BMKG

**REPORT ON
"2011 RA-V TRAINING COURSE ON SATELLITE
APPLICATIONS FOR METEOROLOGY AND
CLIMATOLOGY"
Citeko, Bogor – Indonesia, 19 – 27 September
2011**

WMO OMM

**Organized by :
AGENCY FOR METEOROLOGY, CLIMATOLOGY AND GEOPHYSICS (BMKG)
INDONESIA
With Co-sponsorship of :
THE WORLD METEOROLOGICAL ORGANIZATION (WMO)**

1. INTRODUCTION

Earth observation from space through various satellite-based remote sensing instruments has provided a vantage means of monitoring earth and atmosphere. With the increasing concern for the earth and atmosphere systems, the emphasis on the use of satellite observation for understanding processes in earth, ocean and atmosphere systems has assumed greater importance.

Satellite data provided by several providers via either direct or indirect broadcast have tremendous roles in monitoring earth's environment and atmosphere. RA V region mostly consists of archipelagic countries which are vulnerable to climate variability and several significant weather systems. The regional climate and weather systems are very important to be monitored in the since they bring socio-economic impacts for the countries in South-east Asia and South-west Pacific.

Satellite-based observation offers tremendously useful information for broad areas of application i.e. land, ocean, and atmosphere. In the other hand, the latest technology and techniques developed by various operational or research institutions have also enable users to derive geophysical parameters from the satellite data for earth systems monitoring purposes.

In many of RA V countries the use of satellite data are still limited to weather forecasting and warnings. Acquisition, analysis and interpretation of satellite products have not been fully explored. Therefore, efforts particularly on capacity building are required to enhance the capabilities of RA V member countries for various satellite applications to gain optimum use of the satellite observation for the region and their respective countries' needs.

As a manifestation of Indonesia's commitment to support capacity building activities at regional and international meteorological communities, BMKG organized the "2011 RA V Training Course on Satellite Applications for Meteorology and Climatology" with co-sponsorship of The World Meteorological Organization (WMO).

2. OBJECTIVES

The objectives of the training course are :
   a. To increase skills of RA V meteorologists for providing better meteorological and climatological services through better use of satellite data with latest practical knowledge and tools
   b. To build partnerships across organizations / countries / application areas

3. VENUE

BMKG Training Center Facilities (Multi-Purpose Building), Citeko, Bogor - Indonesia
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4. ORGANIZER

Indonesian Meteorological and Geophysical Agency (BMG)
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With Co-sponsorship of : World Meteorological Organization (WMO)
And supported by :
   - Cooperative Institute for Meteorological Satellite Studies (CIMSS) / SSEC, UW-Madison, USA
   - National Oceanic and Atmospheric Administration (NOAA), USA
   - Bureau of Meteorology (BoM), Australia

5. LECTURE CONTRIBUTORS

Lectures, materials and exercises given in this training course were provided by lecturers and instructors from several institutions in satellite meteorology and applications also from BMKG Indonesia, namely:

   1. Dr. Allen Huang, CIMMS/SSEC, University of Wisconsin, Madison - USA
   2. Ms. Kathy Strabala, CIMMS/SSEC, University of Wisconsin, Madison - USA
   3. Mr. Scott Nolin, SSEC University of Wisconsin, Madison - USA
   4. Dr. Pingping Xie, Climate Prediction Center (CPC) – NOAA, USA
   5. Dr. Andrew Tupper, Australian Bureau of Meteorology (BoM) Northern Territory
   6. Dr. Surono, Center for Volcanology and Geological Hazards Mitigation (CVGHM), Ministry of Energy - Indonesia
   7. Dr. Ardhasena Sopaheluwakan, Center for Climate Change and Air Quality - BMKG Indonesia
   8. Ms. Nurhayati, Center for Agroclimate and Marine Climate - BMKG Indonesia

6. PARTICIPANTS

The training course is designed for operational personnel dealing with satellite data use in order to improve better use of satellite data and products using latest methods and techniques provided by the competent instructors. Twenty-six (26) participants came from 14 member-countries of RA V region (Indonesia, Philippines, Malaysia, Singapore, Timor Leste, Papua New Guinea, Solomon Islands, Samoa, Kiribati, Niue, Fiji, New Caledonia, Australia, and New Zealand) whom are involved with satellite data use for operational or research purposes participated in this event.

