AWS2018)
6 - 9 August 2018, Thailand**

INDONESIA

Name : Dr. Tri Handoko Seto
Position : Director
Organization/Ministry : National Laboratory for Weather Modification Technology,
Agency for the Assessment and Application of Technology
Address : Jl. M.H. Thamrin no. 8, Jakarta, Indonesia

Name : Mr. Agie Wandala Putra
Position : Head of Sub-division for Weather Prediction
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of the Republic of Indonesia (BMKG)
Address : Jl. Angkasa I, No.2 Kemayoran, Jakarta Pusat, Indonesia.

MYANMAR

Name : Ms. Nyein Nyein Naing
Position : Deputy Director
Organization/Ministry : Department of Meteorology and Hydrology (DMH)
Ministry of Transport and Communications
Address : B(31), Tabinshwehti Street, Kyaukyaytwin, Mayangone,
Yangon, Myanmar

PHILIPPINES

Name : Mr. Robert Z. Quinto
Position : Senior Weather Specialist
Organization/Ministry : Department of Science and Technology
Philippine Atmospheric, Geophysical and Astronomical
Services Administration (PAGASA)
Address : PAGASA Science Garden Complex, Agham Rd, Diliman
Quezon City, Philippines 1105

Name : Mr. Lorenzo A. Moron

Position : Weather Specialist
 Organization/Ministry : Department of Science and Technology
 Philippine Atmospheric, Geophysical and Astronomical
 Services Administration (PAGASA)
 Address : PAGASA Science Garden Complex, Agham Rd, Diliman
 Quezon City, Philippines 1105

Name : Mr. Paul Michael Cataguis Espera
 Position : Squadron Commander, 902nd Weather Reconnaissance
 Squadron Cloud Seeding Pilot
 Organization/Ministry : 900th Air Force Weather Group, Philippine Air Force
 Address : 9006-87-2-513, Condo 2, Boutista Extension, Colonel Jesus
 Villamor Air Base, Pasay City

Name : Mr. Von Ryan Potian Timbang
 Position : Cloud Seeding Pilot and Instructor
 Organization/Ministry : 900th Air Force Weather Group, Philippine Air Force
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 Villamor Air Base, Pasay City

SINGAPORE

Name : Ms. Leona Zi Yun Lim
 Position : Meteorologist
 Organization/Ministry : Meteorological Service Singapore
 National Environment Agency
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THAILAND

Name : Mr. Surasri Kidtimonton
 Position : Director-General
 Organization/Ministry : Department of Royal Rainmaking and Agricultural Aviation
 (DRRAA)
 Ministry of Agriculture and Cooperatives
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 10900

Name : Ms. Malinee Sutthirat
 Position : Deputy Director-General for Administrative Section

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Name : Mr. Panithi Samerwong

Position : Deputy Director-General for Operation Section

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Name : Mr. Wathana Sukarnjanaset

Position : Expert on Weather Modification Techniques and Information Technology System

Organization/Ministry : Department of Royal Rainmaking and Agricultural Aviation (DRRAA)

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Name : Mr. Chadet klinchuen

Position : Director of Agricultural Aviation Administration Division

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Name : Mrs. Nareeluck Wannasai

Position : Director of Royal Rainmaking Technology Research and Development Division

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Name : Mr. Sinchai Pungtambol

Position : Director of Royal Rainmaking Academic Group

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Name : Mr.Thitikorn Chanyatham
Position : Director of Royal Rainmaking Technology Research and
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Name : Mr.Chanti Dejyothin
Position : Acting Expert on Applied Atmospheric Science Research
Organization/Ministry : Department of Royal Rainmaking and Agricultural Aviation
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Name : Mr.Pakdee Chantraket
Position : Acting Expert on Royal Rainmaking Technology
Organization/Ministry : Department of Royal Rainmaking and Agricultural Aviation
(DRRAA)

