KEMENTERIAN TENAGA, SAINS, TEKNOLOGI,
ALAM SEKITAR DAN PERUBAHAN IKLIM
MINISTRY OF ENERGY, SCIENCE, TECHNOLOGY, ENVIRONMENT & CLIMATE CHANGE

MET Malaysia

JABATAN METEOROLOGI MALAYSIA

LAPORAN TAHUNAN
ANNUAL REPORT
2017

SIDANG REDAKSI

KANDUNGAN
CONTENT

PERUTUSAN KETUA PENGARAH
MESSAGE FROM DIRECTOR GENERAL

"Secanggih manapun sistem amaran awal yang dibangunkan, ia tidak berkesan tanpa program kesedaran awam dalam memastikan orang ramai lebih peka mengenai langkah-langkah awal yang perlu diambil apabila amaran dikeluarkan"

ALUI BIN BAHARI
Ketua Pengarah
Director General

Secara umumnya pada tahun 2017, negara mengalami keadaan cuaca dan iklim yang normal sepanjang tahun. Namun begitu terdapat kejadian cuaca ekstrem seperti kejadian ini sistem lekukan tropika yang membawa bersama kelompok awan hujan lebat serta angin kencang telah merentasi utara Semenanjung. Kejadian mengakibatkan bencana banjir teruk di negeri Kedah dan Pulau Pinang pada 4 dan 5 November 2017.

Semasa Monsun Timur Laut 2017/2018, lima episod hujan lebat telah berlaku pada November dan Disember 2017 yang melibatkan negeri-negeri di Pantai Timur Semenanjung, pedalaman Sarawak dan timur Sabah. Semasa Monsun Barat Daya, negara tidak menghadapi cuaca panas dan kering ekstrem yang lazimnya menyebabkan jerebu, kemarau dan gelombang haba yang teruk.

Tema sambutan Hari Meteorologi Sedunia 2017 adalah Fahami Awan. Sambutan yang diraikan secara tahunan, kali ini disambut bersama Karnival Sains4U Zon Utara pada 23 Mac di Dewan Bandaran Ipoh Perak.

MMD dengan kerjasama Universiti Pendidikan Sultan Idris (UPSI) telah mengadakan Forum Iklim Kebangsaan Monsun Timur Laut (FIKMTL) 2017/ 2018 dengan tema "Kesiapsiagaan Bersama" pada 28 September di UPSI. Forum ini menjadi platform penyaluran maklumat mengenai keadaan cuaca dan iklim, khususnya semasa Monsun Timur Laut.

Pada tahun ini, MMD telah berjaya menyiapkan empat projek pembangunan iaitu pemantapan aktiviti pemantauan gempa bumi dan tsunami, peningkatan sistem ramalan cuaca, perolehan dan penyediaan tapak bagi cadangan pembinaan stesen meteorologi radar doppler dan pemasangan peralatan wind dan runway visual range (WRVR) di Lapangan Terbang Sultan Azlan Shah, Selangor, Lapangan Terbang Sultan Ismail Petra, Kelantan dan Lapangan Terbang Sultan Mahmud, Terengganu.

Generally, in 2017, the country experienced normal weather and climate conditions throughout the year. However, there were some extreme weather events recorded - among them the occurrence of a tropical depression that caused heavy rain as well as strong winds across the northern region of peninsular which resulted in severe floods in Kedah and Penang on 4th and 5th of November 2017.

During the 2017/2018 Northeast Monsoon, five heavy rain incidences occurred in November and December which also involved the East Coast region of Peninsular, interior areas of Sarawak and east of Sabah. The country did not encounter extreme hot and dry weather which usually cause haze, drought and severe heat waves during Southwest Monsoon.

The 2017 World Meteorological Day celebration theme was Understanding Cloud. The annually celebrated WMD programme was jointly held with the Science4U Carnival in Ipoh, Perak on 23rd of March 2017.

MMD in collaboration with University Pendidikan Sultan Idris (UPSI) organized the Northeast Monsoon National Forum (FIKMTL) 2017/2018 themed "*Kesiapsiagaan Bersama*" on 28th of September in UPSI. The forum is a platform in disseminating information on weather and climate conditions, especially on Northeast Monsoon.

This year also marked an achievement in development whereby MMD successfully completed four development projects. There are strengthening earthquake and tsunami monitoring activities in the states, enhancing the weather forecast system, construction of radar doppler meteorological station and the installation of wind and runway visual range (WRVR) equipment at the Sultan Azlan Shah Airport, Selangor, Sultan Ismail Petra Airport, Kelantan and Sultan Mahmud Airport, Terengganu.

Pelaksanaan projek-projek ini telah membantu meningkatkan model ramalan cuaca, pemantauan cuaca buruk, pengesanan gempa bumi dan pengeluaran amaran cuaca dan tsunami.

MMD juga telah melaksanakan sebanyak 23 kursus dalaman bagi meningkatkan kefahaman dan kemahiran kakitangan dalam bidang meteorologi dan pembangunan insan.

Dalam meningkatkan kompetensi dan kemahiran pegawai, MMD mengendalikan projek kerjasama di peringkat kebangsaan dan antarabangsa. Di peringkat kebangsaan, MMD telah mengadakan projek kerjasama dengan agensi dan institusi seperti SEADPRI-UKM, Lembaga Urus Air Selangor (LUAS) dan Jabatan Pengairan dan Saliran (JPS). Manakala di peringkat antarabangsa, projek kerjasama diadakan dengan *Asia Pasific Network for Global Change Research* (APN), *University of Cambridge*, *UK Meteorology Office (UKMO)* dan University of Washington, Amerika Syarikat.

Secanggih manapun sistem amaran awal yang dibangunkan, ia tidak berkesan tanpa program kesedaran awam dalam memastikan orang ramai lebih peka mengenai langkah-langkah awal yang perlu diambil apabila amaran dikeluarkan. Oleh itu MMD telah melaksanakan dan menyertai 144 aktiviti pameran dan program kesedaran awam bagi meningkatkan kesedaran masyarakat terhadap cuaca ekstrem, iklim, gempa bumi dan tsunami.

Akhir kata, syabas diucapkan kepada seluruh warga MMD yang telah berganding bahu dalam melaksanakan tugas dengan penuh dedikasi sepanjang tahun 2017.

These developments help improve the weather forecast models and minimize poor weather monitoring, earthquake detection and weather and tsunami warning alert.

The department has successfully conducted 23 internal courses to enhance the understanding and skills of its employees in the areas of meteorology and human development.

Besides that, MMD was also involved in collaboration projects both at national and international level to improve the skills and competencies of its officers. At the national level, MMD joined hands with SEADPRI-UKM, Selangor Water Management Authority (LUAS) and the Department of Irrigation and Drainage (DID). Whereas, at the international level, joint projects were conducted with Asia Pacific Network for Global Change Research (APN), the University of Cambridge, the UK Meteorology Office (UKMO) and the University of Washington, USA.

Regardless of how advanced our warning system may be, it is pointless without public awareness programme in ensuring that the public is aware of the measures that should be taken if a warning is issued. Hence, MMD took part in 144 exhibition and public awareness programmes aimed at creating public awareness on extreme weather, climate, earthquake and tsunami.

Finally, I would like to take this opportunity to congratulate the employees of MMD for dedicatedly carrying out their duties and responsibilities throughout the year.

ALUI BIN BAHARI
Ketua Pengarah Jabatan Meteorologi Malaysia
Director General of Malaysian Meteorological Department

PROFIL KORPORAT
CORPORATE PROFILE

VISI

Menjadi pusat meteorologi, iklim dan geofizik yang unggul menjelang tahun 2030

VISION

To be the best meteorological, climate and geophysical service centre by year 2030

MISI

Memenuhi keperluan negara dalam perkhidmatan meteorologi, iklim dan geofizik untuk kesejahteraan, keselamatan dan pembangunan lestari

MISSION

To fulfill the needs of the nation by providing meteorological, climatological and geophysical services for social well-being, safety and sustainable development

OBJEKTIF

1. Mempertingkatkan sistem perkhidmatan meteorologi, iklim dan geofizik untuk:
   - Keselamatan dan kecekapan operasi di udara, darat, laut dan ketenteraan;
   - Keselamatan negara (seperti pengurusan bencana alam, ancaman perubahan iklim, cuaca melampau, gempa bumi dan tsunami);
   - Keselamatan dan kesejahteraan orang awam; dan
   - Perancangan pembangunan sosio-ekonomi dan pengurusan alam sekitar.

2. Meningkatkan sistem pencerapan, mewujud dan mengawal selia pangkalan data meteorologi, iklim, seismologi dan tsunami Negara untuk memenuhi keperluan generasi kini dan akan datang.

3. Melindungi kepentingan Negara di peringkat antarabangsa serta mempromosikan kefahaman dan kemajuan sains meteorologi, iklim, seismologi dan tsunami dalam Negara.

OBJECTIVE

1. Enhance the meteorological, climatological and geophysical service system:
   - Safety and operational efficiency on air, land, sea and military;
   - Homeland security (such as disaster management and threats from climate change, extreme weather, earthquake and tsunami);
   - Public safety and well-being; and
   - Social economic development and environmental management planning.

2. Enhance the observation system, establish and regulate the meteorological climate, seismological and tsunami database of the country to meet the needs of the present and future generation.

3. Protecting national interest at the international level and to promote the understanding and advancement of science in meteorological, climatological, seismological and tsunami in the nations.

PIAGAM PELANGGAN

- Permohonan maklumat meteorologi, seismologi dan tsunami akan diberi maklumbalas dalam tempoh satu hari bekerja dan dibekalkan dalam tempoh lima hari bekerja.

- Maklumat cuaca untuk penerbangan disediakan dalam tempoh tiga jam sebelum pelepasan.

- Buletin Cuaca Bulanan akan diterbitkan dalam tempoh 10 hari bekerja pada setiap permulaan bulan berikutnya.

- Ringkasan Pencerapan Cuaca Tahunan akan diterbitkan pada Februari tahun berikutnya.

- Buletin Agrometeorologi 10 hari akan diterbitkan dalam tempoh lima hari bekerja selepas setiap dekad.

- Tinjauan dan Analisis Agroklimatik Bulanan akan diterbitkan pada minggu kedua bulan berikutnya.

- Imej radar dan satelit di laman web akan dikemaskini setiap 10 minit.

- Maklumat awal gempa bumi dan tsunami akan disebarkan kepada agensi-agensi berkaitan dan media massa dalam tempoh lapan minit daripada kejadian gempa bumi dikesan.

CLIENT CHARTER

- Request for meteorological, seismological and tsunami information will be responded within one working day and supplied within five working days.

- Weather information for flights will be ready three hours before departure.

- Monthly Weather Bulletin will be published within 10 working days in the beginning of the following month.

- Annual Weather Observation Summary will be published by February of the following year.

- 10-day Agrometeorological Bulletin will be published within five working days after each decade.

- Monthly Agroclimatic Review and Analysis will be published in the second week of the following month.

- Radar and satellite images on the website will be updated every 10 minutes.

- Preliminary earthquake and tsunami information will be disseminated to the relevant agencies and media within eight minutes upon the detection of earthquake.

CARTA ORGANISASI
ORGANISATION CHART

ALUI BAHARI
Ketua Pengarah
Director General

DR. WAN AZLI WAN HASSAN
Timbalan Ketua Pengarah
(Strategik & Teknikal)
Deputy Director General
(Strategic & Technical)

DR. MOHD ROSAIDI CHE ABAS
Timbalan Ketua Pengarah
(Operasi)
Deputy Director General
(Operation)

Bahagian Penyelidikan &
Pembangunan Teknikal
Research & Technical
Development Division

Pusat Meteorologi
Penerbangan Nasional
National Meteorological
Aviation Centre

Pusat Instrumentasi
Meteorologi & Sains
Atmosfera
Meteorological
Instrumentation &
Atmospheric Science
Centre

Pusat Operasi Cuaca &
Geofizik Nasional
National Weather &
Geophysic Operation
Centre

Pusat Iklim Nasional
National Climate Centre

Bahagian Khidmat
Pengurusan
Management Service
Division

Unit Integriti
Integrity Unit

Bahagian Teknikal Cuaca
& Geofizik
Technical Weather &
Geophysic Division

Bahagian Latihan
Teknikal
Technical Training
Division

Unit Komunikasi
Korporat
Corporate
Communication Unit

Bahagian Radar &
Satelit Meteorologi
Radar & Satellite
Meteorological Division

Bahagian Komunikasi
Meteorologi
Meteorological
Communication Division

Bahagian Perancangan
Strategik &
Antarabangsa
Strategic Planning &
International Division

Pejabat Meteorologi Negeri
State Meteorological Offices

Pejabat Meteorologi Sarawak
Sarawak Meteorological Office

Pejabat Meteorologi Sabah
Sabah Meteorological Office

Pejabat Meteorologi Pulau Pinang
Penang Meteorological Office

Pejabat Meteorologi Kelantan
Kelantan Meteorological Office

Pejabat Meteorologi Terengganu
Terengganu Meteorological Office

Pejabat Meteorologi Pahang
Pahang Meteorological Office

Pejabat Meteorologi Johor
Johor Meteorological Office

Pejabat Meteorologi Wilayah Persekutuan Labuan
Federal Territory of Labuan Meteorological Office

Pejabat Meteorologi Perak
Perak Meteorological Office

Pejabat Meteorologi Selangor
Selangor Meteorological Office

Pejabat Meteorologi Kedah
Kedah Meteorological Office

Pejabat Meteorologi Negeri Sembilan
Negeri Sembilan Meteorological Office

Pejabat Meteorologi Perlis
Perlis Meteorological Office

Pejabat Meteorologi Melaka
Melaka Meteorological Office

PENGURUSAN TERTINGGI
TOP MANAGEMENT

DR. WAN AZLI WAN HASSAN
Timbalan Ketua Pengarah
(Strategik & Teknikal)
Deputy Director General
(Strategic & Technical)

ALUI BAHARI
Ketua Pengarah
Director General

DR. MOHD ROSAIDI CHE ABAS
Timbalan Ketua Pengarah
(Operasi)
Deputy Director General
(Operation)

MMD
BERSAMA MOSTI

MMD
WITH MOSTI

MMD BERSAMA YB MENTERI MOSTI
MMD WITH YB MINISTER OF MOSTI

Sesi Penerangan YB Menteri Sains, Teknologi dan Inovasi kepada media mengenai aplikasi myCuaca dan iDengue.

Briefing Session by YB Minister of Science, Technology and Innovation to the media on myCuaca and iDengue application.

Pada 7 Disember 2017, YB Menteri MOSTI Datuk Seri Panglima Wilfred Madius Tangau telah menghadiri sesi penerangan aplikasi myCuaca dan iDengue yang diadakan di Ibu Pejabat MMD.

On 7th December 2017, YB Minister of MOSTI attended a briefing session on myCuaca and iDengue application at MMD Headquarters.

Program ini bertujuan memberi penerangan mengenai aplikasi myCuaca dan iDengue supaya dapat digunakan oleh orang ramai dengan optimum. Sesi ini turut disertai oleh wakil media iaitu Radio Televisyen Malaysia (RTM), BERNAMA, The Star dan Utusan Malaysia.

The programme is aimed at promoting the myCuaca and iDengue app and optimize the use of the app. Among the members of the media who took part in this session are Radio Television Malaysia (RTM), BERNAMA, The Star and Utusan Malaysia.
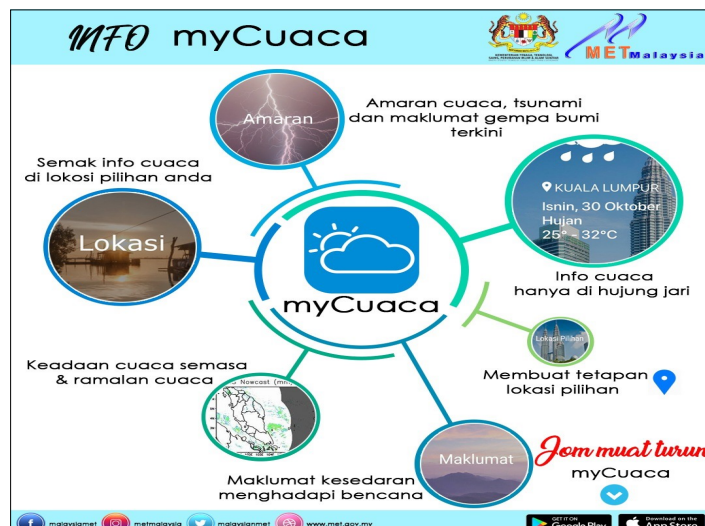
MMD BERSAMA KSU MENTERI MOSTI
MMD WITH SECRETARY GENERAL OF MOSTI

Lawatan rasmi Ketua Setiausaha Kementerian Sains, Teknologi dan Inovasi (KSU MOSTI) ke Pejabat Meteorologi Sarawak.

Pejabat Meteorologi Sarawak telah menerima lawatan daripada YBhg. Datuk Seri Dr. Mohd Azhar bin Haji Yahya, KSU MOSTI pada 9 Mei 2017.

Tujuh pegawai dari MOSTI turut menyertai lawatan tersebut. Pengarah Pejabat Meteorologi Sarawak, Encik Wong Teck Kiong telah menyambut dan menyampaikan taklimat kepada rombongan tersebut.

Secretary General, Ministry of Science, Technology (SG MOSTI) and Innovation official visit to Sarawak Meteorological Office.

Sarawak Meteorological Office welcomed YBhg. Datuk Seri Dr. Mohd Azhar bin Haji Yahya, SG MOSTI on 9th of May 2017.

Seven officers from MOSTI also joined the visit. Head of Sarawak Meteorological Office, Mr. Wong Teck Kiong welcomed and briefed the delegation.

Sesi Townhall Ketua Setiausaha, Kementerian Sains, Teknologi dan Inovasi (KSU MOSTI) bersama warga MMD di Ibu Pejabat.

Sesi townhall YBhg. Datuk Seri Dr. Mohd Azhar bin Haji Yahya, KSU MOSTI telah diadakan pada 21 September 2017.

Sesi tersebut dihadiri oleh 168 warga MMD yang terdiri dari gred 48 ke bawah. KSU MOSTI telah menyampaikan aspirasi beliau secara terus kepada warga MMD yang hadir.

Townhall Session with Secretary General, Ministry of Science, Technology and Innovation (SG MOSTI) with MMD employees at MMD Headquarters.

The townhall session with YBhg. Datuk Seri Dr. Mohd Azhar bin Haji Yahya, SG MOSTI was held on 21st September 2017.

The session was attended by 168 employees ranging from grade 48 and below. The Secretary General conveyed his aspirations directly to all the employees.

Program Kesedaran Awam mengenai Bencana Gempa Bumi dan Tsunami

YBhg. Datuk Seri Dr. Mohd Azhar bin Haji Yahya, KSU MOSTI telah merasmikan Program Kesedaran Awam Mengenai Bencana Gempa Bumi dan Tsunami bertempat di Dewan MBPP Teluk Bahang, Pulau Pinang pada 5 November 2017.

Program ini dianjurkan oleh MMD dengan kerjasama Agensi Pengurusan Bencana Negara (NADMA) sempena dengan sambutan World Tsunami Awareness Day (WTAD) yang disambut pada setiap 5 November sejak tahun 2015.