7. TRAINING COURSE CURRICULUM AND PROGRAMS

The course curriculum comprises : 45 % lecture and 55 % exercises/lab. activities, and arranged as follows :

1. Lectures and exercises from CIMMS/SSEC University of Wisconsin-Madison, USA : 25-hours total
   Lecture topics include:
   a. Current Status and Future Plan Operational of Geostationary and Polar-Orbiting Satellites (2-hours lectures)
   b. Introduction to the MODIS Sensor and Products (6-hours lectures)
      1. Quick Review of Remote Sensing Basics Theory (2-hours lectures)
      2. MODIS Standard Products (4-hours lectures)
         i. MODIS Atmosphere Products
            1. MOD 04 - Aerosol Product
            2. MOD 05 - Total Precipitable Water (Water Vapor)
            3. MOD 06 - Cloud Product
               a. Cloud Top Properties (MOD06CT)
               b. Cloud Phase (part of MOD06CT)
               c. Cloud Optical Depth (MOD06OD)
            4. MOD 07 - Atmospheric Profiles
            5. MOD 35 - Cloud Mask
         ii. MODIS Ocean Products
            1. Chlorophyll
            2. Sea Surface Temperature (SST)
         iii. MODIS Land Products
            1. MOD 09 - Land Surface Reflectance
            2. MOD 11 - Land Surface Temperature & Emissivity
            3. MOD 13 - Gridded Vegetation Indices (NDVI & EVI)
            4. MOD 14 - Thermal Anomalies (Fires)
            5. MOD 43 - Bidirectional Reflectance Distribution Function (BRDF)
   c. MODIS Direct Broadcast Software and Products (3-hours lectures ; 2 hours exercises)
      1. What is MODIS Direct Broadcast (DB)?
      2. MODIS DB Image Products
      3. MODIS DB Atmosphere Products

        4. MODIS DB Land products

        5. MODIS DB Ocean products

        6. Software for interpreting MODIS DB products

        7. Downloading MODIS data from the Web

d. Direct Broadcast Applications (3-hours lectures ; 3-hours lectures)

        1. Weather Observation and Forecasting

        2. Public Safety and Public Interest

            i. Nighttime Fog Detection

            ii. Snow/Ice Detection

            iii. Fires

            iv. Severe Weather

        3. Aviation Interest

            i. Everything clouds, Cloud composition, Height and Temperature

            ii. Turbulence

            iii. Ash Detection

        4. Numerical Weather Prediction

            i. IMAPP, DCRAS

        5. Aerosols

            i. Detection

            ii. IDEA

        6. Others

e. Overview of AIRS (4-hours lectures)

        1. Instrument

        2. Radiances

        3. Spectral Resolution

        4. Gases Absorption

        5. Temperature Inversion

        6. Surface Property/Signature

        7. Cloud, Dust, and Ash Signature

        8. Regression Retrieval (All Sky)

        9. Spectral Movie

        10. Hyper/Ultra Spectral H_2O Improve TC Forecast

f. AIRS Lab Exercises (2-hours exercises)