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Name : Mr.Marut Ratmanee
Position : Director of Information Technology Center
Organization/Ministry : Department of Royal Rainmaking and Agricultural Aviation
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Name : Ms.Supinya Boonchouy
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Organization/Ministry : Department of Royal Rainmaking and Agricultural Aviation
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Name : Ms.Montarat Buranahirun
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Name : Ms. Jaturaporn Leenanon
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Name : Mr.Parinya Indaracharoen
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Organization/Ministry : Department of Royal Rainmaking and Agricultural Aviation (DRRAA)
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Name : Mr.Boonlert Arcchevarahuprok
Position : Expert on Research and Development for Meteorology
Organization/Ministry : Thai Meteorological Department (TMD)
Ministry of Digital Economy and Society
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Name : Dr.Kamol Promasakha Na Sakolnaklion
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Name : Dr. Alisa Jaiyu
Position : Senior Researcher
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Name : Mrs.Piyamarn Sisomphon
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Name : Mr.Narongrit Luangdilok
Position : Model Developer
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Name : Mr.Krittayod Kaewlumhud
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10900

Name : Asst. Prof. Dr. Chinnawat Surussavadee
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Name : Mr. Adisorn Champathong
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Name : Mr. Thawatchai Vierra
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Name : Mr. Boonliang Suksai
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VIET NAM

Name : Mr. Nguyen Nam Thanh
Position : Acting Director of Center of Hydro-Meteorological Technology Application
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Non-ASEAN Entities

CHINA

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Name : Prof. Yue Chen
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SOUTH KOREA

Name : Dr. Joowan Cha
Position : Senior Scientist
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WMO

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**ANNEX 2
PROGRAM**
“ASEAN Workshop on Weather Modification 2018”
6 – 9 August 2018

Day 1, Monday, 6 August 2018		At Miracle Grand Convention Hotel, Bangkok	
Time	Activity	Presented by	
08:30 - 09:00	Registration	DRRAA	
09:00 - 09:30	Opening Ceremony	Minister of Ministry of Agriculture and Cooperatives	
Session I : Weather Modification Activities			
09:30 - 10:00	<ul style="list-style-type: none">WMO Expert Team on Weather Modification: Recent Activities	Dr. Thara Prabhakaran	
10:00 - 10:20	<ul style="list-style-type: none">Strategy and Activities of BMKG on Supporting the Weather Modification Mission in Indonesia	Dr. Tri Handoko Seto Mr. Agie Wandala Putra	
10:20 - 10:40	<ul style="list-style-type: none">Country Report of Myanmar	Ms. Nyein Nyein Naing	
10:40 - 11:00	<ul style="list-style-type: none">Weather Modification in the Philippines	Mr. Robert Z. Quinto Mr. Lorenzo A. Moron	
11:00 - 11:20	<ul style="list-style-type: none">Country Report of Singapore	Ms. Leona Lim	
11:20 - 11:40	<ul style="list-style-type: none">Country Report of Viet Nam	Mr. Nguyen Nam Thanh	
11:40 - 13:00	Lunch		
13:00 - 13:20	<ul style="list-style-type: none">Mission on Weather Modification of China	Prof. Lou Xiaofeng Prof. Chen Yue	
13:20 - 13:40	<ul style="list-style-type: none">Mission and Current Status of Weather Modification Research in Republic of Korea	Dr. Joowan Cha	
13:40 - 14:30	<ul style="list-style-type: none">Royal Rainmaking Mission and Operation for Solving Drought and Natural Disaster in Thailand	Mr. Watana Sukarnjanaset Ms. Nareeluck Wannasai Mr. Thitikorn Chanyatham	
14:30 - 15:00	Break		
Session II : Technical Papers on Weather Modification			
15:00 - 15:20	DRRAA's Research and Development Activities to Support Weather Modification <ul style="list-style-type: none">Development of Upper Air Thailand Cumulus Model (TCM)	DRRAA Mr. Chanti Dejyothin	
15:20 - 15:40	<ul style="list-style-type: none">DRRAA Weather Radars for Rainmaking Operation and Research	Mr. Parinya Indaracharoen	
15:40 - 16:00	<ul style="list-style-type: none">Rainstorm Properties over the Northeastern Region of Thailand: Weather Radar Analysis	Mr. Parinya Indaracharoen	
16:00 - 16:20	<ul style="list-style-type: none">Observation of Cloud Condensation Nuclei and Aerosol in the Northern Thailand	Mr. Thitikorn Chanyatham	
16:20 - 16:40	<ul style="list-style-type: none">Efficiency Enhancement of Hail Suppression Operation	Ms. Montarat Buranahirun	