Earthquake and Tsunami Disaster Awareness Programme

YBhg. Datuk Seri Dr. Mohd Azhar bin Haji Yahya, SG MOSTI officiated the launching of Earthquake and Tsunami Disaster Awareness Programme at Dewan MBPP Teluk Bahang, Penang on 5th of November 2017.

The programme was jointly organised by MMD and National Disaster Management Agency (NADMA) in conjunction with the World Tsunami Awareness Day (WTAD), celebrated annually on 5th of November since 2015.
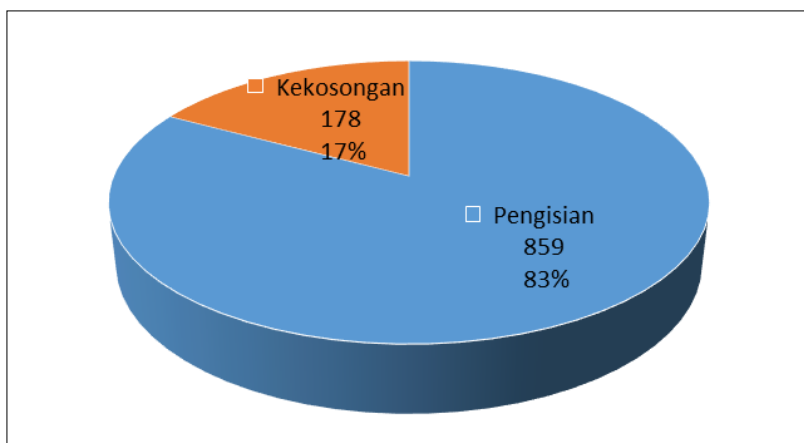
SOROTAN 2017

2017 OVERVIEW

KEMAJUAN KERJAYA

Pada tahun 2017, dalam memastikan kesinambungan fungsi-fungsi utama serta kemajuan kerjaya, MMD telah memproses 84 pemangkuan dan 49 kenaikan pangkat bagi kakitangannya. Sehingga 31 Disember 2017, pengisian warga kerja MMD adalah seramai 859 orang dari 1037 perjawatan. Peratus pengisian perjawatan adalah sebanyak 82.84%.

CAREER DEVELOPMENT

In 2017, to ensure the continuity of the core business and career development, MMD has processed the acting posts of 84 employees and promotion for 49 employees. As at 31st December 2017, MMD has a total number of 859 employees from 1037 posts. The percentage of filled in posts are 82.84%.

Bilangan anggota MMD sehingga 31 Disember 2017
Total number of MMD employees as at 31st December 2017

PROGRAM PEMENTORAN

MMD meneruskan Program Pementoran untuk memberi bimbingan, sokongan dan bantuan melalui penerapan elemen psikologi dan kaunseling kerjaya di kalangan kakitangannya.

Program ini bertujuan untuk meningkatkan pembangunan, kompetensi profesional, budaya, peribadi dan sosial bagi pegawai lantikan baru dan pegawai yang dinaikkan pangkat. Seramai 13 orang mentor dan 13 orang menti telah dilantik melalui program ini.

SISTEM MAKLUMAT PENGURUSAN SUMBER MANUSIA (HRMIS)

Pada tahun 2017, MMD telah berjaya mencapai 100% penggunaan Modul HRMIS yang melibatkan Data Perjawatan, Modul Pengurusan Prestasi, Pengurusan Rekod Peribadi dan Pengurusan Saraan Faedah dan Ganjaran Cuti.

MENTORING PROGRAM

MMD continues to implement its Mentoring Programme which provides guidance, support and assistance through elements of psychology and career counselling for its employees.

The programme is aimed at enhancing the development, competence, culture, personal and social ethics for the newly appointed and promoted officers. A total of 13 mentors and 13 mentees was appointed through this programme

HUMAN RESOURCE MANAGEMENT INFORMATION SYSTEM (HRMIS)

In 2017, MMD successfully achieved 100% usage for HRMIS that includes modules on Occupational Data, Performance Management, Personal Record Management and Remuneration, Benefit and Rewards.
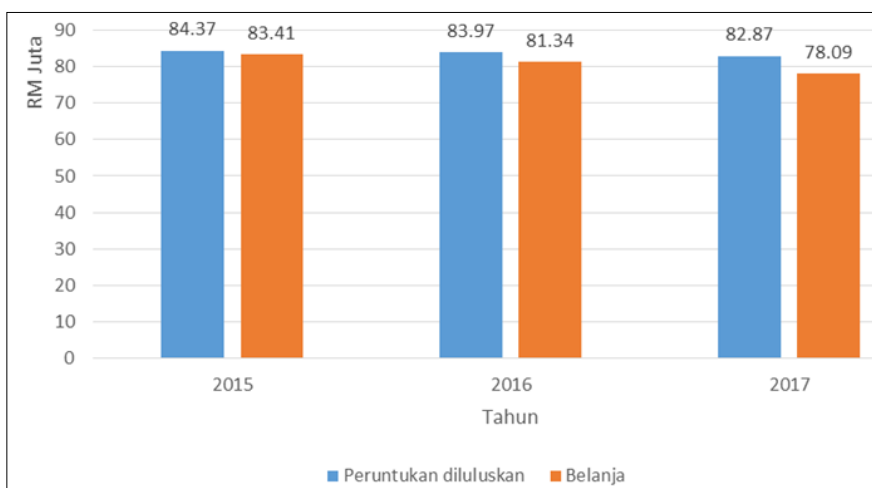
PERUNTUKAN

BUDGET

Perbelanjaan mengurus MMD bagi tahun 2017 adalah RM78.09 juta, iaitu 94.24% berbanding peruntukan yang diluluskan iaitu RM82.87 juta.

Jumlah ini adalah satu pengurangan berbanding dengan tahun 2016 (96.87%) disebabkan oleh langkah penjimatan perbelanjaan yang diamalkan MMD selaras dengan hasrat kerajaan bagi mengoptimumkan perbelanjaan kerajaan.

The MMD's operating expenditure for 2017 was RM78.09 million, which was 94.24% compared to the approved allocations of RM82.87 million.

The reduction of expenditure compared to year 2016 (96.87%) was due to the saving measures practiced by the department in line with the government's intention to optimize government spending.

Prestasi Perbelanjaan Mengurus MMD
MMD's Operating Expenditure

Perbelanjaan pembangunan MMD bagi tahun 2017 adalah RM59.97 juta, iaitu 99.71% berbanding peruntukkan yang diluluskan iaitu RM60.14 juta. Jumlah ini adalah satu peningkatan berbanding dengan tahun 2016 (97.89%).

MMD's development expenditure for 2017 was RM59.97 million, which was 99.71% compared to the approved allocations of RM60.14 million. There is a hike in development expenditure with in comparison with year 2016 where the expenditure was 97.89%.
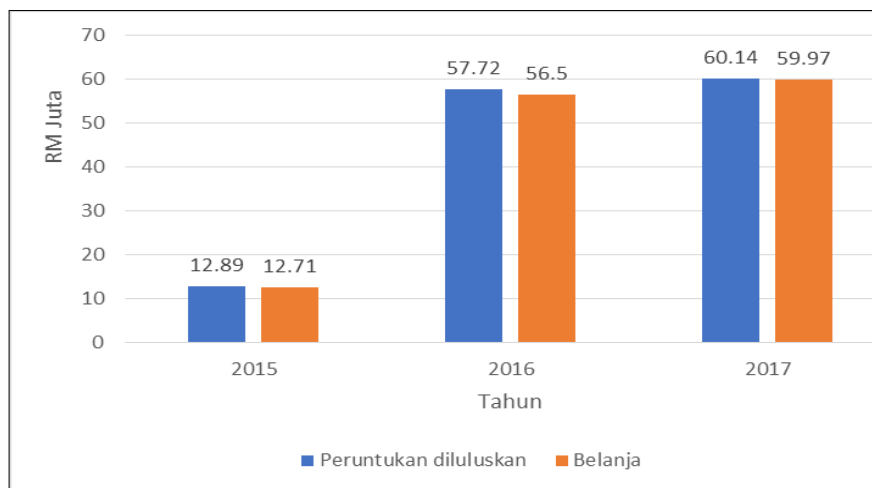
Prestasi Perbelanjaan Pembangunan MMD
MMD's Development Expenditure

PEMBANGUNAN MODAL INSAN

HUMAN CAPITAL DEVELOPMENT

Sepanjang tahun 2017, sebanyak 23 kursus dalaman telah dilaksanakan untuk meningkatkan kefahaman dan kemahiran dalam bidang berkaitan meteorologi dan pembangunan insan.

Throughout the year 2017, a total of 23 internal courses was held to enhance the understanding and skills in the areas of meteorology and human development.

Sejumlah 783 daripada 861 pegawai berjaya menghadiri tujuh atau lebih hari berkursus dengan Penunjuk Prestasi Utama sebanyak 91% peratus.

783 out of 861 employees have successfully attended seven or more days of courses with a Key Performance Indicator of 91% achievement.
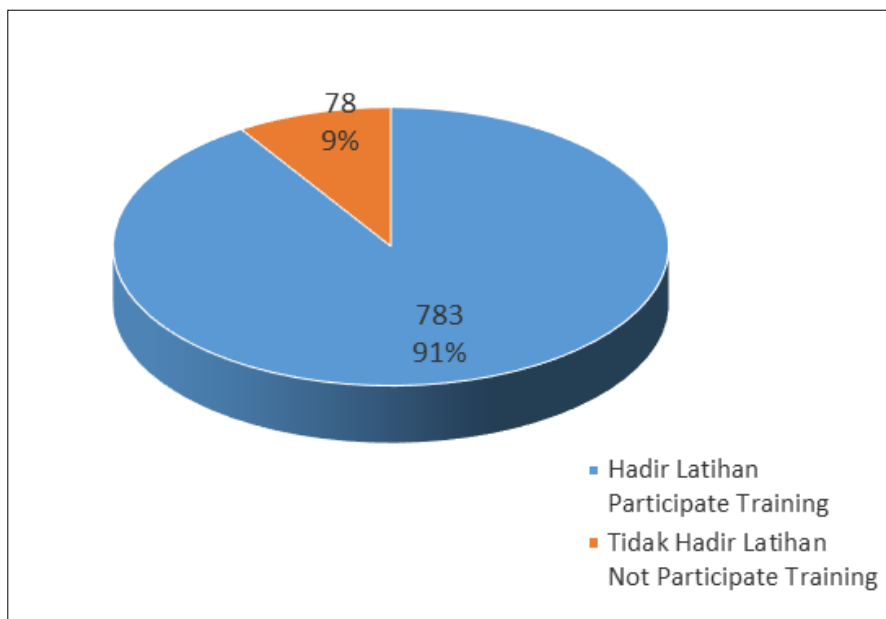
Bilangan kakitangan yang mengikuti kursus
Total number of employees participated in training

Antara kursus yang dilaksanakan ialah Kursus Peralihan Pelantikan di bawah Urusan Skim Perkhidmatan bagi Pembantu Meteorologi Gred C17, C22 dan C26 kepada Penolong Pegawai Meteorologi Gred C29. Kursus selama enam bulan mulai 8 Disember 2016 sehingga 18 Jun 2017 melibatkan 392 orang Pembantu Meteorologi.

Among the courses implemented are Transition Courses under the Scheme of Service for Meteorological Assistants Grade C17, C22 and C26 to Assistant Meteorological Officers Grade C29. The six-month course was held from 8th December 2016 until 18th June 2017 involving 392 Meteorological Assistants.

Di samping itu sebanyak 17 program Skim Latihan Kepakaran Teknikal (LKT) telah dilaksanakan di bawah Program Pembangunan Modal Insan. Seramai tiga orang pegawai meteorologi telah melanjutkan pelajaran ke peringkat Sarjana.

Besides that, a total of 17 programmes on Technical Expertise Training Scheme (LKT) was completed under the Human Capital Development Program (HCD). Whereas, three meteorological officers pursued their education in Masters.

38 orang kakitangan meteorologi telah dinilai melalui Penilaian Kompetensi bagi Aeronautical Meteorological Personnel (AMP). Penilaian ini telah melibatkan 11 orang Pegawai Meteorologi dan 27 orang Penolong Pegawai Meteorologi.

MMD juga menawarkan latihan industri kepada para pelajar dan seramai 34 orang menjalani latihan industri di Ibu Pejabat MMD dan juga Pejabat Meteorologi Negeri.

A total of 38 employees have been assessed through the Competency Assessment for Aeronautical Meteorological Personnel (AMP). This assessment involved 11 meteorological officers and 27 Assistant Meteorological Officers.

MMD also offered industrial trainings for students where 34 students were offered industrial training placements in MMD Headquarters and State Meteorological Office.

AKTIVITI KESEDARAN AWAM

MMD telah mengadakan dan mengambil bahagian aktif dalam pameran dan aktiviti lain berkaitan bagi mendidik, memberi kefahaman, kesedaran dan meningkatkan kesiapsiagaan dalam kalangan orang awam terutamanya dari aspek kepentingan memahami maklumat dan data meteorologi. Sepanjang tahun 2017, sejumlah 144 aktiviti pameran dan kempen kesedaran awam telah dilaksanakan oleh MMD.

PUBLIC AWARENESS ACTIVITIES

MMD have organised and participated actively in exhibitions and other related activities to educate, create an understanding and awareness, improve preparedness among the people especially on the importance of understanding the meteorological information and data. Throughout the year 2017, a total of 144 exhibition activities and public awareness campaigns was conducted by MMD.

PENCAPAIAN KPI 2017

Petunjuk-petunjuk prestasi utama (KPI) yang diterapkan dalam perkhidmatan awam bertujuan membantu jabatan menjelas dan mengawal tahap kemajuan sesuatu proses perkhidmatan yang disampaikan kepada pelanggan selaras dengan misi dan visi jabatan dan kementerian.

KPI ACHIEVEMENT 2017

The key performance indicators (KPIs) applied in the public service ia aimed at assisting the department to control the progress of a service process delivered to the customer in line with the missions and visions of the department and ministry.
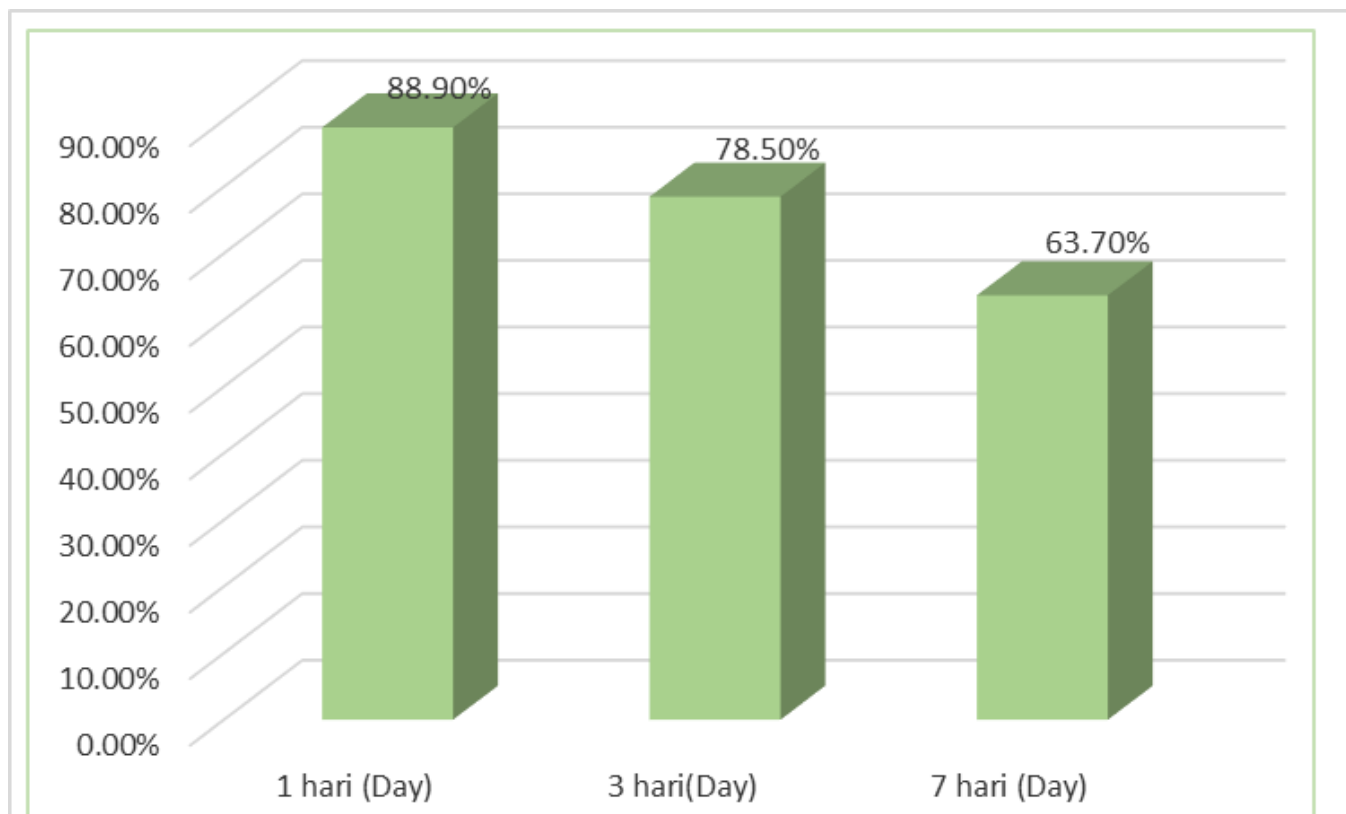
Purata kejituan ramalan cuaca awam
Public weather forecast average accuracy

Sehubungan dengan itu, Petunjuk Prestasi utama (KPI) MMD dipantau dengan teliti agar mematuhi semua kriteria yang telah ditetapkan di dalam Piagam Pelanggan Jabatan.

Tindakan pembetulan dan penambah baikan secara berterusan diambil bagi memastikan perkhidmatan yang disampaikan kepada pelanggan kekal relevan dan berkesan. Pencapaian Piagam Pelanggan MMD dipantau dan dimuatnaik ke dalam laman sesawang MMD secara mingguan.

Therefore, MMD's Key Performance Indicators (KPIs) are carefully monitored to comply with all the criteria set out in the Department's Client Charter.

Continuous correction and enhancement measures are taken to ensure that the services delivered to the customer remain relevant and effective. The MMD's Client Charter Achievement is monitored and uploaded into the MMD's website on a weekly basis.