        1. Identify Atmospheric Gases Absorption Feature

        2. Identify Land/Ocean Surface Emission Feature

        3. Identify Temperature Inversion Absorption Feature

        4. Identify Clouds Absorption Feature

        5. Examine Characteristic of AIRS Profile Retrievals

        6. Optional Exercises (Take Home)

        7. Trace gases detection & further investigation on temperature inversion

2. Lectures and exercises from NOAA's CPC Lecturer : 6-hours

    a. Applications of Satellite Precipitation Estimates in Weather and Climate :

        i. Satellite Precipitation Estimates from Individual Sources

        ii. Combining Information from Multiple Sources

iii. Applications of Satellite Precipitation Estimates
                    iv. Exercises
                     v. Discussions and feedbacks
3. Lecture from Center for Volcanology and Geological Hazards Mitigation
    (CVGHM) Indonesia : 1.5-hours
            a. Volcanic-ash monitoring to support aviation safety
4. Lectures and case studies from Australian BoM Lecturer : 4.5-hours
            a. Meteorological remote sensing techniques for assisting mitigating
                volcanic hazards
5. Lectures from BMKG lecturer : 3-hours
            a. SST Prediction System for the Indonesian Seas derived from MODIS
                data (1.5-hours lecture)
            b. Overview of BMKG Indonesia and Its Services (1.5-hours lecture)

Detailed training program/agenda is attached (see : Appendix 1)

8. SUMMARY OF THE WORKSHOP

"2011 RA V Training Course on Satellite Applications for Meteorology and Climatology" was opened by Dr. Sri Woro B. Harijono (Director General of BMKG Indonesia / President of WMO RA V Region) on 20 September, 2011. The Director General of BMKG delivered welcome address which underlined the needs in enhancing better use of satellite data and product in RA V region to support multi-hazards early warning system and for environmental/climate change monitoring. Representative from Cooperative Institute for Meteorological Satellite Studies (CIMMS) / SSEC UW-Madison, Dr. Allen Huang also honored to have his courtesy speech in the opening ceremony. He mentioned that the SSEC team were very happy to be part of the training and get along with RA V satellite meteorology community in this event for sharing information and transferring knowledge for promoting satellite remote sensing applications in the region.

In the 1st day after opening program, Dr. Allen Huang delivered his introductory lectures on the Current Status and Future Plan Operational of Geostationary and Polar-Orbiting Satellites (2 hours-lectures), followed by Country Report presentations by each countries' representatives and the session was ended at 17.30 LT.

At 2nd-Day to 7th-Day of the training course sessions started on 09.00 - 12.30 LT (morning session), and 13.30 – 17.30 LT (afternoon session). On Day-2 to Day-3 Ms. Kathy Strabala (SSEC/UW-Madison) gave lectures and exercises on MODIS Applications using Hydra, McIDAS-V and GoogleEarth softwares (with Co-instructor : Mr. Scott Nolin). The lectures emphasized that MODIS data have broad applications ranging from atmosphere, ocean and land monitoring i.e: weather observation and forecasting (complementary to Geostationary satellite data and improved NWP model), public safety (identification of severe weather), aviation (identifying : cloud's temperature, height, phase and composition, turbulence and ash detection), and monitoring aerosol concentration in the atmosphere. Ocean products derived from

MODIS (i.e. ocean chlorophyll and sea surface temperature) provide great advantages in ocean information for various stakeholders. Land products of MODIS data is used for fire detection, vegetation and crop monitoring, etc.

Dr. Allen Huang delivered lectures and exercises on AIRS on Day-4. Basic science on Advanced InfraRed Sounders of MODIS and its applications of were introduced to participants, from the characteristics of AIRS sensors and derived-products which are very useful for identifying cloud, dust and ash signatures.

On 5th-Day participants got lectures from Dr. Pingping Xie on Satellite Precipitation Estimates Application for Weather and Climate. He overviewed the history of satellite precipitation estimation techniques developed by researchers in many research institutions since 1980s (Arkin's GPI) until present (CMORPH). He also introduced many useful satellite precipitation estimates and other products available online at Climate Prediction Centre (CPC) NOAA's website.

Dr. Andrew Tupper along with co-lecturer Dr. Surono presented lectures on Volcanic Ash Monitoring to Support Aviation and Public Safety and Meteorological Remote Sensing Techniques for Assisting Mitigating Volcanic Hazards on 7th-Day.