16:40 - 17:00	<ul style="list-style-type: none">Images Based Classification for Warm Cloud Rainmaking Using Convolutional Neural Networks	Mr.Sarawut Arthayakun
Time	Activity	Presented by
17:00 - 17:20	<ul style="list-style-type: none">R³ Cooperation Project on Sustainable Resources and Agricultural Production Management in Phetchaburi Basin	Mr. Marut Ratmanee
17:20 - 17:40	<ul style="list-style-type: none">Water Quality Assessment of Rain Enhancement Program in Thailand	Ms.Supinya Boonchouy
17:40 - 18:00	<ul style="list-style-type: none">Capacity Building of Royal Rainmaking Volunteers	Mr. Pakdee Chantraket
17:40 - 18:00	Discussion	AMS, China, Korea, WMO
18:00 - 19:00	Dinner	
Day 2, Tuesday, 7 August 2018 At Miracle Grand Convention Hotel, Bangkok		
08:30 - 09:00	Registration	DRRAA
09:00 - 10:30	Weather Modification Research of AMS, China, Korea, and WMO <ul style="list-style-type: none">Indian Science Experiment on Cloud Seeding : CAIPEEX	AMS, China, Korea, WMO Dr. Thara Prabhakaran
	<ul style="list-style-type: none">Technical Paper from Indonesia	Dr. Tri Handoko Seto Mr. Agie Wandala Putra
	<ul style="list-style-type: none">Climate and Cloud Seeding Efforts	Mr.Paul Michael Cataguis Espera Mr. Von Ryan Potian Timbang
	<ul style="list-style-type: none">Research on Weather Modification of China	Prof. Lou Xiaofeng Prof. Chen Yue
	<ul style="list-style-type: none">Introduction of the NIM/KMA Research and Preliminary Result of Snow Enhancement Experiment in Pyeongchang Region	Ms. Areum Ko
10:30 - 11:00	Break	
11:00 - 11:20	Research and Development on Rainmaking Technology to Support Royal Rainmaking Operation by MOU Counterparts of DRRAA <ul style="list-style-type: none">Rainfall Estimation and Forecast by Radar Composite and QPE and QPF	Mr.Boonlert Archevarahuprok, Thai Meteorological Department (TMD)
	<ul style="list-style-type: none">Applying Radar-Based Rainfall Estimation for Real Time Flood Forecast and Early Warning System	Mr. Narongrit Luangdilok, Hydro and Agro Informatics Institute
11:40 - 12:00	<ul style="list-style-type: none">www.worldmeteorology.com, the mobile app WMAApp, and the Facebook Page “KMITL Weather Forecasts for Thailand”	Asst.Prof.Dr. Chinnawat Surussavadee, King Mongkut’s Institute of Technology Ladkrabang
12:00 - 13:00	Lunch	