Secara keseluruhan, pencapaian Petunjuk Prestasi Utama (KPI) MMD pada tahun 2017 adalah seperti berikut:

Overall, the achievement of MMD's Key Performance Indicator (KPI) in 2017 is as follows:

Purata kejituan ramalan cuaca awam bagi tempoh:

Public weather forecast accuracy for:

Pencapaian	Sasaran	
1 hari	88.9%	85.0%
3 hari	78.5%	75.0%
7 hari	63.7%	65.0%

Achieved	Target	
1 day	88.9%	85.0%
3 day	78.5%	75.0%
7 day	63.7%	65.0%

Purata kejituan ramalan cuaca lautan dalam tempoh:

Average accuracy of ocean weather forecast within:

Pencapaian	Sasaran	
1 hari	90.9%	85.0%
3 hari	80.7%	75.0%
7 hari	70.5%	65.0%

Achieved	Target	
1 hari	90.9%	85.0%
3 hari	80.7%	75.0%
7 hari	70.5%	65.0%

Purata penghantaran maklumat awal berkaitan gempa bumi dan tsunami tempatan dalam tempoh 8 minit dari masa kejadian gempa tersebut adalah

The average dissemination of early information on local earthquakes and tsunamis within 8 minutes from the beginning of the earthquake is 99.0%.
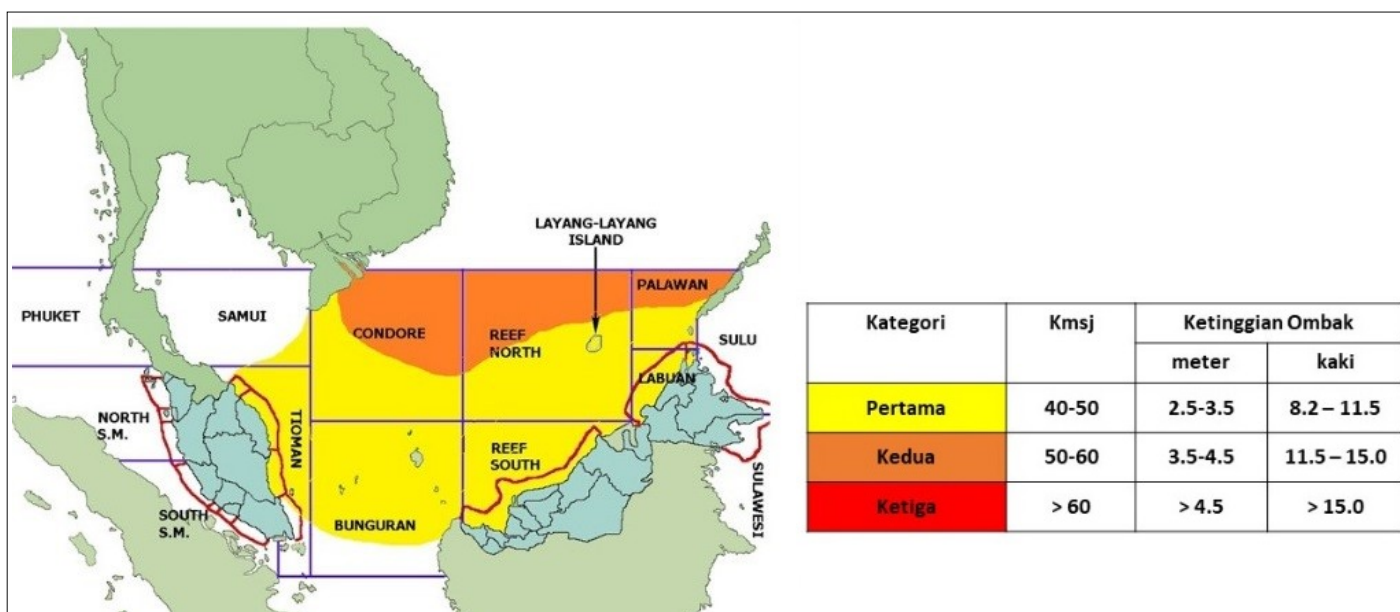
Contoh amaran angin kencang dan laut bergelora
Example of warning on strong winds and rough seas

PROJEK PEMBANGUNAN

Pada tahun 2017, empat projek pembangunan telah berjaya disiapkan. Antara projek tersebut ialah:

a) Pemantapan aktiviti pemantauan gempa bumi dan tsunami di negeri Sabah dengan peruntukkan berjumlah RM14 juta.

- Skop projek melibatkan perolehan 15 alat sensor *seismometer* dan meter intensity, perolehan perkakasan dan perisian serta pengubahsuaian ruang operasi Sub-Pusat Gempa Bumi dan Tsunami Nasional (Sub-PGTN); dan

- Operasi pemantauan dan pengesanan serta hebahan maklumat gempa bumi yang berlaku di Malaysia terutamanya di Sabah akan dapat ditingkatkan melalui projek ini.

DEVELOPMENT PROJECT

In 2017, four development projects have been successfully completed. The projects are:

a) Strengthening the earthquake and tsunami monitoring activities in Sabah with an allocation of RM14 million.

- The scope of this project involves an acquisition of 15 seismometer sensor tools and intensity meters, procurement of hardware and software and modification of the Earthquake and Tsunami National Sub-Centre (Sub-PGTN); and

- The monitoring and tracking operations and dissemination of earthquake information disclosure in Malaysia especially in Sabah will be enhanced through this project.

Stesen Seismologi (Seismology Station) Tamparuli
Lokasi (Location): Sekolah Menengah Kebangsaan Tamparuli

b) Peningkatan Sistem Ramalan Cuaca dengan peruntukkan berjumlah RM66.7 juta yang melibatkan:

- Pembangunan sistem komputer berkeupayaan tinggi bagi meningkatkan keupayaan Sistem *Numerical Weather Prediction* (NWP);

b) Enhancing the Weather Forecast System with an allocation of RM66.7 million that involves:

- Development of high-performance computing system to enhance the Numerical Weather Prediction (NWP) system;

- Pembangunan sistem pengurusan ramalan cuaca secara bersepadu yang merangkumi *Computer Message Switching System* (CMSS) dan *Malaysian Integrated Forecasting System* (MIFS);
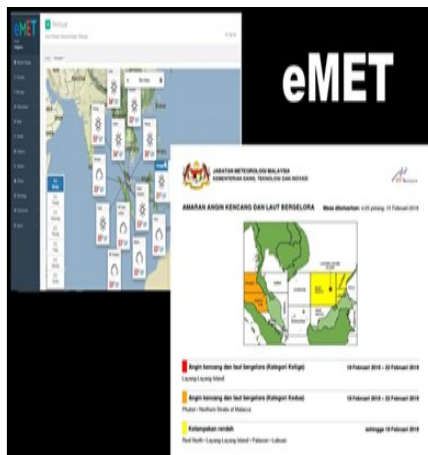
- Development of an integrated weather forecast management system that includes the Computer Message Switching System (CMSS) and the Malaysian Integrated Forecasting System (MIFS);

- Pembangunan sistem pangkalan data meteorologi;
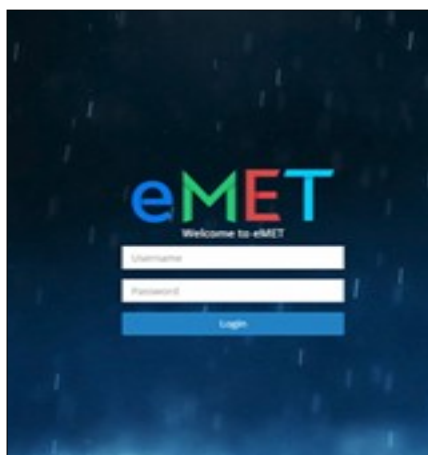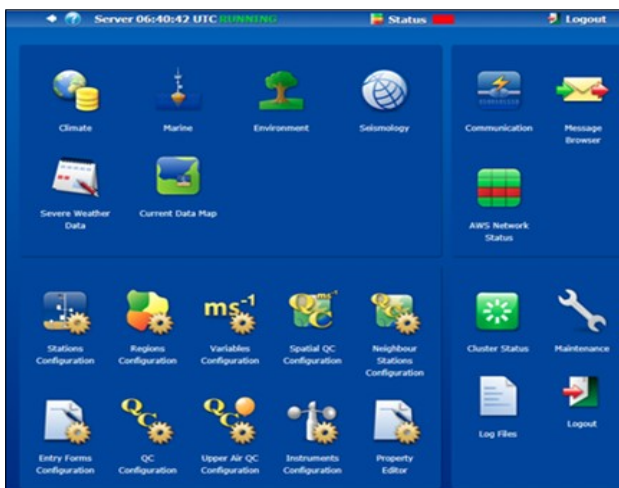
- Development of meteorological database system;

- Pembangunan sistem penyampaian cuaca yang merangkumi TV grafik, laman web dalaman (eCuaca), SMS, Aplikasi mobil, RakanMET dan Whatsapp;

- Development of weather presentation system including TV graphics, internal website (eCuaca), SMS, Mobile Applications, RakanMET and Whatsapp;
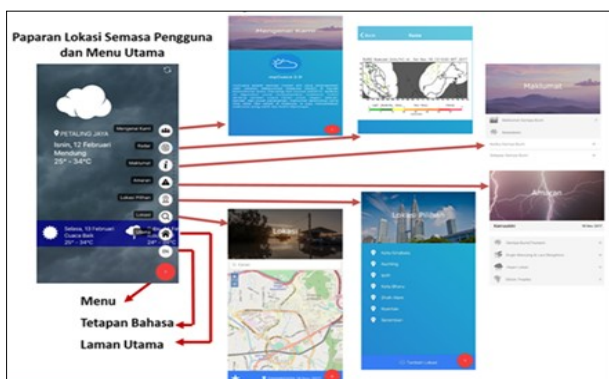
- *Support Forecasting System* serta sistem paparan dan kemasukan data di semua pejabat meteorologi;

- Kemudahan latihan di pusat kompetensi; dan

- Peningkatan dan penyediaan infrastruktur.

- Support Forecasting System along with the display and data entry system at all the meteorological offices;

- Training facility at competency centre; and

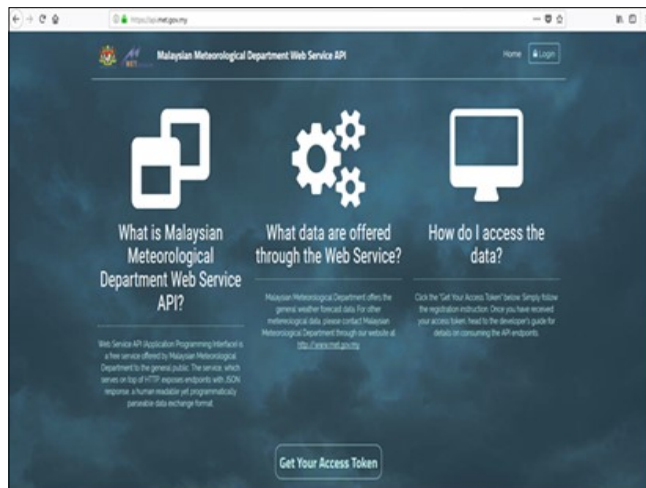- Improving and providing infrastructure.

Pelaksanaan projek in dapat meningkatkan keupayaan pengumpulan data meteorologi, kecekapan proses analisis data dan ketepatan ramalan cuaca serta keberkesanan sistem penyediaan dan penyampaian maklumat cuaca.

The implementation of this project will enhance the capabilities of meteorological data collection, the efficiency of the data analysis process, the accuracy of weather forecast, the effectiveness of the system in preparing and presenting weather information.

c) Penyediaan tapak bagi cadangan pembinaan Stesen Meteorologi Radar Doppler di lokasi-lokasi berikut dengan peruntukkan sejumlah RM5 juta.

c) Site preparation for the proposed construction of Radar Doppler Meteorological Station at the following locations with an allocation of RM5 million:

- Marang , Terengganu
- Rompin, Pahang
- Kuala Gula, Perak
- Sibu, Sarawak
- Tawau, Sabah (tanpa kuarters)

- Marang, Terengganu
- Rompin, Pahang
- Kuala Gula, Perak
- Sibu, Sarawak
- Tawau, Sabah (without quarters)

Gambar Illustrasi Pembinaan Stesen Meteorologi Radar Doppler
Illustration of proposed construction of Radar Doppler Meteorological Station

d) Pemasangan *wind shear detection system* di tiga Lapangan Terbang di Malaysia iaitu Kuching, Kota Kinabalu dan Miri. Projek ini dapat meningkatkan tahap keselamatan dan kecekapan operasi penerbangan di lapangan terbang di Malaysia.

d) Installation of wind shear detection system at three airports in Malaysia namely Kuching, Kota Kinabalu and Miri. This project will enhance the safety and efficiency of flight operations at airports in Malaysia.
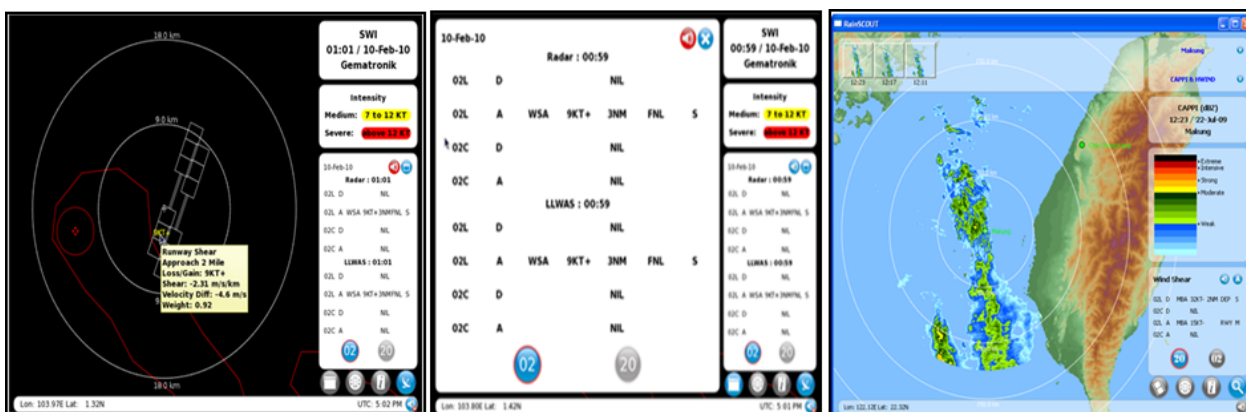
Komponen dan Peralatan Wind Shear
Wind Shear Components and Equipment

CUACA & IKLIM

WEATHER & CLIMATE

CUACA PADA 2017
WEATHER IN 2017

Anggaran suhu purata dunia bagi 2017 adalah 0.77 ± 0.1°C atas paras purata 1961 –1990. Manakala 2017 mempunyai suhu purata tahunan global dianggarkan sedikit panas daripada 2015, perbezaan antara kedua-dua tahun ini adalah kurang daripada 0.01°C. Oleh itu, Pertubuhan Meteorologi Sedunia (WMO) menganggap 2017 tiada perbezaan ketara daripada 0.76 ± 0.1°C tahun 2015, dan kedua-dua tahun ini terikat bagi kedudukan tahun kedua terpanas dalam rekod sejak tahun 1850. Tahun paling panas dalam rekod adalah tahun 2016 dengan anomali +0.88 ± 0.1°C. El Niño yang kuat telah menyumbang kepada keadaan cuaca panas pada 2015 dan 2016, namun keadaan cuaca panas 2017 berlaku tanpa kehadiran El Niño.

Suhu global telah meningkat lebih daripada 1°C semenjak tempoh pra-industri. Rekod sepuluh tahun paling panas telah berlaku antara 1998 sehingga kini. Semenjak tahun 1985, tiada lagi bacaan suhu purata global di bawah purata (1961-1990).

The world's average temperature estimation for 2017 was 0.77 ± 0.1°C above the average of 1961-1990. Whereas in 2017, the global annual temperature estimated to be slightly warmer than year 2015, the difference between these two years were less than 0.01°C. Therefore, the World Meteorological Organization (WMO) considered the weather in 2017 has no significant difference from 0.76 ± 0.1°C in year 2015, and both these years were tied for the second warmest position in the record since 1850. The warmest year in record was 2016 with the anomaly of +0.88 ± 0.1°C). El Niño has strongly contributed to the hot weather in 2015 and 2016, but the hot weather in 2017 took place without the presence of El Niño.

The global temperature has increased more than 1°C since the pre-industrial period. The warmest ten-year record has occurred between 1998 until today. Since 1985, there has been no average global temperature reading below the average (1961-1990).
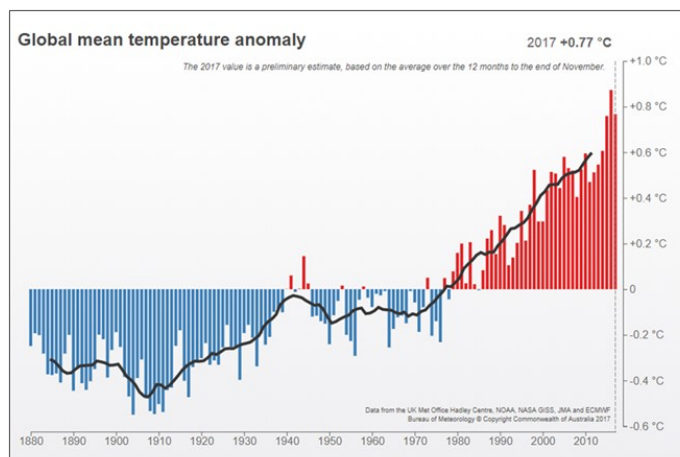
Anomali purata suhu tahunan global (purata 1961-1990). Nilai 2017 adalah anggaran awal berdasarkan purata 12 bulan sehingga November. Garis hitam menunjukkan 'moving average' untuk 11 tahun
Annual global average temperature anomaly (average 1961-1990). The 2017 value is a preliminary estimate based on the average over the 12 months till end of November. The black line shows the "moving average" in 11 years

Secara global, tahun 2017 merupakan tahun yang panas dan suhu yang lebih tinggi daripada purata (tahun 1961 – 1990) direkodkan di hampir semua kawasan daratan di dunia. Antara rantau yang paling panas adalah selatan Eropah, sekitar Algeria, utara Afrika, bahagian timur dan selatan Afrika dan bahagian timur tengah Rusia.

Globally, year 2017 was a hot year and a higher temperature from the average (year 1961 - 1990) was recorded in nearly every major land area in the world and the warmest region was Southern Europe, around Algeria in Northern Africa, Eastern and Southern Africa and regions in middle to the far east of Russia.

ARCTIC SEA ICE EXTENT
During its growth season, the Arctic had its smallest annual maximum extent. During its melt season, the Arctic reached its eighth smallest minimum extent on record.

ALASKA
Barrow, AK had its warmest November on record, with a temperature departure from average of 9.1°C (16.4°F) above average.

CONTIGUOUS UNITED STATES
The 2017 national temperature was the third highest since 1895, behind 2012 and 2016.

HURRICANE HARVEY
(August 17th–September 1st, 2017)
Maximum winds ~ 215 km/hr
Harvey produced record precipitation totals in areas of Texas and Louisiana.

EASTERN NORTH PACIFIC HURRICANE SEASON
Near average activity
18 storms, 9 hurricanes

MEXICO
Mexico had its highest January-October temperature since records began in 1971, besting the previous record set in 2016.

CHILE & ARGENTINA
An intense heat wave affected parts of southern South America in January. Of note, the maximum temperature of 43.5°C (110.3°F) was recorded at Puerto Madryn on 27 January—this was the highest temperature ever recorded so far south (43°S) in the world.

ARGENTINA
The 2017 national temperature was the highest since records began in 1961, surpassing the previous record set in 2012.