On the 8th-Day of the training course, participants have two lectures from BMKG, Dr. Ardhasena Sopaheluwakan (SST Prediction System for Indonesian Seas Using MODIS Level-3 Data) and Ms. Nurhayati (Brief Overview on BMKG Indonesia and Its Services). Last session is discussion and evaluation of the training course for further follow up and recommendations.

Technically, the "2011 RA V Training Course on Satellite Applications for Meteorology and Climatology" consisted of following subjects :

1. Lectures presentation delivered by lecturers followed with question-and-answer or discussion between participants and lecturer.

2. Exercises and case studies, where participants were guided by lecturers to have practical activities using satellite data analysis tools for examining the data that could be utilized to support their routine tasks. These assignments that given after participants learn about specific subjects enabled to enhance their skills in operating Hydra and McIDAS-V softwares.

3. Discussions and evaluation

After evaluation in the afternoon session of 27 September 2011, the training was closed by Ms. Nurhayati (Director of Center for Agroclimate and Marine Climate – BMKG) as Co-Chair of the Organizing Committee on behalf of Director General of BMKG. In her brief closing remarks Ms. Nurhayati extended appreciation and thanks to all guest lecturers who have contribute to the training and to all participants she expected continuation of communications among training alumnis as well as lecturers to share information particularly in satellite applications to optimize services provided by NMHSs for national and regional communities.

9. CONCLUDING REMARKS

The "2011 RA V Training Course on Satellite Applications for Meteorology and Climatology" was successfully organized in terms of technical and administrative matters, this is reflected by the participant's enthusiasm during the programs and activities. Almost no serious problem occurred due to good cooperation among training organizer, lecturers and participants.

By the end of the training course participants gained useful kowledge in MODIS and other meteorological satellite data applications and related knowledge from expert lecturers from leading institutions in satellite meteorology. All knowledge obtained are expected to be useful and applicable for the respective RA V member-countries to support their meteorological services.

10. ACKNOWLEDGEMENT

BMKG wish to extend appreciations to all institution, scientists and experts for their important and kind contribution during "2011 RA V Training Course on Satellite Applications for Meteorology and Climatology", among others are :

1. Mr. Michel Jarraud, Secretary General of The WMO for his kind attentive support and commitment to the capacity building efforts of RA V Region
2. Dr. Barbara Ryan, Director of WMO Space Programme for her generous support and facilitation from the beginning to enable the training conducted successfully
3. Dr. Jeff Wilson, Director of WMO ETR Programme for his constructive and kind advices and support to the Organizing Committee
4. Dr. Allen Huang, Ms. Kathleen Strabala, Mr. Liam Gumley and Mr. Scott Nolin, Scientists and researchers from CIMSS/SSEC UW-Madison, USA, Dr. Pingping Xie (CPC-NOAA, USA), Dr. Andrew C. Tupper (Australian BoM), Dr. Surono (CVGHM Indonesia) for their important and kind contributions in sharing their expertise and knowledge to the participants

APPENDICES

Appendix-1

RA V REGIONAL TRAINING COURSE ON SATELLITE APPLICATIONS FOR METEOROLOGY AND CLIMATOLOGY
(PROGRAMS AND LECTURES)
CITEKO, BOGOR – INDONESIA / 19 – 27 SEPTEMBER 2011