13:00 - 13:20	<ul style="list-style-type: none">Pilot Research Project on Alternative Substances for Rain Enhancement Operation	Dr. Arisa Jaiyu, Thailand Institute of Scientific and Technological Research
Time	Activity	Presented by
13:20 - 13:40	<ul style="list-style-type: none">Development of Machine and Devices for Grinding and Spreading for Rainmaking Substances for Royal Rainmaking Project	Dr. Arisa Jaiyu, Thailand Institute of Scientific and Technological Research
13:40 - 14:00	<ul style="list-style-type: none">Research and Development of Weather Modification Rockets in Thailand	Dr. Pawat Chusilp, Defense Technology Institute
Time	Activity	Presented by
14:00 - 14:20	<ul style="list-style-type: none">Unmanned Aerial Vehicle Base Weather Sounding Platform for Precision Weather Modification Planning and Operation	Mr. Eakarat Suwannagood, Faculty of Engineering, Kasetsart University
14:20 - 15:00	Break	
Session III : Discussion on Further Cooperation on Weather Modification		
15:00 - 18:00	Discussion on Cooperation of Rainmaking Activities	AMS, China, Korea, WMO
18:00 - 19:00	Dinner	
Day 3, Wednesday, 8 August 2018 At Northern Royal Rainmaking Operation Center		
Time	Activity	
Session IV : Study Visit		
07:00-08:00	Check out and Travel to Don Muang International Airport, Bangkok	
08:00-10:15	Depart Bangkok to Chiang Mai Province by CN Aircraft of DRRAA	
10:15-10:30	Arrive Chiang Mai International Airport and Proceed to Northern Royal Rainmaking Operation Center	
10:30-12:00	Presentation on Daily Royal Rainmaking at the Center	
12:00-13:00	Lunch	
13:00-15:00	In-Flight Observation on Daily Royal Rainmaking Operation	
15:00-16:00	Wrap-up on ASEAN Workshop on Weather Modification 2018	
16:00-17:30	Check in at Kantary Hills Hotel, Chiang Mai Province	
18:00-21:00	Farewell Dinner	
Day 4, Thursday, 9 August 2018 Chiang Mai Province		
08:00-09:30	Check out and Proceed to Huai Hong Khrai Royal Development Study Centre Initiated by H.M. King Bhumibol Adulyadej	
09:30-12:00	Study Visit at Huai Hong Khrai Royal Development Study Centre Initiated by H.M. King Bhumibol Adulyadej	
12:00-13:00	Lunch	
13:00-14:00	Proceed to Bo-sang Handicrafts Center	
14:00-15:00	Study Visit at Bo-sang Handicrafts Center	

15.00-15.30	Depart for Chiang Mai International Airport
15.30-17.30	Travel to Bangkok by CN Aircraft of DRRAA and Arrive at Miracle Grand Convention Hotel, Bangkok
18.00-19.00	Dinner

ANNEX 3
PROVISIONAL DISCUSSION AGENDA

ASEAN Workshop On Weather Modification 2018
6 – 9 August 2018, Bangkok and Chiangmai, Thailand

AGENDA ITEM 1: Adoption of agenda

AGENDA ITEM 2: Summary of technical workshop on weather modification 2018

AGENDA ITEM 3: Proposed collaborative activities on weather modification

3.1 Discussion on technology exchange among ASEAN Member States and Dialogue partners

3.2 Discussion on collaborative research among ASEAN Member States and Dialogue partners

AGENDA ITEM 4: Discussion on pattern and management of ASEAN weather modification workshop

AGENDA ITEM 5: Discussion on representative of ASEAN Member States in WMO expert team on weather modification

AGENDA ITEM 6: Other matters

ANNEX 6

Draft Agreement on ASEAN Cooperative Weather Modification

On the day of August 8, 2018 at the ASEAN Workshop on “Weather Modification 2018” at Bangkok and Chiang Mai, Thailand. It is agreed upon by the representatives from Thailand, Indonesia, Myanmar, Philippines, Singapore, Vietnam, South Korea, China and WMO as follows:

1. ASEAN Member States will establish the ASEAN Weather Modification collaboration to strengthen weather modification activities for the benefit of ASEAN for water and food security of the region.

2. The collaboration will be the venue for ASEAN member countries to pull together the resources, instruments, and man power to operate joint experiments, researches and exchange technology in cloud seeding and various other weather modification projects.

3. The collaboration will be the venue for weather modification database where scientific information can be exchanged and shared among ASEAN Member countries.

4. The established collaboration will coordinate the participation of the scientists and/or personnel of the member countries in weather modification projects of mutual interest to the participating members.

5. The collaboration will seek technical as well as financial assistances from the governmental and non-governmental organizations in the ASEAN Member countries and international organizations to finance activities under the cooperative weather modification project. The scope will include countries outside region subjected to approval of ASEAN Member countries.

6. The collaboration will provide standard and operating procedures on weather modification to the participating members.