CANADA
Severe precipitation deficits in 2017 in the province of British Columbia contributed to the development of the largest wildfire season (2.5 million acres of land affected) in the province's history

ATLANTIC HURRICANE SEASON
Above average activity
This was the most active season since 2005 and the 7th most active on record in the basin.
17 storms, 10 hurricanes

EUROPE
Europe, as a whole, experienced its fifth warmest year on record. Several countries had a top 8 year: Portugal (2nd), UK (5th), France (5th), Austria (8th), and Germany (8th).

PORTUGAL
Had its fourth driest year on record. The April-December period was the driest such period in the 87-year record.

HURRICANE IRMA
(August 30th–September 16th, 2017)
Maximum winds ~ 295 km/hr
Irma affected Puerto Rico, the U.S. Virgin Islands, and Florida.

HURRICANE MARIA
(September 16th–30th, 2017)
Maximum winds ~ 280 km/hr
Maria caused major destruction across the Caribbean Islands.

AFRICA
2017 was the fourth warmest year on record, behind 2010, 2016, and 2015.

ASIA
Much-warmer-than-average conditions were present across much of the continent. 2017 was the third warmest year since continental records began in 1910, behind 2015 and 2007. Russia and China had their warmest Jan–Sep since national records began. The Kingdom of Bahrain set a new monthly temperature record in April, July, August, and September.

CHINA
Heavy precipitation during June 29-July 2 triggered severe floods across parts of southern China, causing 56 fatalities and over 5 billion USD in damages.

WESTERN PACIFIC OCEAN TYPHOON SEASON
Near average activity
26 storms, 12 typhoons

THAILAND
Had its second wettest January-September on record.

BANGLADESH, INDIA & NEPAL
Torrential rain fell during Aug 9-12, with several locations receiving nearly their normal monthly precipitation totals in just a few days.

NORTH INDIAN OCEAN CYCLONE SEASON
Near average activity
4 storms, 2 cyclones

SOUTH WEST INDIAN OCEAN CYCLONE SEASON
Below average activity
5 storms, 3 cyclones

SOUTH WEST PACIFIC OCEAN CYCLONE SEASON
Below average activity
6 storms, 3 cyclones

AUSTRALIAN CYCLONE SEASON
Below average activity
7 storms, 3 cyclones

AUSTRALIA
Experienced its third warmest year since national records began in 1910. Seven of Australia's ten warmest years on record have occurred since 2005.

ANTARCTIC SEA ICE EXTENT
During its growth season, the Antarctic had its second smallest annual maximum extent. During its melt season, the Antarctic reached its smallest minimum extent on record.

Please Note: Material provided in this map was compiled from NOAA's NCEI State of the Climate Reports and the WMO Provisional Status of the Climate in 2017.
For more information please visit: http://www.ncdc.noaa.gov/sotc

Anomali iklim yang signifikan dan peristiwa-peristiwa global yang berlaku dalam tahun 2017
The significant climate anomalies and global events that occurred in 2017
Sumber (source): https://www.ncdc.noaa.gov

Iklim Malaysia yang dicirikan dengan tiga komponen utama iaitu corak tiupan angin, taburan hujan dan suhu.

Malaysia's climate is characterized by three main components namely wind pattern, rainfall and temperature.

Pada tahun 2017, iklim di Malaysia banyak dipengaruhi oleh keragaman iklim semula jadi kerana mengalami cuaca yang normal dan keadaan ENSO neutral. Keadaan ini adalah berbeza dengan iklim pada tahun 2016 di mana *Super El Niño* telah berlaku.

In 2017, the climate in Malaysia was greatly influenced by the natural climate variability due to the normal weather conditions and neutral ENSO. This condition was different from the climate in 2016 where Super El Niño has taken place.

Indeks ENSO adalah neutral bermula Januari 2017 sehingga penghujung November 2017. Keadaan La Niña lemah mula menyusuri bermula Disember 2017. Sepanjang 2017, Malaysia tidak mengalami cuaca panas dan kering yang berpanjangan. Fenomena jerebu, musim kemarau serta gelombang haba juga tidak berlaku.

ENSO index was neutral starting from January 2017 till the end of November 2017. A weak La Niña condition started in December 2017. Throughout 2017, Malaysia did not experience long-lasting hot and dry weather. The haze phenomenon, drought and heat wave also did not happen.

Berikut adalah tempoh musim yang dialami Malaysia pada tahun 2017.

Below are the periods of season experienced by Malaysia in 2017.

MUSIM/ SEASON	TEMPOH/ DURATION
Tempoh Peralihan Monsun **Monsoon Transitional Period**	April 2017 sehingga 16 Mei 2017 April 2017 to 16th May 2017
Monsun Barat Daya **Southwest Monsoon**	17 Mei 2017 sehingga 5 Oktober 2017 17th May 2017 to 5th October 2017
Tempoh Peralihan Monsun **Monsoon Transitional Period**	6 Oktober sehingga 12 November 2017 6th October to 12th November 2017
Monsun Timur Laut **Northeast Monsoon**	13 November sehingga 27 Mac 2018 13th November to 27th March 2018

Bagi tahun 2017, kebanyakan stesen merekodkan purata kelajuan angin yang seragam berbanding jangka panjang, namun bagi kawasan-kawasan di Sarawak dan Sabah yang banyak dipengaruhi oleh kedudukan bentuk muka bumi yang dikelilingi laut, purata kelajuan angin menunjukkan perbezaan berbanding jangka panjang.

In 2017, most of the stations recorded a consistent average wind speed compared to the long-term average; however, Sarawak and Sabah areas were highly influenced by their landform locations which are surrounded by sea and making the average wind speed difference compared to the long-term average.

Kelajuan angin tertinggi yang direkodkan bagi seluruh Malaysia adalah 7.1m/s di Kota Bharu pada 31 Disember 2017.

The highest wind speed recorded all over Malaysia was 7.1m/s in Kota Bharu on 31st December 2017.
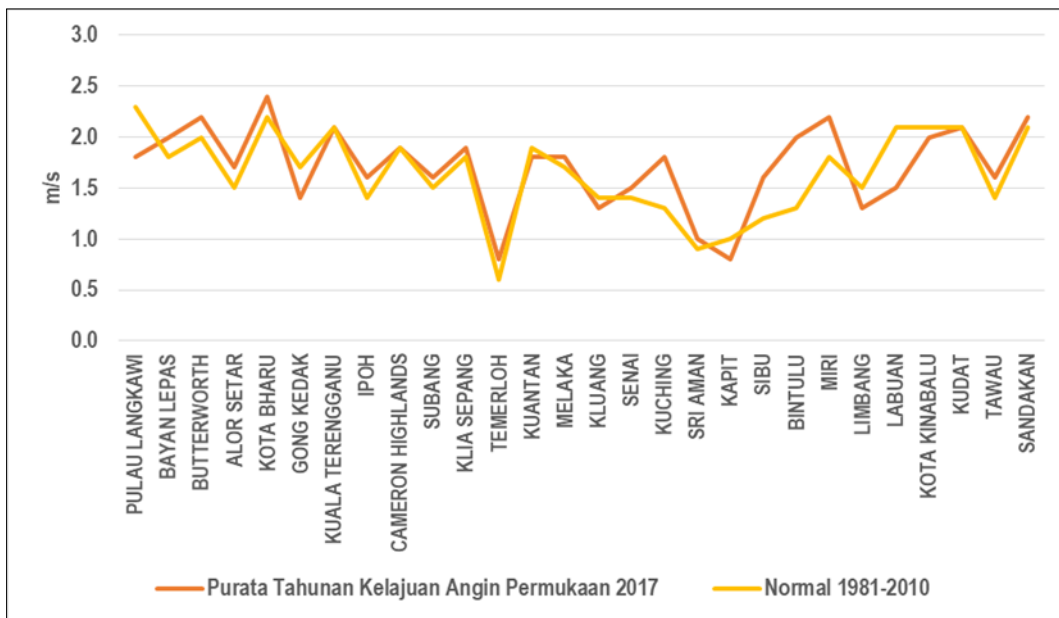
Purata tahunan kelajuan angin permukaan 2017 berbanding normal (1981 – 2010)
The annual average of surface wind speed compared to the normal (1981 – 2010)

Secara umumnya bagi tahun 2017, Malaysia mengalami keadaan cuaca dan iklim yang normal sepanjang tahun dengan beberapa peristiwa ekstrem, seperti kehadiran lekukan tropika yang menyebabkan terdapat negeri menerima kesan yang agak teruk. Keadaan ENSO neutral pada 2017 juga antara faktor penyumbang kepada kurangnya kewujudan fenomena jerebu, kemarau serta gelombang haba.

Generally, throughout the year 2017, Malaysia has experienced normal weather and climate conditions with some extreme incidents, such as the presence of tropical depression which has caused some states to suffer quite severe effects. The neutral state of ENSO in 2017 was also a contributing factor to the lack of haze, drought and heat waves phenomenon.
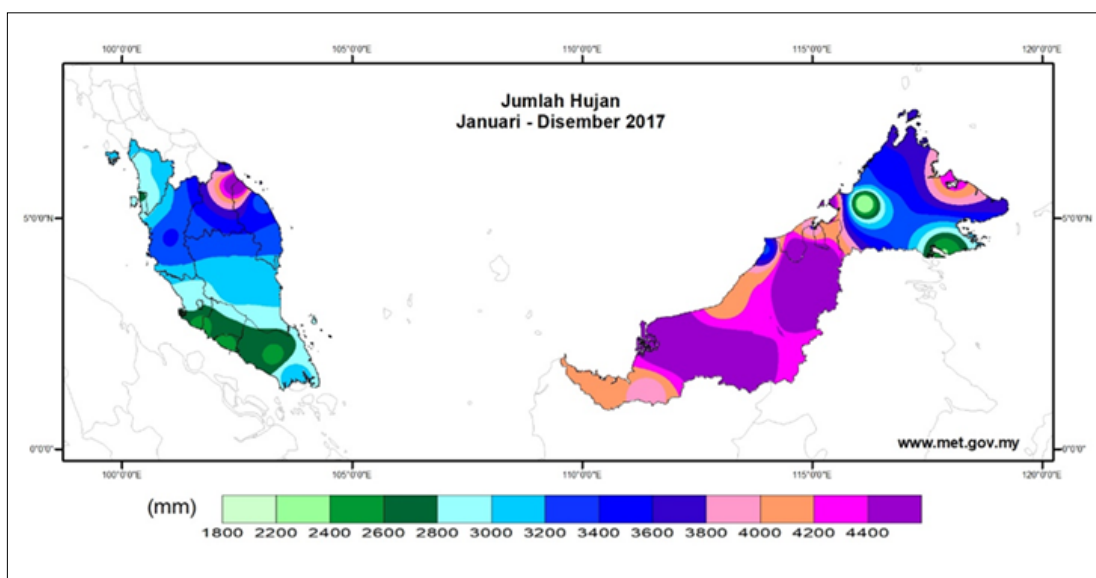
Jumlah taburan hujan tahunan 2017
Total annual rainfall 2017

CUACA EKSTREM PADA 4 -5 NOVEMBER 2017

EXTREME WEATHER ON 4 -5 NOVEMBER 2017

Pada 26 Oktober 2017, satu kejadian lekukan tropika telah dikesan di Laut China Selatan. Trajektori taufan daripada *Joint Typhoon Warning Center (JTWC)* menunjukkan lekukan tropika ini bergerak merentasi selatan Thailand yang mengakibatkan Kelantan dan utara Terengganu menerima hujan berterusan.

On 26 October 2017, a tropical depression was detected in the South China Sea. The tropical trajectory from the Joint Typhoon Warning Center (JWTC) showed that this tropical depression was moving across southern Thailand resulting in the constant rain in Kelantan and northern Terengganu.

Sistem ini telah bergerak dan membuat pusingan U di utara Semenanjung sebelum kembali semula ke Teluk Thailand yang mengakibatkan bencana yang serius di Pulau Pinang dan Kedah. Kejadian hujan lebat berterusan serta angin kencang telah berlaku di negeri Kedah dan Pulau Pinang terutama di Bayan Baru, Bayan Lepas, Batu Feringghi, Balik Pulau dan Seberang Perai pada 4 dan 5 November 2017.

This system has moved and made a U-turn over northern Peninsular before returned to The Gulf of Thailand which resulted in serious disasters in Penang and Kedah. Continuous heavy rains and strong winds occurred in Kedah and Penang especially in Bayan Baru, Bayan Lepas, Batu Feringghi, Balik Pulau and Seberang Perai on 4th and 5th November 2017.
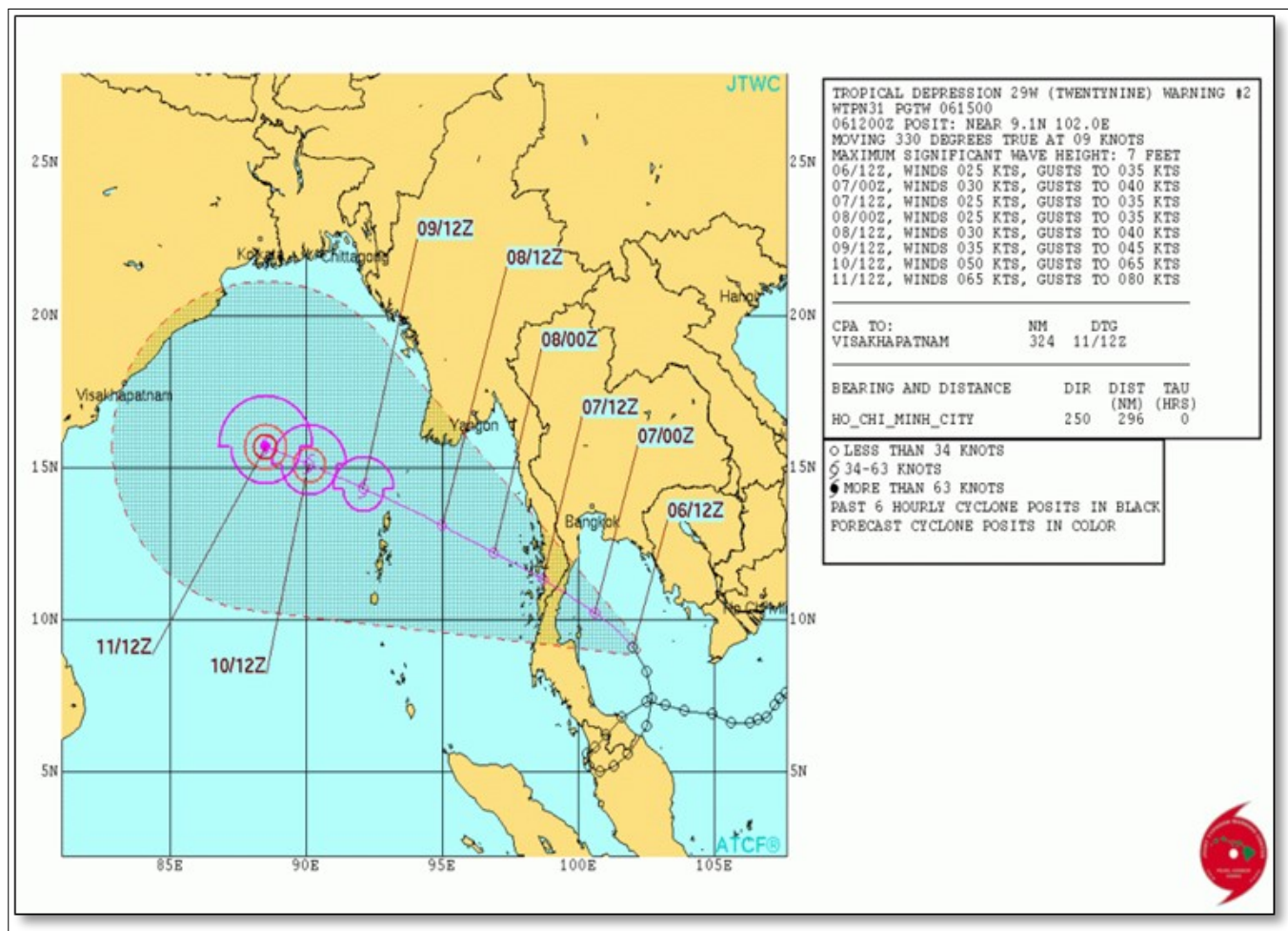
Trajektori Lekukan Tropika 29W
Tropical Depression 29W Trajectory

	Stn. Bayan Lepas	Stn. Butterworth	Stn. Alor Setar	Stn. Pulau Langkawi
Semasa (mm)	213.80	384.80	110.00	56.40
Purata Jangka Panjang (mm)	257.60	188.00	164.10	152.80
Rekod Tertinggi (mm)	288.20	350.00	178.80	267.30
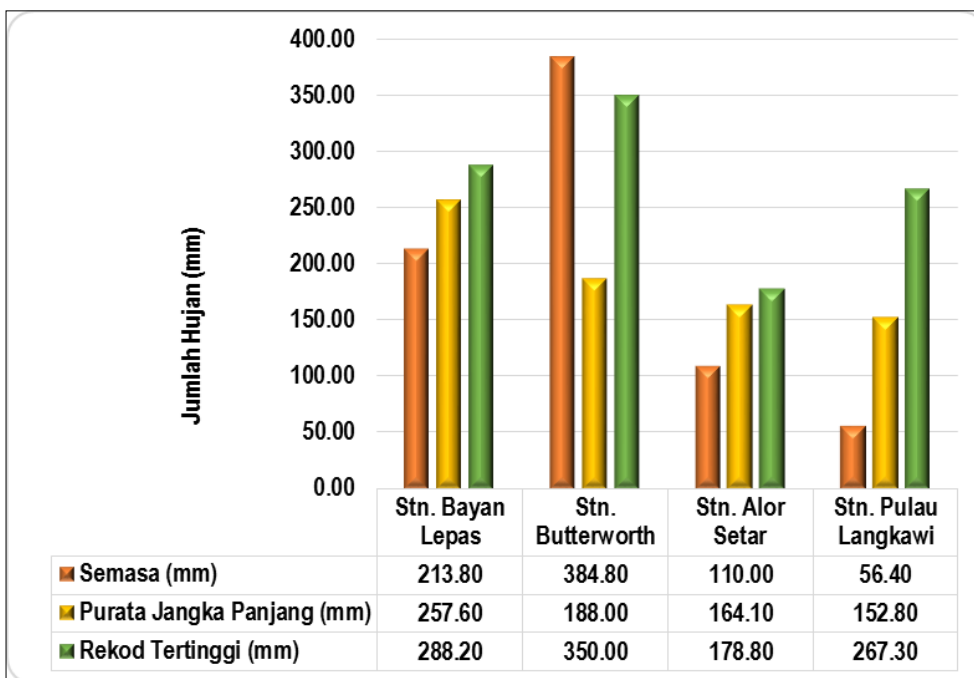
Ringkasan jumlah hujan harian November 2017 untuk Pulau Pinang dan Kedah
Daily rainfall summary of November 2017 for Penang and Kedah

	Stn. Bayan Lepas	Stn. Butterworth	Stn. Alor Setar	Stn. Pulau Langkawi
Semasa (mm)	395.60	489.90	425.20	178.80
Purata Jangka Panjang (mm)	239.80	239.90	215.70	206.80
Rekod Tertinggi (mm)	516.90	605.10	457.10	394.50
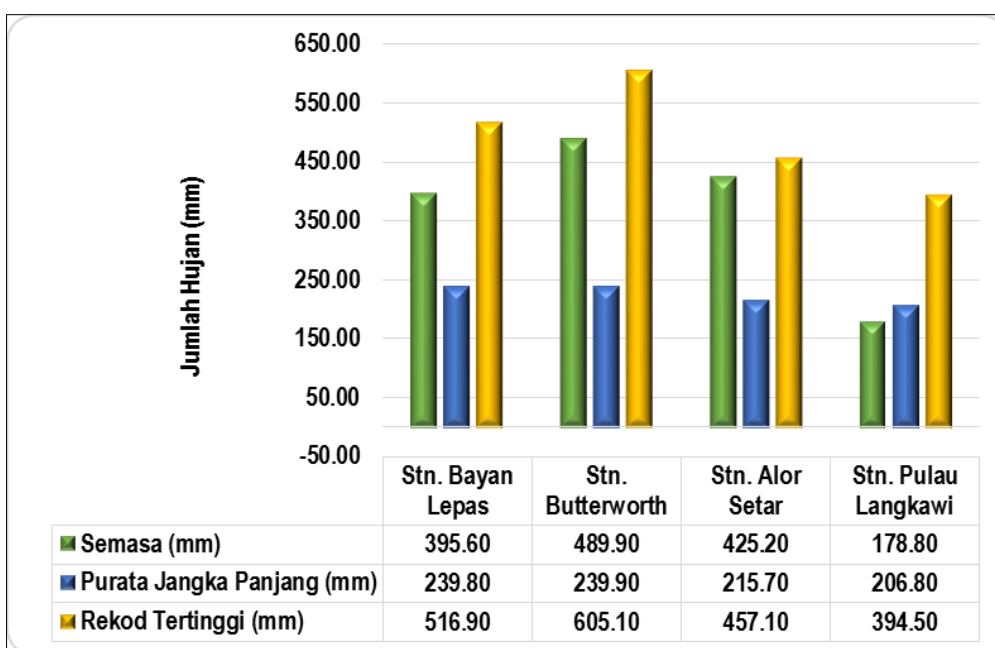
Ringkasan jumlah hujan bulanan November 2017 bagi Pulau Pinang dan Kedah
Monthly accumulated rainfall of November 2017 for Penang and Kedah

Butterworth merekodkan jumlah hujan harian melebihi purata jangka panjang (188.0mm) dan rekod tertinggi (350.0mm) yang pernah dicatatkan iaitu 384.8mm. Stesen Meteorologi Bayan Lepas, Butterworth dan Alor Setar pula merekodkan jumlah hujan bulanan semasa melebihi purata jangka panjang stesen masing-masing.