Time	MONDAY 19-SEP-2011 (DAY-1)	TUESDAY 20-SEP-2011 (DAY-2)	WEDNESDAY 21-SEP-2011 (DAY-3)	THURSDAY 22-SEP-2011 (DAY-4)	FRIDAY 23-SEP-2011 (DAY-5)
09.00 – 10.00	Participant's arrivals	**Opening Session :** Welcoming Address **(Director General of BMKG / President WMO RA V)**	Introduction to IMAPP **(Kathy Strabala/SSEC, UW-Madison, USA)**	MODIS Applications Weather, Aviation **(Kathy Strabala/SSEC, UW-Madison, USA)**	Lectures Introduction to AIRS **(Allen Huang/SSEC, UW-Madison, USA)**
10.00 - 11.00		Introduction : Guidance and Outline of Training Workshop **(Coordinator)**	Introduction to MODIS data characteristics and uses **(Kathy Strabala/SSEC, UW-Madison, USA)**	MODIS Applications Public Safety, NWP **(Kathy Strabala/SSEC, UW-Madison, USA)**	AIRS & Radiative Transfer **(Allen Huang/SSEC, UW-Madison, USA)**
11.15 – 12.15		Current Status of Operational of Geostationary and Polar-Orbiting Satellites **(Allen Huang/SSEC, UW-Madison, USA)**	Overview of MODIS Land and Ocean and Atmosphere Products **(Kathy Strabala/SSEC, UW-Madison, USA)**	MODIS Applications Fires, Air Quality **(Kathy Strabala/SSEC, UW-Madison, USA)**	AIRS Temperature, Water Vapor and Cloud Retrieval **(Allen Huang/SSEC, UW-Madison, USA)**
12.15 – 13.30		LUNCH - BREAK	LUNCH - BREAK	LUNCH - BREAK	LUNCH - BREAK
13.30 – 14.30		Future Plan Operational of Geostationary and Polar-Orbiting Satellites **(Allen Huang/SSEC, UW-Madison, USA)**	Exercises Exploring MODIS Data and Products in HYDRA Including NDVI & NDSI **(Kathy Strabala/SSEC, UW-Madison, USA)**	Exercises : Exploring Fires and Aerosols **(Huang, Nolin & Strabala/SSEC, UW-Madison, USA)**	Exercises : Exploring AIRS information content **(Huang & Strabala/SSEC, UW-Madison, USA))**
14.30 - 15.30		Participant's Country Reports Presentation			
16.00 – 17.30		Participant's Country Reports Presentation (continued)	Exercises Exploring MODIS Data and Products Over Typhoon "NANMADOL" **(Huang, Nolin & Strabala/SSEC, UW-Madison, USA)**	Exercises : Fog/Low Cloud Detection, NWP **(Huang, Nolin & Strabala/SSEC, UW-Madison, USA)**	Exercises : Online/Offline including Volcano & Trace Gases **(Huang & Strabala/SSEC, UW-Madison, USA)**
19.00 – 21.00		**Welcome Dinner**			

Time	SATURDAY 24-SEP-2011 (DAY-6)	SUNDAY 25-SEP-2011 (DAY-8)	MONDAY 26-SEP-2011 (DAY-7)	TUESDAY 27-SEP-2011 (DAY-9)	WEDNESDAY 28-SEP-2011 (DAY-10)
09.00 – 10.00	Introduction to Rainfall Estimation Using Satellite Data **(Pingping Xie, NOAA-USA)**		Volcanic Ash Monitoring to Support Aviation Safety **(Surono, CVGHM Indonesia)**	Introduction to BMKG Indonesia : Organization and Its Services **(Ms. Nurhayati - Director for Climate Services BMKG)**	
10.15 - 11.15	Rainfall Estimation Algorithms Using Satellite Data **(Pingping Xie, NOAA-USA)**		Meteorological remote sensing techniques for assisting mitigating volcanic hazards **(Andrew Tupper, BoM Australia)**	Development of Monthly SST Prediction System using MODIS Data at BMKG **(Dr. Ardhasena Sopaheluwakan - BMKG)**	
11.15 – 12.15	NOAA CPC Morphing Technique ("CMORPH") for Rainfall Estimation **(Pingping Xie, NOAA-USA)**	Excursion	Case study: Remote sensing and the International Airways Volcano Watch **(Andrew Tupper, BoM Australia)**	Discussion : Future Challenges of Satellite Data Utilization for South-West Pacific Region	Departure
12.15 – 13.30	LUNCH - BREAK		LUNCH - BREAK	LUNCH - BREAK	
13.30 – 15.30	NOAA CPC Morphing Technique ("CMORPH") for Rainfall Estimation (with Exercises) **(Pingping Xie, NOAA-USA)**		Discussion : Challenges in using remote sensing for volcanic hazard mitigation **(Panelist : Tupper, Surono, Juswanto)**	Evaluation / Course Wrap-Up / Conclusion and Recommendation	
16.00 – 17.30	NOAA CPC Morphing Technique ("CMORPH") for Rainfall Estimation (with Exercises) **(Pingping Xie, NOAA-USA)**		Exercise: combining forecasts and observations during a volcanic crisis. **(Andrew Tupper, BoM Australia)**	**Closing**	
19.00 – 21.00				**Farewell Dinner**	