Butterworth has recorded the daily rainfall exceeded the long-term average (188.0mm) and the highest rainfall (350.0mm) that has been recorded was 384.8mm. Bayan Lepas Meteorological Station, Butterworth and Alor Setar have recorded the monthly rainfall exceeded the long-term average for their stations.

MAKLUMAT IKLIM 2017/ CLIMATE INFORMATION 2017

Suhu/ Temperature	Data	Lokasi/ Location
Suhu tertinggi direkodkan Highest temperature recorded	37.6°C	Mulu, Sarawak (6 Ogos 2017)
Suhu terendah direkodkan (tanah rendah) Lowest temperature recorded (low land)	15.2°C	Keningau, Sabah (8 Februari 2017)
Suhu terendah direkodkan (tanah tinggi) Lowest temperature recorded (up land)	11°C	Tanah Rata, Pahang (10 Febuari 2017)
Hujan/ Rainfall		
Hujan tertinggi dalam sejam Highest rainfall in an hour	164.6 mm	Perai, Pulau Pinang (14 Ogos 2017)
Hujan tertinggi dalam sehari Highest rainfall in a day	416.8 mm	Gong Kedak, Terengganu (20 Januari 2017)
Hujan bulanan tertinggi Highest monthly rainfall	1340.8 mm	Gong Kedak, Terengganu (Januari 2017)
Hujan tahunan tertinggi Highest annual rainfall	6078.52 mm	Mulu, Sarawak
Hujan bulanan terendah Lowest monthly rainfall	7.8 mm	Chuping, Perlis (Februari 2017)
Hujan tahunan terendah Lowest annual rainfall	1311.28 mm	Sitiawan, Perak
Bilangan hari hujan tertinggi Highest total daily rainfall	278 hari/days	Cameron Highlands, Pahang
Bilangan hari tanpa hujan paling lama Longest total of days without rain	28 hari/days	Kerteh, Terengganu (15 Julai – 11 Ogos 2017)
Angin/ Wind		
Purata kelajuan angin harian tertinggi Highest daily average of wind speed	7.1m/s	Kota Bharu, Kelantan (31 Disember 2017)
Kelajuan angin maksimum tertinggi Highest maximum wind speed	16.1 m/s	Kuala Pilah, Negeri Sembilan (27 Januari 2017)
Kilat dan Ribut Petir/ Lightning and Thunderstorms		
Bilangan hari tertinggi dalam setahun yang ada kilat The highest number of days lightning in a year	341 hari/days	KLIA, Sepang
Bilangan hari tertinggi dalam setahun yang ada ribut petir The highest number of days of thunderstorm in a year	227 hari/days	KLIA, Sepang

LAPORAN DAN ANALISIS BULANAN
MONTHLY REPORT AND ANALYSIS

PUSAT AKTIVITI MONSUN KUALA LUMPUR

MMD merupakan salah sebuah agensi yang bertanggungjawab bagi Pusat Aktiviti Monsun di bawah World Meteorological Organization (WMO) untuk komuniti antarabangsa. MMD telah menerbitkan dua laporan monsun pada tahun 2017, iaitu Laporan Monsun Timur Laut dan Laporan Monsun Barat Daya.

Kedua-dua laporan ini menekankan keadaan sinoptik dan perkembangan cuaca semasa bulan-bulan pra-monsun yang mempengaruhi corak cuaca di Asia Tenggara. Ramalan hujan bermusim semasa bulan-bulan monsun bagi rantau ini juga turut disertakan. Laporan telah dimuatnaik ke laman web rasmi jabatan.

KUALA LUMPUR MONSOON ACTIVITY CENTER

MMD is one of the agencies responsible for Kuala Lumpur Monsoon Activity Center under the World Meteorological Organization (WMO) for international community. MMD has published two reports in 2017, titled Northeast Monsoon Report and Southwest Monsoon Report.

These reports emphasised on the synoptic situation and recent weather development prior to monsoons that influenced the weather pattern in Southeast Asia. Seasonal rainfall forecasts are also included in the reports. The reports are uploaded in the department's official website.
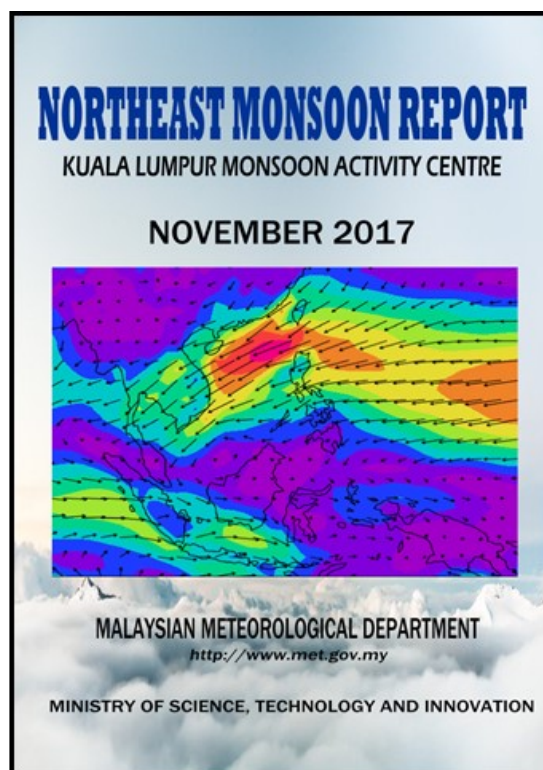
KLIMATOLOGI SINOPTIK

Bagi memantau dan menganalisis corak pergerakan angin di seluruh rantau Malaysia dan Asia Tenggara, Laporan Klimatologi Sinoptik diterbitkan setiap bulan.

Pada tahun 2017, MMD telah menerbitkan 12 laporan Klimatologi Sinoptik yang turut dimuatnaik ke laman web rasmi jabatan.

Laporan tersebut menjelaskan keadaan sinpotik dan kehadiran ribut tropika, jika ada. Laporan tersebut biasanya menghuraikan keadaan sinoptik kepada tiga dekad iaitu dekad pertama dari 1 hingga 10 haribulan, dekad kedua dari 11 hingga 20 haribulan dan dekad tiga dari 21 hingga 31 haribulan.

SYNOPTIC CLIMATOLOGY

In monitoring and analysing the wind pattern over Malaysia and Southeast Asia, the Synoptic Climatology Report was issued every month.

In 2017, the Research and Technical Development Division of MMD have published twelve reports and uploaded them into the department's official website.

The reports describe the synoptic condition of the month and presence of tropical storm, if any. The report is divided into three decades, namely first decade from 1st until 10th of the month, second decade from 11th until 20th of the month and third decade from 21st until 31st of the month.

Rajah 1: Purata Angin Bulanan di Paras 850hPa Bagi Dec 2017
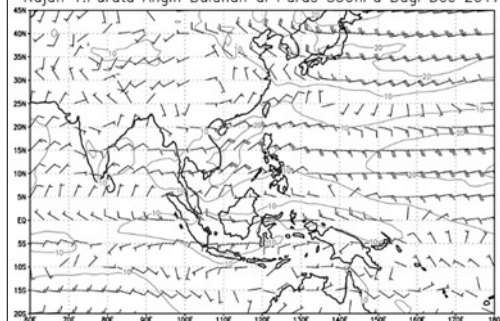
Rajah 2: Purata Angin Bulanan di Paras 200hPa Bagi Dec 2017
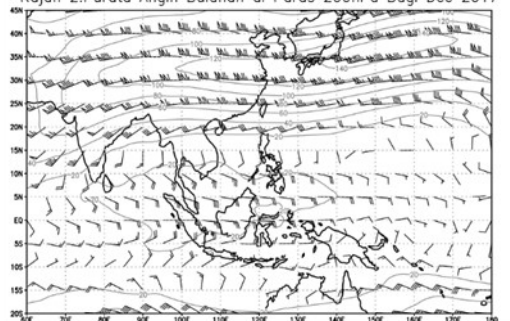
TINJAUAN ENSO

Interaksi laut dan atmosfera berskala besar seperti fenomena El-Nino Southern Oscillation (ENSO) turut mempengaruhi cuaca serantau dan keadaan ini dipantau rapi dan dikemaskini setiap bulan melalui Laporan Tinjauan ENSO. Laporan ini diterbitkan setiap bulan dan dimuatnaik ke laman web jabatan.

ENSO OUTLOOK

Large scale interaction between ocean and atmospheric phenomena such as El-Nino Southern Oscillation (ENSO) affects the regional weather and this situation is monitored through monthly ENSO Outlook Report. This report is published every month and uploaded to the department's website.

Rajah 2(a): Suhu Permukaan Laut (°C) Minggu Berpusat 7 Jun 2017

Rajah 2(a): Suhu Permukaan Laut (°C) Minggu Berpusat 6 Disember 2017
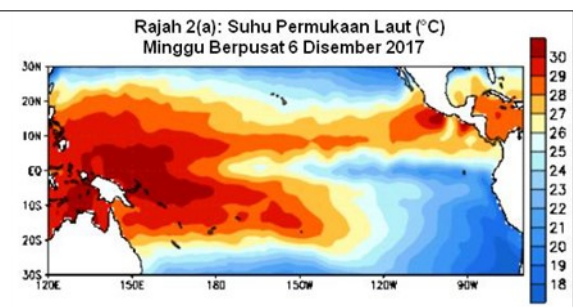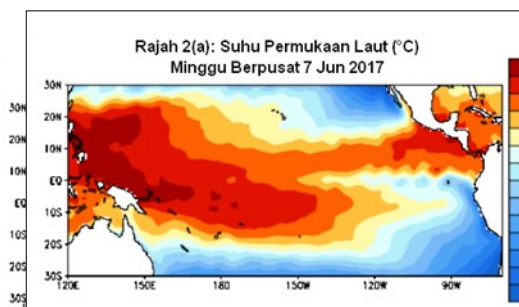
PRODUK-PRODUK BERKAITAN CUACA

PRODUCTS RELATED TO WEATHER

Sepanjang tahun 2017, sebanyak 42,925 produk berkaitan cuaca yang meliputi 31,025 tinjauan cuaca umum, 8,395 tinjauan cuaca laut, 1,152 permintaan cuaca khas serta 2,353 nasihat dan amaran cuaca buruk telah dikeluarkan.

Throughout 2017, a total 42,925 products related to weather comprising 31,025 public weather forecasts, 8,395 marine forecasts, 1,152 special weather request and 2,353 advisories and warnings of bad weather were issued.
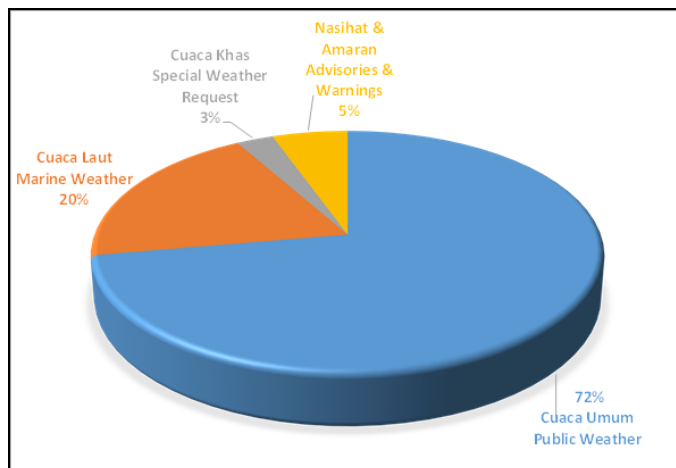
Produk-produk berkaitan cuaca pada tahun 2017
Products related to weather in year 2017

DATA IKLIM

CLIMATE INFORMATION

Pada tahun 2017, MMD 2,984 permohonan maklumat dan data iklim yang berdaftar, peningkatan sebanyak 17% berbanding tahun sebelumnya.

In 2017, MMD has received 2,984 registered application for climate information and data, an increment of 17% higher than previous year.

Kutipan fi yang direkodkan adalah sebanyak RM665,835 diperoleh hasil daripada penjualan data iklim kepada pelbagai sektor. Permintaan tertinggi masih lagi kekal dengan sektor perundangan 60%, sektor swasta 23%, sektor akademik 11% dan sektor kerajaan 6%.

A total fees collection of RM665,835 were collected from the sale of various sector climate data. The highest number came from the legal sector with a percentage of 60%, followed by private sector 23%, academic sector 11% and government sector 6%.
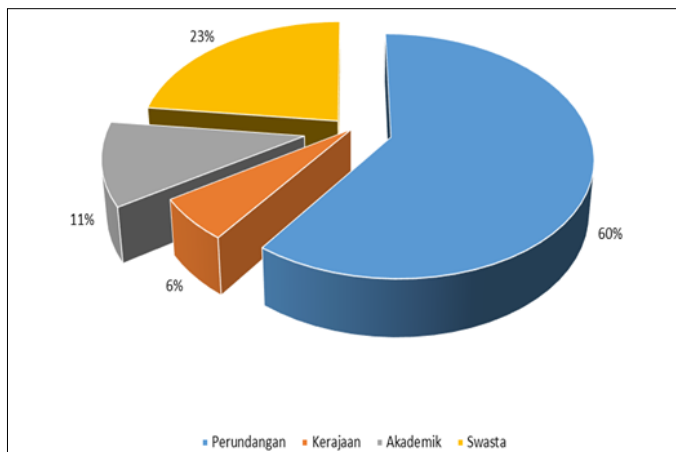
Permohonan maklumat dan data iklim yang diterima mengikut sektor pada 2017
Requests for climate information and data by sector in 2017

PERISTIWA BERKAITAN CUACA PADA TAHUN 2017
WEATHER RELATED EVENTS IN 2017

Kejadian belalai air di Jambatan Pulau Pinang
pada 28 Mac
Whirlwind in Penang Bridge on 28th of March

Banjir di Bandar Baru Sungai Buloh
pada 16 April
Flood in Bandar Baru Sungai Buloh
on 16th April

Kejadian ribut di plaza Tol Batu Tiga
Shah Alam pada 26 Oktober
Storm incident at the Plaza Tol Batu Tiga
Shah Alam on 26th of October

Kejadian banjir di Pulau Pinang pada 4-5 November
Flood in Pulau Pinang on 4th to 5th of November

Banjir kilat di Seremban pada 10 November
Flash flood in Seremban on 10th November

Banjir di Kota Bharu, Kelantan
pada 29 November
Flood in Kota Bharu, Kelantan
on 29th November

METEOROLOGI PENERBANGAN & PEJABAT METEOROLOGI NEGERI

AVIATION METEOROLOGY & STATE METEOROLOGICAL OFFICES

METEOROLOGI PENERBANGAN
AVIATION METEOROLOGY

Sepanjang tahun 2017, kesemua 43 kakitangan Pusat Meteorologi Penerbangan Nasional (PMPN) telah menghadiri pelbagai kursus, latihan dan pembelajaran kendiri di dalam dan luar negara.

In 2017, all 43 employees of National Aviation Meteorological Centre (NAMC) attended various courses, trainings and self-learning courses both locally and internationally.
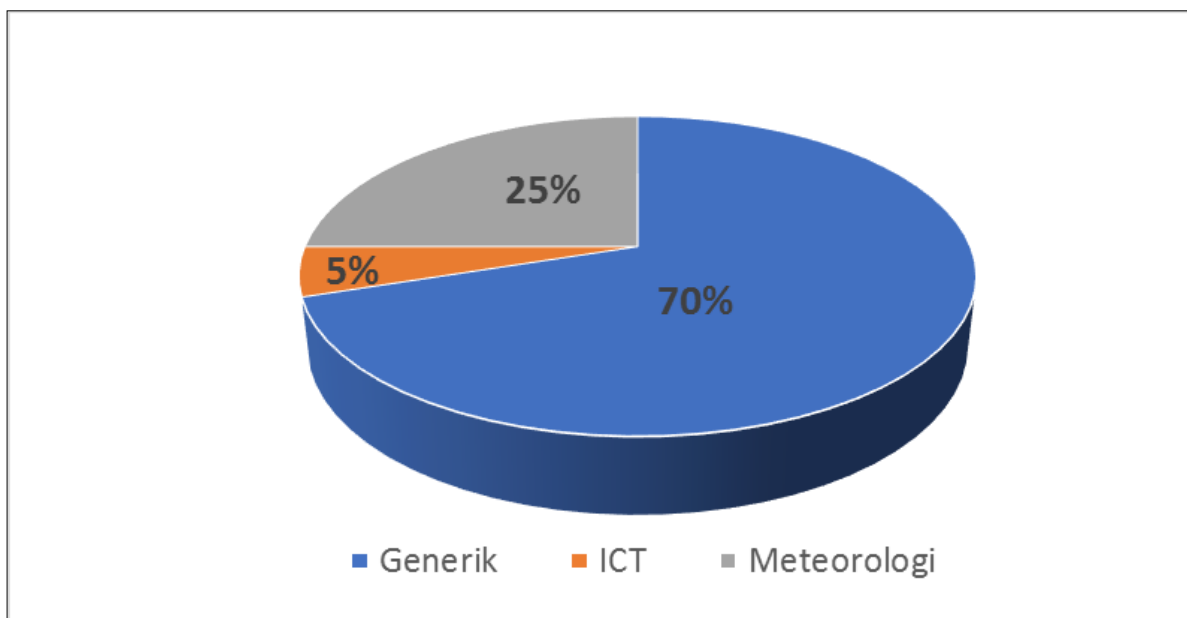
Kursus/latihan dan Pembelajaran Kendiri oleh PMPN bagi tahun 2017
Course/Training and Self-Learning Course of NAMC in 2017

PMPN telah menyertai *Pilot Project on the SIGMET Coordination in Southeast Asia* sejak 2016. Mesyuarat bulanan anjuran Meteorological Service Singapore (MSS) telah dilaksanakan secara atas talian dengan menggunakan aplikasi *Cisco WebEx Meeting*.

NAMC have participated in the Pilot Project on the SIGMET Coordination in Southeast Asia since 2016. Monthly meetings organized by the Meteorological Service Singapore (MSS) has been conducted online using the Cisco WebEx Meeting Application.

Pegawai-pegawai Meteorologi PMPN telah menyumbang dan berkongsi hasil penemuan dan pendapat mereka dengan agensi-agensi lain yang turut serta iaitu Hong Kong Observatory (HKO) dan Badan Meteorologi serta Klimatologi dan Geofizik Indonesia (BMKG). World Meteorological Organization (WMO) telah menganugerahkan PMPN sijil penyertaan.

NAMC Meteorological Officers contributed and shared their findings and opinions along with other participating agencies, namely Hong Kong Observatory (HKO) and Indonesian Agency for Meteorological, Climatological and Geophysics (BMKG). World Meteorological Organization (WMO) awarded NAMC a certificate for active participation.

Penganugerahan Sijil dari WMO
Award Certificate from WMO

Pada 8 November 2017, SIRIM QAS International Sdn Bhd telah menjalankan Audit Pemantauan untuk MS ISO 9001:2008 di PMPN. Ini merupakan audit terakhir untuk versi 9001:2008 kerana MMD dalam proses migrasi ke arah pensijilan MS ISO 9001:2015 menjelang 2018. Kesemua peluang penambahbaikan (OFI) dan rekod ketakakuran (NCR) telah diselesaikan pada 24 November 2017 .

On 8th of November 2017, SIRIM QAS International Sdn Bhd performed the Surveillance Audit for MS ISO 9001:2008 in NAMC. This would be the last audit for the 9001:2008 version as MMD is moving towards achieving the MS ISO 9001:2015 certification by 2018. All improvements (OFI) and nonconformity record (NCR) findings has been closed on 24th November 2017.

Lokasi 19 WRVR di lapangan terbang
19 WRVR location at the airport

PEJABAT METEOROLOGI NEGERI
STATE METEOROLOGICAL OFFICES

MMD melalui Pejabat Meteorologi Negeri bertanggungjawab memantau dan mengeluarkan tinjauan cuaca negeri masing-masing, menyebarkan nasihat/ amaran cuaca buruk, nasihat/ amaran angin kencang dan laut bergelora, maklumat gempa bumi, tsunami kepada orang awam, Pejabat Setiausaha Kerajaan Negeri, pejabat daerah dan agensi-agensi pengurusan bencana.

MMD through the State Meteorological Offices are responsible for monitoring and issuing weather forecasts for their respective states, disseminating advice/ warnings of severe weather, strong winds and rough seas, earthquakes and tsunami to the public, the State Secretary Office, district offices and disaster management agencies.

Pejabat Meteorologi Negeri juga adalah ahli jawatankuasa pengurusan bencana di peringkat negeri dan daerah.

The State Meteorological Offices are also members of disaster management committee at district and state levels.

Mesyuarat Pengurusan Bencana Daerah Kemumin, Kota Bharu di Pejabat Meteorologi Kelantan
Disaster Management Meeting of Kemumin District, Kota Bharu in Kelantan Meteorological Office

Pejabat Meteorologi Negeri juga berperanan menyelenggara peralatan yang terdapat di stesen-stesen meteorologi masing-masing.

The State Meteorological Offices are also responsible to maintain the equipment at their respective meteorological stations.

Kursus *Frontline Maintenance* dan Penyelenggaraan *Wind Runway Visual Range* (WRVR) telah diadakan pada 16 hingga 17 Februari 2017 di Pejabat Meteorologi (PM) Pahang bagi meningkatkan pemahaman dan pengetahuan tentang operasi dan penyelenggaraan sistem WRVR.

Frontline Maintenance and Visual Runway Visual Range (WRVR) Course was held from 16th to 17th of February 2017 at Pahang Meteorological Office (PM) to enhance understanding and knowledge of PM Pahang employees on the operation and maintenance of the WRVR system.

Alat Wind-RVR yang terdapat di Lapangan Terbang Kuantan
Wind-RVR instrument at Airport Kuantan

PENCERAPAN CUACA & RANGKAIAN PEMANTAUAN

WEATHER OBSERVATION & MONITORING NETWORK

PENCERAPAN CUACA & RANGKAIAN PEMANTAUAN
WEATHER OBSERVATION & MONITORING NETWORK

Operasi ramalan cuaca, amaran awal cuaca ekstrem dan pemantauan iklim memerlukan pencerapan meteorologi yang tepat dan menepati masa. Bagi memenuhi keperluan tersebut, MMD telah mengoperasikan rangkaian stesen meteorologi dan pencerapan iklim seperti berikut:

Weather forecast operation, early warning of extreme weather and climate monitoring requires accurate and timely meteorological observations. To meet this requirement, the MMD operates the following meteorological and climate observation network:

Rangkaian/ Network	Jumlah/ Total
Stesen Meteorologi Utama	42
Stesen Cuaca Auksiliari	380
Stesen Udara Atas	8
Radar Cuaca	12
Stesen Penerima Satelit Cuaca	5
Pencerapan Meteorologi Marin	4

Lokasi 42 Stesen Meteorologi Utama
Location of 42 Principal Meteorological Station

Keberkesanan MMD menjalankan aktiviti-aktiviti pemantauan cuaca membolehkan pengeluaran ramalan cuaca dan amaran cuaca buruk dengan lebih tepat dan cepat kepada agensi pengurusan bencana negara bagi merancang dan mengambil langkah-langkah menangani dan mengurangkan impak bencana ke atas negara.

The effectiveness of MMD conducting climate monitoring activities allows for more accurate and timely release of weather forecasts and weather alerts to disaster management agencies, to plan and implement measures that can address and mitigate the impact of disasters in the country.

Lokasi pencerapan marin
Location of marine observation

Sebahagian daripada stesen cuaca auksiliari
Some of the auxillary weather stations
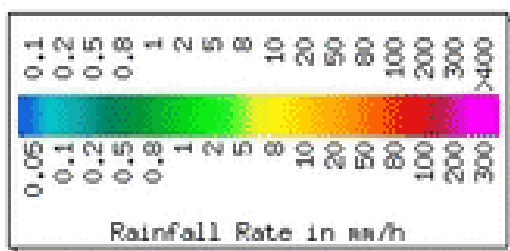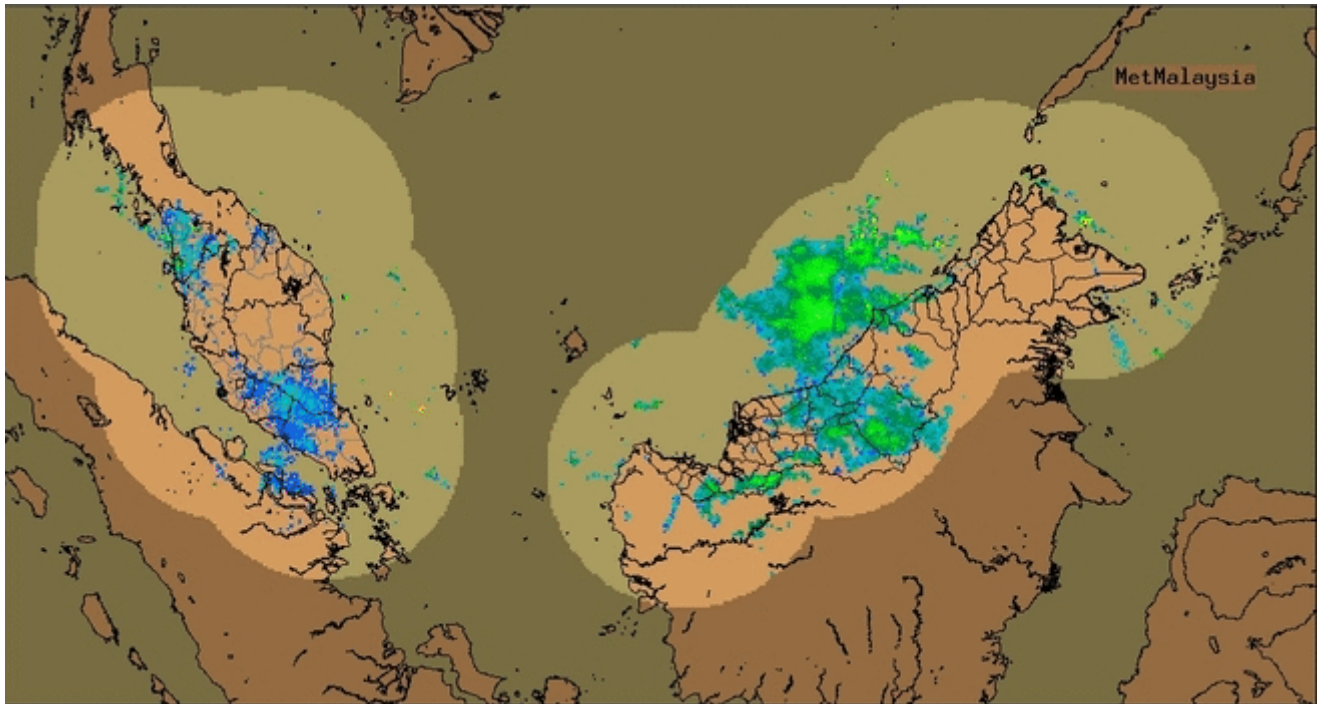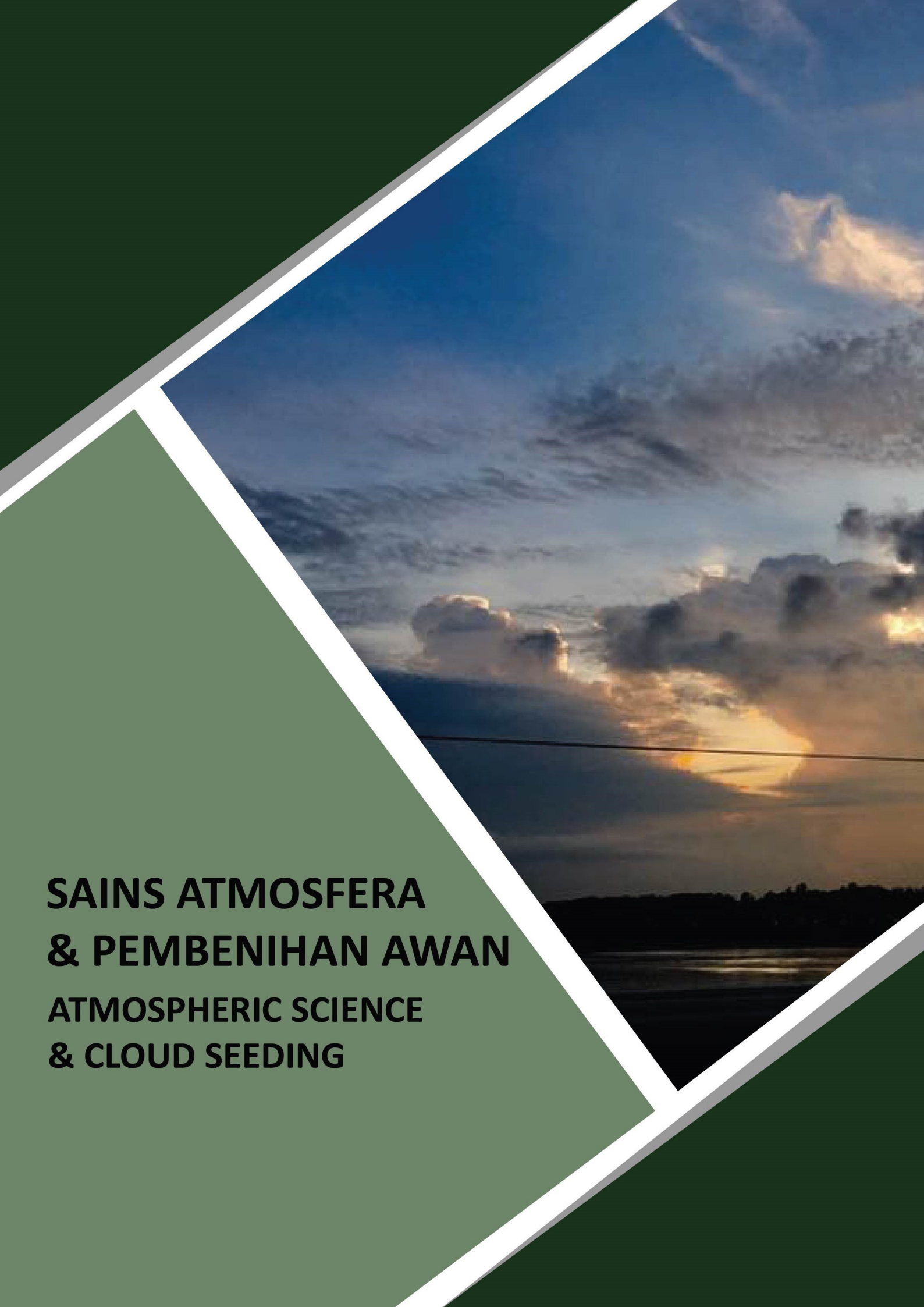
Liputan radar seluruh negara
Nationwide radar coverage
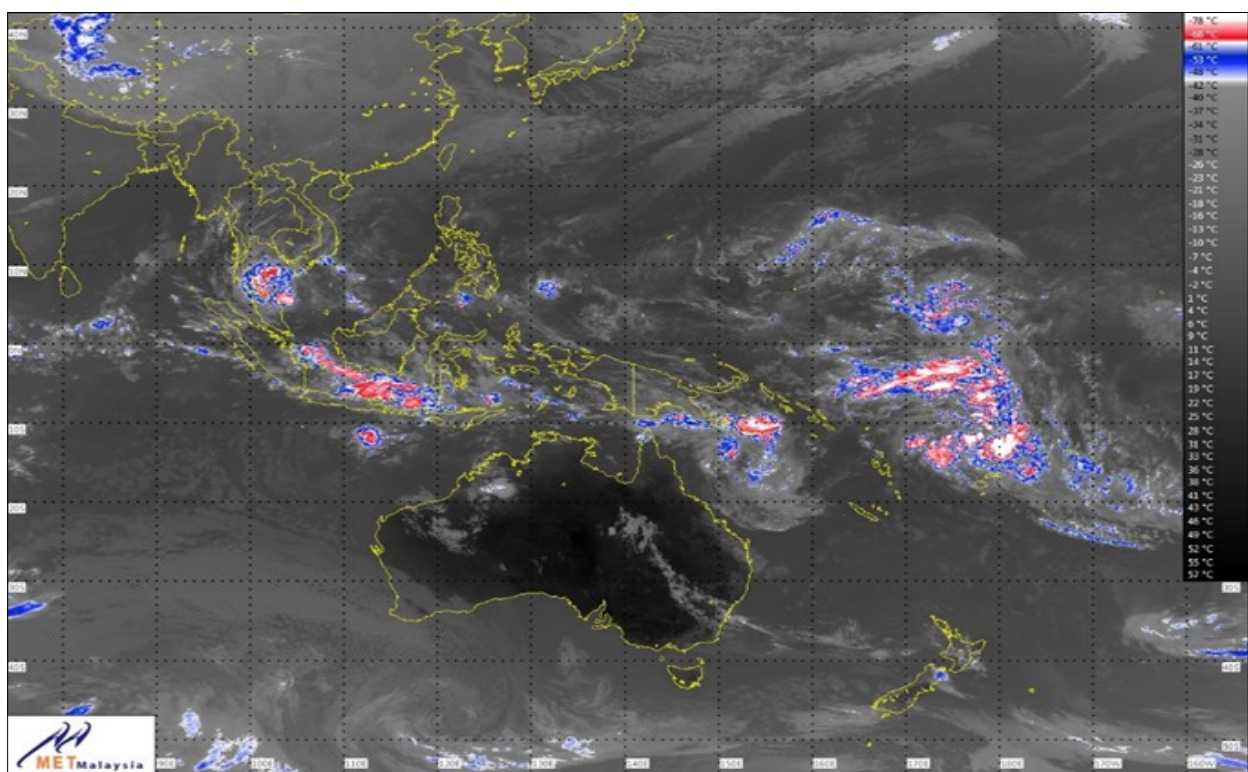
Pemantauan Satelit pada 16 Jun 2017
Satellite Observation on 16th June 2017

SAINS ATMOSFERA & PEMBENIHAN AWAN

ATMOSPHERIC SCIENCE & CLOUD SEEDING

SAINS ATMOSFERA

ATMOSPHERIC SCIENCE

MMD bertanggungjawab menjalankan pemantauan komposisi atmosfera dan kualiti udara di 26 buah stesen di seluruh negara. Empat daripadanya ialah Stesen Pemantauan Atmosfera Global (GAW), yang terletak di Petaling Jaya (serantau), Cameron Highlands (serantau), Lembah Danum (global) dan Stesen Penyelidikan Marin Bachok (serantau) iaitu sebuah stesen penyelidikan di Universiti Malaya, Kuala Lumpur.