Lecturer/Instructor's Institutions :

1. Space Science Engineering Center (SSEC), University of Wisconsin - Madison, USA
2. Climate Prediction Center (CPC), National Oceanic and Atmospheric Administration (NOAA), USA
3. Australian Bureau of Meteorology (BoM)
4. Center for Volcanology and Geological Hazard Mitigation, Ministry of Energy, Indonesia
5. The Agency for Meteorology, Climatology and Geophysics (BMKG), Indonesia

Appendix-2 :

Training Course Photos

Group Photo (after Opening Ceremony / Citeko, 20 September 2011)
Participants, Organizer with The President of WMO RA V, High-level Officials of BMKG and Guest Lecturers

Dr. Allen Huang (SSEC/UW-Madison) delivered lectures

Ms. Kathy Strabala (SSEC/UW-Madison) in a lectures session

Dr. Pingping Xie (CPC-NOAA) session

Ms. Kathy Strabala assisting participants in Exercise/Lab.Session

Appendix-3 :

LIST OF PARTICIPANTS
"2011 RA-V TRAINING COURSE ON SATELLITE APPLICATIONS FOR METEOROLOGY AND CLIMATOLOGY"
Citeko, Bogor - Indonesia / 19 - 27 September 2011

No.	Name	Country	Name of Institution	Field of Expertise / Specialization	Email Address
1.	William (Wim) Van Dijk	New Zealand	Met Service New Zealand	Data Management	wim.vandijk@metservice.com
2.	Sugeng Indarto	Indonesia	BMKG Indonesia	Satellite Meteorology	sugeng.indarto@bmkg.go.id
3.	Constancio Jose Da Costa	Timor Leste	DNMG of Timor Leste	Weather Observation	costa170265@gmail.com
4.	Manoah Tepa	Solomon Island	Solomon Island Meteorological Service	Forecasting section	manoahtepa@gmail.com
5.	Noor Laily . A	Indonesia	BMKG Indonesia	Climatology	nadhyani@yahoo.com noor.adyani@bmkg.go.id
6.	Siti Rohana Binti Mohd Saad	Malaysia	Malaysia Meteorological Departement (MMD)	Forecasting for Aviation	sitirohana@met.gov.my
7.	Denis Margetic	Australia	Bureau of Meteorology Melbourne, Australia	Satellite Imagery	d.margetic@bom.gov.au
8.	Agus Yarcana	Indonesia	BMKG Indonesia	Forecaster	agus_zanetti@yahoo.com
9.	Adi Mulsandi	Indonesia	Academy of Meteorology and Geophisics – BMKG Indonesia	Lecturer	adimulsandi@yahoo.com
10	Esperanza Cayanan	Philippines	PAGASA, Philippines	Research-Rainfall Lecturer-Meteorology	eocayanan@gmail.com
11	Asri Susilawati	Indonesia	BMKG	Satellite Meteorology	asri.susilawati@gmail.com
12	Eugene Chong Wei Ming	Singapore	NEA, MSS	Meteorological Officer	chong-wei-ming@nea.gov.sg
13.	Devi Febrianty	Indonesia	BMKG	Climatologist	devifebrianty@yahoo.com
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No.	Name	Country	Name of Institution	Field of Expertise / Specialization	Email Address
15.	Percy Kavana	Papua New Guinea	PNG NWS	Aviation Forecasting /Briefing	percy.kavana@gmail.com
16.	Eseese Ah Ken	Samoa	Meteorological Division MNRE Samoa	Met. Forecaster	eseese.ahken@mnre.gov.ws
17.	Kairorongari Iabeti	Kiribati	Kiribati Meteorological Service	Technical Officer	ionatia@gmail.com
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19.	Agus Fitrianto	Indonesia	BMKG Indonesia	Meteorology	agus.fitrianto@bmkg.go.id aguscengkareng@yahoo.com
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23.	Sean Tukutama	Niue	Niue Meteorological Services	Supervisor	sean.tukutama@mail.gov.nu
24	Shalwin Sharneel Singh	Fiji	Fiji Meteorological Services	Meteorologist	shalwin.singh@met.gov.fj
25	Khairullah	Indonesia	BMKG Indonesia	Climatologist	bmg.hairul@yahoo.co.id