MMD is responsible to monitor the atmospheric composition and air quality at 26 stations nationwide. Four of these stations are the Global Atmosphere Watch (GAW) stations namely in Petaling Jaya (regional), Cameron Highlands (regional), Danum Valley (global) and Bachok Marine Research Station (regional) which is a research station in University of Malaya, Kuala Lumpur.
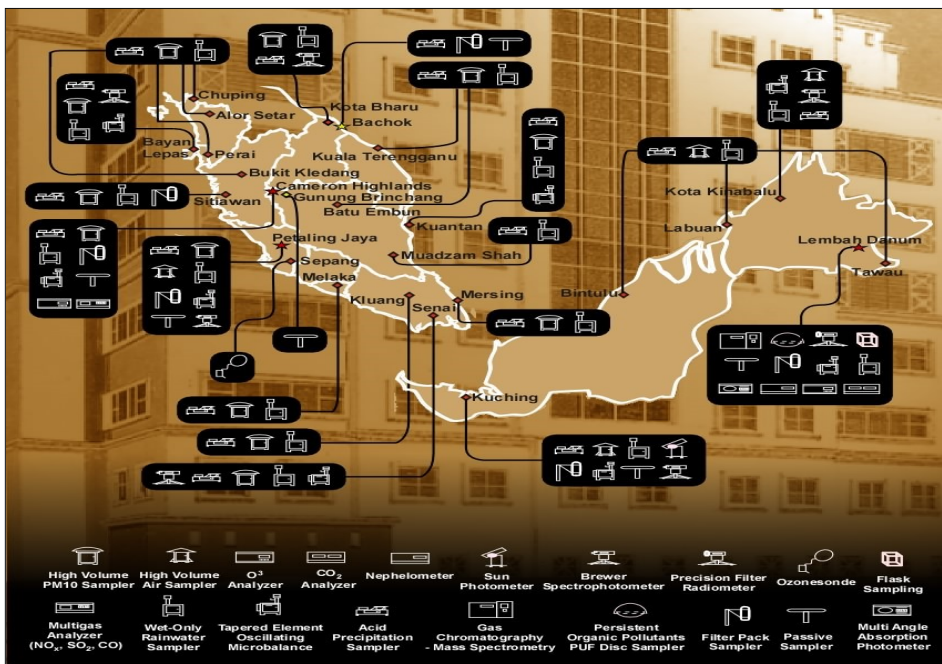
Rangkaian stesen pemonitoran komposisi atmosfera MMD
Atmospheric composition monitoring station network of MMD

Stesen GAW Cameron Highlands
Cameron Highlands GAW Station

Pemantauan sains atmosfera yang dijalankan adalah seperti komposisi kimia air hujan, gas reaktif, ozon, sinaran ultra ungu (UV), gas rumah kaca, *persistent organic pollutants* (POPs) dan aerosol.

The atmospheric science monitoring includes precipitation chemistry, reactive gases, ozone, UV radiation, greenhouse gases, persistent organic pollutants (POPs) and aerosol.

MMD juga telah memasang enam sistem Brewer Spectrophotometer MKIII di Bayan Lepas, Kota Bharu, Petaling Jaya, Senai, Sibu dan Kota Kinabalu dan membangunkan sistem pemusatan data bagi pemantauan ozon dan sinaran UV di Ibu Pejabat MMD, Petaling Jaya.

MMD has successfully installed six units of Brewer Spectrophotometers at Bayan Lepas, Kota Bharu, Petaling Jaya, Senai, Sibu and Kota Kinabalu besides developing a centralized data system to monitor the ozone and UV radiation in MMD Headquarters, Petaling Jaya.


Pemasangan sistem Brewer di Senai, Johor
Brewer system installation in Senai, Johor
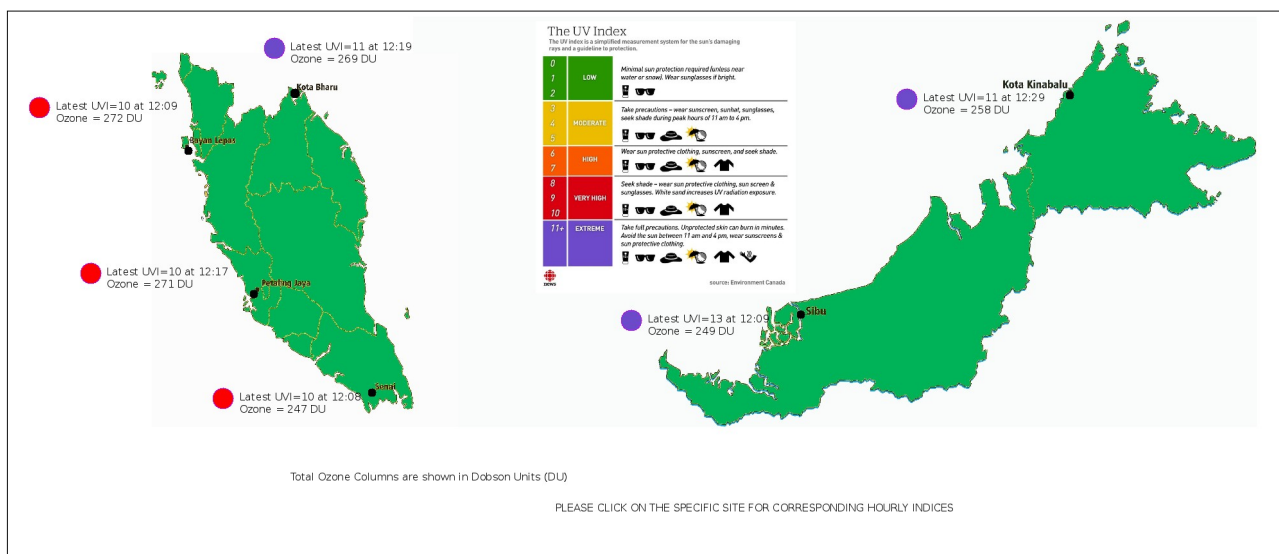
Rangkaian Stesen Sistem Brewer Spectrophotometer MMD
MMD's Brewer Spectrophotometer Station Network

Melalui sistem ini, Indeks UV (UVI) bagi keenam-enam bandar tersebut dipaparkan di laman web MMD pada hampir masa nyata untuk rujukan orang awam mengenai tahap dedahan sinaran UV di bandar-bandar tersebut.

Through this system, UV Index (UVI) for six cities is displayed on MMD website in near real time and public can obtain information about the level of UV radiation exposure in their cities.
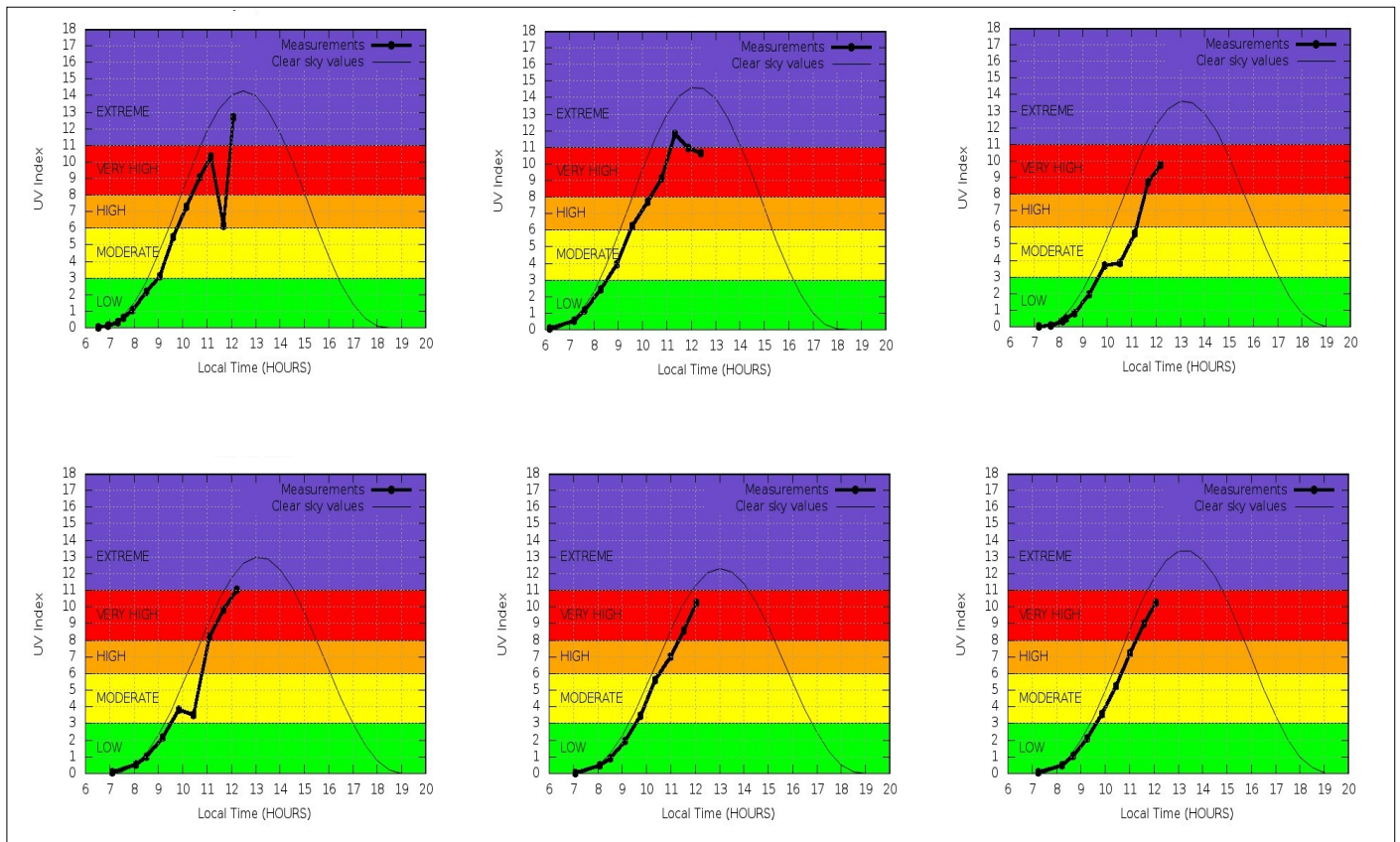
Indeks UV setiap jam yang dipapar pada hampir masa nyata di laman sesawang MMD
Near real-time hourly UV Index displayed in MMD's website

PEMBENIHAN AWAN
CLOUD SEEDING

Sepanjang tahun 2017, tiada permohonan untuk operasi pembenihan awan (OPA) diterima berikutan tiada masalah bekalan air yang tidak mencukupi dihadapi di kawasan tadahan dan empangan. Pada masa yang sama, negara kita tidak menghadapi fenomena jerebu yang teruk.

Manakala, Pejabat Meteorologi Bergerak telah menyertai 13 pameran dan program kesedaran awam yang berkaitan dengan cuaca ekstrem.

Throughout 2017, there was no requests for cloud seeding operations (OPA) as there was no water shortage issues reported in the water catchment areas and dams. At the same time, our country did not face any severe haze conditions.

Besides that, the Mobile Meteorological Office took part in 13 exibition and public awareness programmes related to exhibition weather.

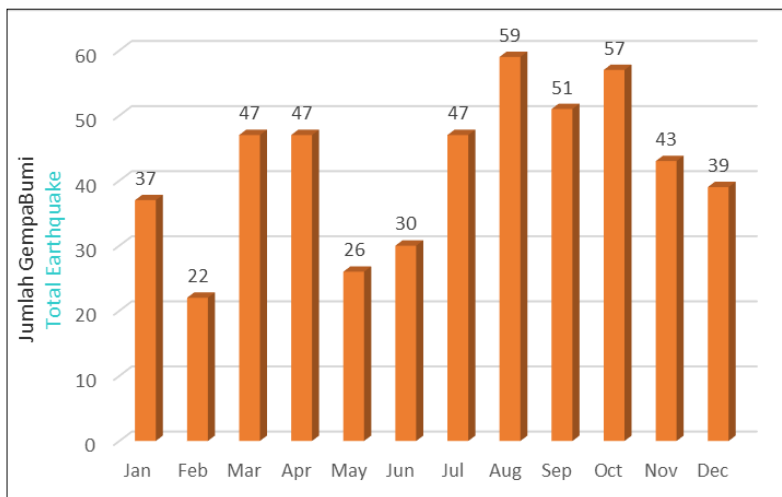

Pejabat Meteorologi Bergerak
Mobile Meteorological Office

GEMPA BUMI

EARTHQUAKE

GEMPA BUMI
EARTHQUAKE

Pada tahun 2017, MMD telah mengesan sebanyak 505 kejadian gempa bumi di seluruh dunia.

In 2017, MMD have detected a total of 505 earthquake incidences worldwide.

Bilangan gempa bumi yang dikesan pada tahun 2017
Total earthquake incidences detected in year 2017

Sebanyak 200 kejadian gempa bumi tempatan (magnitud kurang daripada 5.0 pada skala Richter) telah dikesan di 16 kawasan di Sabah. Ranau merekodkan jumlah tertinggi sebanyak 88 diikuti Semporna, 45 dan Lahad Datu, 33.

A total of 200 local earthquakes (less than 5.0 on the Richter scale) was detected in 16 areas in Sabah. Ranau recorded the highest number of 88, followed by Semporna, 45 and Lahad Datu, 33.

Kejadian gempa bumi magnitud tertinggi yang direkodkan adalah pada 26 Mac 2017 pada jam 9.30 pagi di Lahad Datu, Sabah dengan 4.2 pada skala Richter.

The highest magnitude incident occurred on 26th March 2017 in Lahad Datu, Sabah at 9.30am with a 4.2 magnitude earthquake.
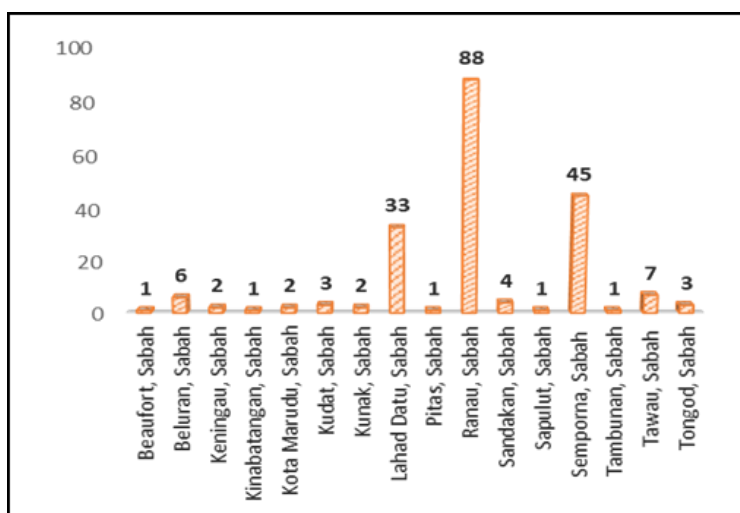
Bilangan gempa bumi tempatan yang dikesan pada tahun 2017
Total local earthquake incidences detected in year 2017

Pencapaian Petunjuk Prestasi Utama (KPI) bagi pengeluaran maklumat gempa bumi dalam tempoh 8 minit kepada agensi pengurusan bencana dan orang awam adalah 90.1%.

Sekiranya gempa bumi besar bermagnitud 6 atau lebih pada skala Richter dan gempa bumi, magnitud 3 atau lebih pada skala Richter berlaku di dalam negara atau gegarannya boleh dirasai orang awam, maka siaran media dan makluman di TV melalui *crawlers* serta makluman di sosial media Facebook dan Twitter jabatan akan dibuat.

Sebanyak 13 laporan gegaran dirasai yang berpunca daripada gempa bumi tempatan manakala sebanyak tujuh laporan gegaran diterima bagi gempa bumi luar yang telah dirasai.

The department achieved a Key Performance Indicator (KPI) of 90.1% for the release of earthquake information within 8 minutes to the disaster management agency and the public.

If major earthquake with a magnitude of 6 or more on the Richter scale, magnitude of 3 or more in the country or tremors can be felt by the public, then a media release, information through TV crawlers and departments social media pages (Facebook and Twitter) will be disseminated.

A total of 13 reports of tremors felt due to local earthquake and seven tremors felt due to earthquake out of the country were received.
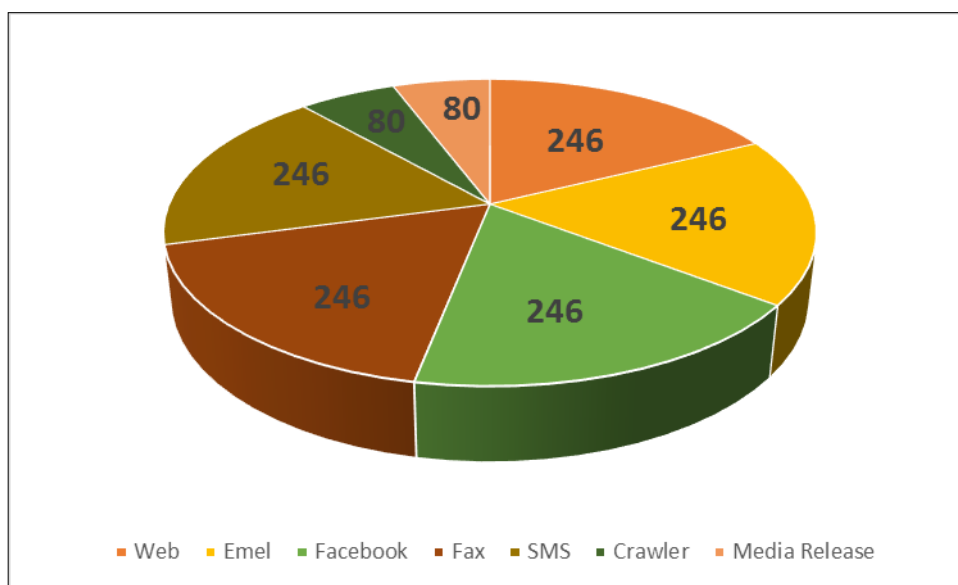
Hebahan maklumat gempa bumi melalui pelbagai medium
Dissemination of earthquake information using various mediums

Pada tahun 2017, sebanyak 160 siaran media dan TV *crawler* telah dikeluarkan. Pencapaian KPI untuk penghantaran siaran media dan *crawler* yang mematuhi masa penghantaran dalam 30 minit adalah 98.2%.

In 2017, a total of 160 media releases and TV crawlers were released. The department achieved a KPI of 98.2% for time compliant of 30-minutes in disseminating information to the media and TV crawlers.

RANGKAIAN PEMANTAUAN GEMPA BUMI DAN TSUNAMI

## EARTHQUAKE AND TSUNAMI MONITORING NETWORKS

MMD telah mengoperasikan rangkaian pemantauan gempa bumi dan tsunami bagi mengeluarkan maklumat gempa bumi dan tsunami terkini untuk agensi pengurusan bencana, orang awam dan media. Rangkaian tersebut terdiri daripada:

MMD operates the earthquake and tsunami monitoring networks to provide timely information on earthquake and tsunami for disaster management agencies, public and media. The network consists of:

Rangkaian/ Network	Jumlah/ Total
Stesen Seismik Seismic Station	77
Stesen Tolok Pasang Surut Tide Gauge Station	17
Sistem Kamera Pantai Coastal Camera System	18
Sistem Siren Tsunami Tsunami Siren System	53
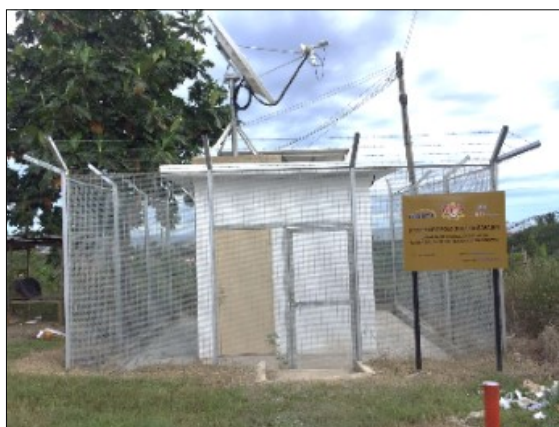
Stesen Seismik
Seismic Station
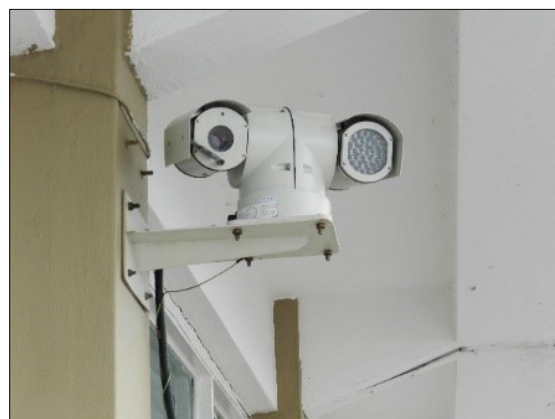
Sistem Kamera Pantai
Coastal Camera System

Sistem Siren Tsunami
Tsunami Siren System

Stesen Tolok Pasang Surut
Tide Gauge Station

PENYELIDIKAN & PEMBANGUNAN TEKNIKAL

RESEARCH & TECHNICAL DEVELOPMENT

PROJEK DI PERINGKAT ANTARABANGSA

MMD telah mengendalikan beberapa projek di peringkat antarabangsa iaitu:

a) *Southeast Asia Climate Downscaling (SEACLID) Project* di bawah *Asia Pasific Network for Global Change Research (*APN). Penurunan skala data unjuran iklim sehingga tahun 2100 akan dilaksanakan oleh MMD dengan menggunakan Sistem Komputer Berprestasi Tinggi.