LIST OF LECTURERS / INSTRUCTORS
& ORGANIZING COMMITTEE
"2011 RA-V TRAINING COURSE ON SATELLITE APPLICATIONS FOR METEOROLOGY AND CLIMATOLOGY"
Citeko, Bogor – Indonesia / 19 – 27 September 2011

No.	Name	Country	Name of Institution	Field of Expertise / Specialization	Email Address	Remarks
1.	Dr. Allen Huang, Ph.D	USA	Space Science and Engineering Center (SSEC), University of Winconsin-Madison	Hyperspectral Remote Sensing Science, Applications System & Training	allenh@ssec.wisc.edu	Lecturer
2.	Kathleen Strabala	USA	Space Science and Engineering Center (SSEC), University of Winconsin-Madison	Satellite Applications	kathys@ssec.wisc.edu	Lecturer
3.	Scott Nolin	USA	Space Science and Engineering Center (SSEC), University of Winconsin-Madison	Computing Technology Networking and System Administration	scott.nolin@ssec.wisc.edu	Instructor
4.	Dr. Ping Ping Xie	USA	Climate Prediction Center National Oceanic and Atmospheric Administration	Application of Satellite Precipitation in Climate, Weather and Water	Pingping.xie@noaa.gov	Lecturer
5.	Dr. Andrew C. Tupper	Australia	Australian Bureau of Meteorology (BoM)	Satellite applications for aviation safety	A.Tupper@bom.gov.au	Lecturer
6.	Dr. Surono	Indonesia	Center for Volcanology and Geological Hazards Mitigation (CVGHM), Ministry of Energy	Vulcanology	surono@vsi.esdm.go.id	Lecturer
7.	Dr. Ardhasena Sopaheluwakan	Indonesia	The Agency for Meteorology, Climatology and Geophysics (BMKG)	Mathematics, Modeling, Optical Science	ardhasena@bmkg.go.id ardhasena@gmail.com	Lecturer / OC
8.	Nurhayati	Indonesia	The Agency for Meteorology, Climatology and Geophysics (BMKG)	Climatology and Air Quality	nurhayati@bmkg.go.id	Lecturer
9.	Riris Adriyanto	Indonesia	The Agency for Meteorology, Climatology and Geophysics (BMKG)	Satellite applications	riris.adriyanto@bmkg.go.id	OC
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11.	Mulyono R. Prabowo	Indonesia	The Agency for Meteorology, Climatology and Geophysics (BMKG)	Meteorologist, Public weather Services	mulyono.prabowo@bmkg.go.id	OC
12.	Hadi Widiatmoko	Indonesia	The Agency for Meteorology, Climatology and Geophysics (BMKG)	Meteorologist, Remote sensing	hadi.widiatmoko@bmkg.go.id	OC