PROJECT AT INTERNATIONAL LEVEL

MMD have conducted several projects at the international level:

a) Southeast Asia Climate Downscaling (SEACLID) Project under Asia Pacific Network for Global Change Research (APN). The reduction in data scaling for climate projection until year 2100 will be carried out by MMD using the High Performing Computing System.
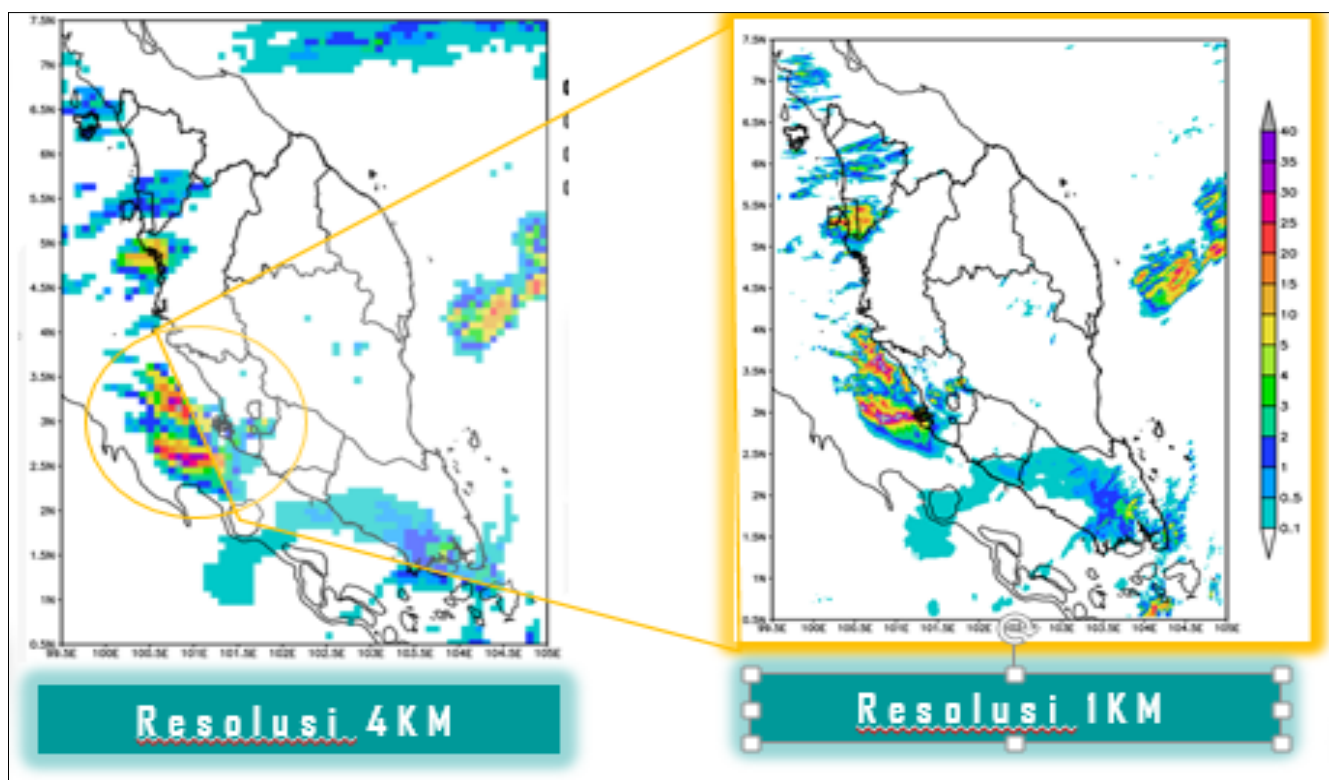
Unjuran suhu maksimum di bawah Projek SEACAM
Maximum tempature projection under the SEACAM Project

b) Kerjasama dengan *South East Asia Disaster Prevention Initiative* - Universiti Kebangsaan Malaysia (SEADPRI-UKM); Fakulti Geologi, Universiti Malaya; Jabatan Mineral dan Geosains dan *University of Cambridge* di bawah Projek *Newton-Ungku Omar Disaster Resilient Cities: Forecasting Local Level Climate Extremes and Physical Hazards for Kuala Lumpur*.

b) Cooperation with South East Asia Disaster Prevention Initiative-Universiti Kebangsaan Malaysia (SEADPRI-UKM); Faculty of Geology, University of Malaya, Mineral and Geoscience Department and University of Cambridge under the Newton-Ungku Omar Project Disaster Resilient Cities: Forecasting Local Level Climate Extremes and Physical Hazards for Kuala Lumpur.

c) Kerjasama dengan *UK Met Office* (UKMO) di bawah program *Weather and Climate Science Service Partnership* (WCSSP).

c) Co-operation with the UK Met Office (UKMO) under the Weather and Climate Science Service Partnership (WCSSP) programme.

d) Kerjasama dengan Universiti Washington, Amerika Syarikat dalam Projek *Year of Maritime Continent* (YMC) bertajuk *Maritime Continent Convective Heartbeat Diurnal Cycle for Global Weather* (MC-CARDIO).

d) Collaboration with University of Washington, United States of America in Year of Maritime Continent (YMC) Project called Maritime Continent Convective Heartbeat Diurnal Cycle for Global Weather (MC-CARDIO).
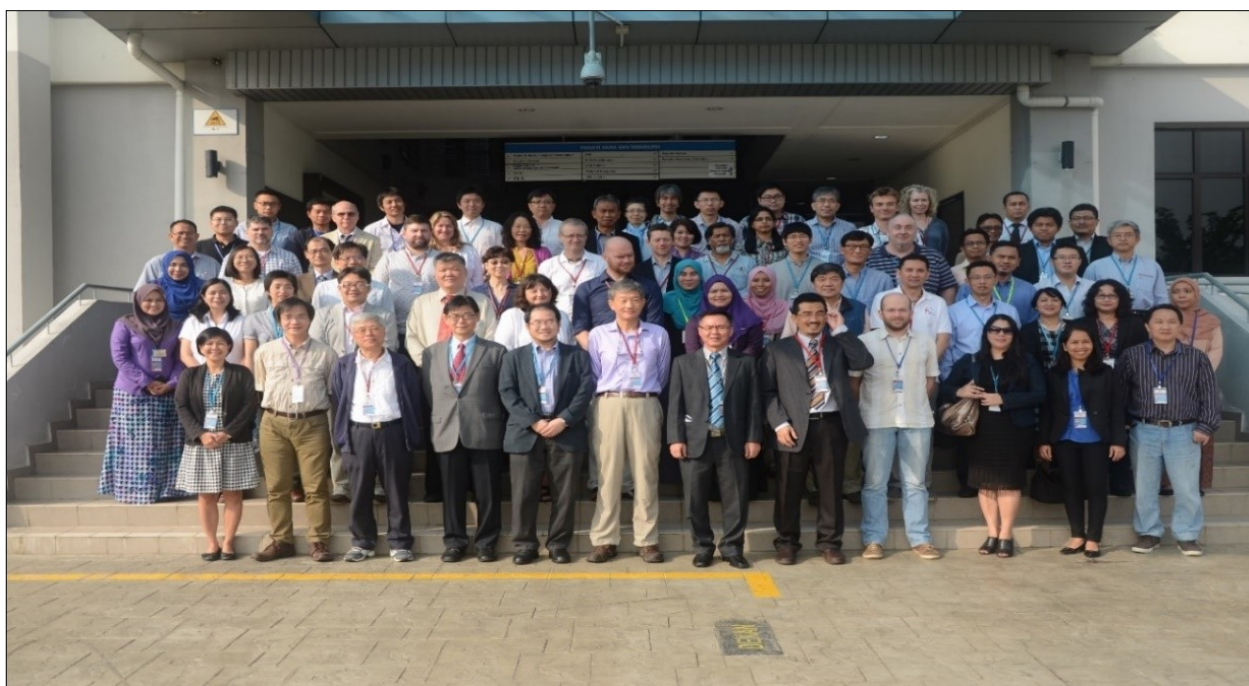
PROJEK DI PERINGKAT KEBANGSAAN

MMD juga melaksanakan beberapa projek di peringkat kebangsaan iaitu:

a) Penggunaan model WRF-CHEM untuk meningkatkan ketepatan model ramalan cuaca numerikal yang dioperasi oleh MMD di bawah projek Jawatankuasa antara agensi bagi melaksanakan Kajian Komprehensif untuk Ramalan Cuaca Ekstrem dan Banjir.

PROJECT AT NATIONAL LEVEL

MMD also implemented several projects at the national level:

a) The use of the WRF-CHEM model to improve the accuracy of the numerical weather forecast model operated by MMD under the inter-agency committee project to implement a comprehensive research of Extreme Weather Forecast and Flood.
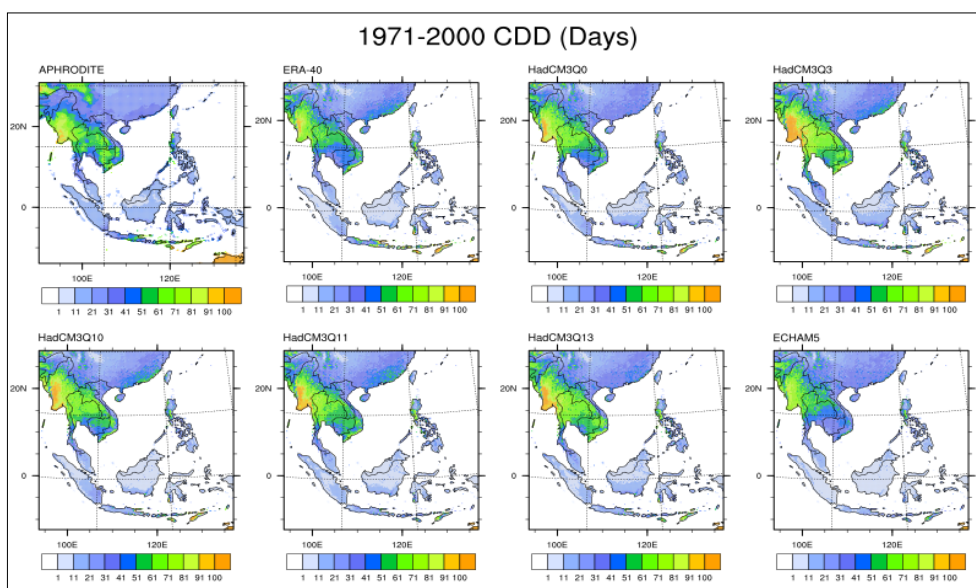
Model cuaca MMD-WRF resolusi 1km
MMD-WRF weather model with 1km resolution

b) Peningkatan keupayaan ketepatan model ramalan cuaca numerikal (NWP) yang dioperasi oleh MMD melalui asimilasi data *Global Positioning System* (GPS) *Integrated Water Vapour* (IWV) di bawah projek Jawatankuasa antara Agensi bagi melaksanakan Kajian Komprehensif untuk Ramalan Cuaca Ekstrem dan Banjir.

b) Improved capability of numerical weather forecast (NWP) model operated by MMD through data assimilation of Global Positioning System (GPS) Integrated Water Vapour (IWV) under the inter-agency committees project to implement a Comprehensive Research for Extreme Weather Forecast and Flood.

Siri Mesyuarat Projek Komponen Peningkatan Model Cuaca
Series of Weather Model Improvement Component Project Meeting

c) *Disasters and Climate Extreme - An Integrated Research Framework for Malaysia* di bawah program kerjasama MOSTI dan SEADPRI-UKM. MMD terlibat untuk melaksanakan sub-projek bertajuk *Variability and Climate Extremes over Malaysia.*

c) Disasters and Climate Extreme - An Integrated Research Framework for Malaysia under the cooperation program of MOSTI and SEADPRI-UKM. MMD was involved in implementing a sub-project entitled Variability and Climate Extremes over Malaysia.

d) Sebagai peneraju Kumpulan Kerja Teknikal Penyelidikan dan Pencerapan Sistematik, *Third National Communication dan Biennial Update Report, United Nations Framework Convention on Climate Change* (UNFCCC).

d) As the leading agency in Research and Systematic Observation Technical Working Group, Third National Communication and Biennial Update Report, United Nations Framework Convention on Climate Change (UNFCCC).

Sesi perbincangan Kumpulan Kerja (Working group discussion session)
Research and Systematic Observation Technical Working Group

e) Kerjasama dengan Lembaga Urus Air Selangor (LUAS) dalam projek *Development of a Decision Support System (DSS) for Sustainable Water Resources Management System for Sungai Selangor.*

e) Collaboration with Lembaga Urus Air Selangor (LUAS) in Development of a Decision Support System (DSS) for Sustainable Water Resources Management System for Sungai Selangor Project.

f) Kerjasama dengan *Institute of Ocean and Earth Sciences* (IOES), Universiti Malaya di bawah Projek Simulasi WRF untuk kegunaan Model Hidrologi.

f) Collaboration with Institute of Ocean and Earth Sciences (IOES), Universiti Malaya under the WRF Simulation Project for the use of Hydrological Models.

g) Kerjasama dengan Institut Penyelidikan Perubatan (IMR) untuk kajian *Assessing Effects of Climatic Factors on Dengue Incidence in Malaysia*.

g) Collaboration with the Institute for Medical Research (IMR) for Assessing Effects of Climatic Factors on Dengue Incidence in Malaysia research.
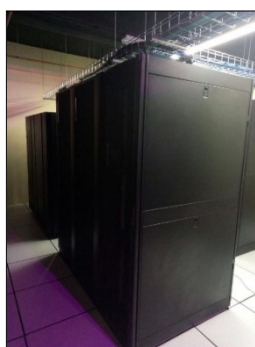
Penempatan Sistem Komputeran Berprestasi Tinggi di PDSA
Installation of High Perfomance Computer System

Kerjasama dengan Jabatan Pengairan dan Saliran (JPS) untuk:
Collaboration with Department of Irrigation and Drainage (DID) for:

i)   National Flood Prevention and Warning Program (Phase 2)

ii)   National Water Balance Management System (NAWABs) for Sungai Muda Basin.

iii)   The Development of Integrated Flood Forecasting and River Monitoring (iFFRM) with Warning System for Sungai Kedah River Basin

iv)   The Development of National Flood Foreca

v)   The Development of National Flood Forecasting and Warning System for Terengganu River Basin (NaFFWS Sungai Terengganu)

vi)   The Development of National Flood Forecasting and Warning System for Pahang River Basin (NaFFWS Sungai Pahang)

vii)   Debris and Mudflow Warning System (DMFS) for Cameron Highlands (DMFWS Phase 2B)

Mesyuarat kumpulan tematik meteorologi mengenai ramalan cuaca ekstrem
Meteorological thematic group meeting on predictability of extreme weather

PROJEK KAJIAN DI BAWAH DANA SAINS

MMD juga telah melaksanakan projek kajian di bawah eScienceFund dengan peruntukan Dana MOSTI berjumlah RM 383,667.66.

Projek *Study of Effectiveness Commonly Used Rainfall Measuring Instruments in Measuring Rainfall Intensity in Malaysia* bertujuan untuk membuat perbandingan keupayaan peralatan dalam pengukuran hujan di antara tiga peralatan iaitu *OTT Laser Distrometer (OTT), Theis Laser Distrometer (Thies)* dan *Vaisala Weather Transmitter (VXT)* dengan tipping bucket rain gauge yang dijadikan rujukan utama dalam kajian ini.

Kajian ini dibuat dengan menggunakan data hujan yang terkumpul bermula dari bulan Januari hingga Julai 2017 pada lima lokasi yang berbeza di Pejabat Meteorologi Utama yang terletak di Semenanjung seperti berikut:
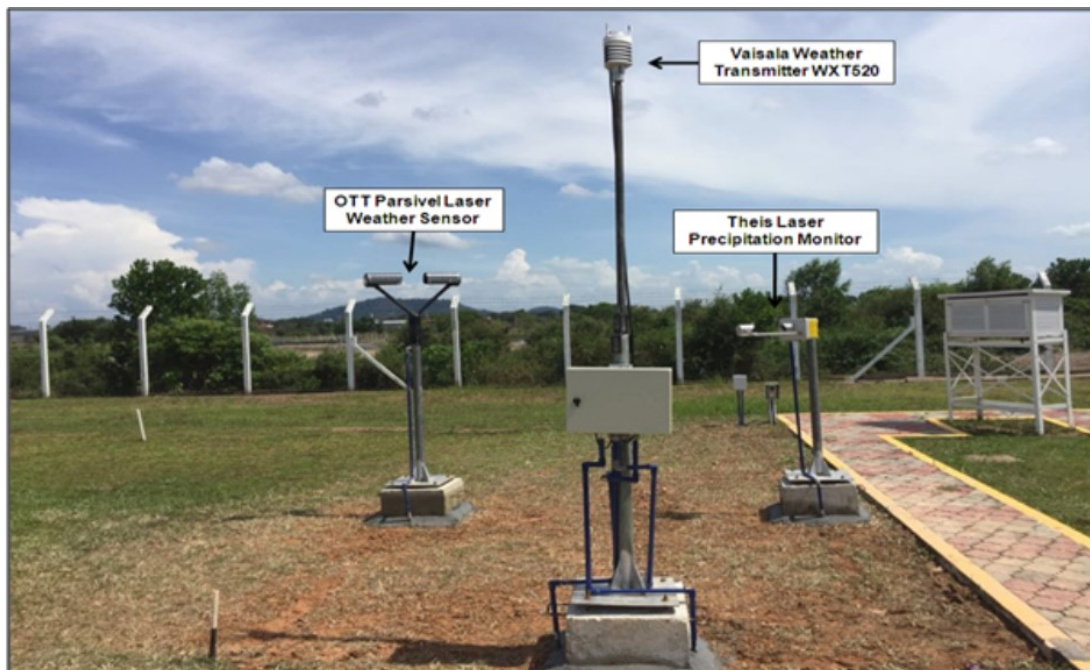
RESEARCH PROJECT UNDER eSCIENCEFUND

MMD has also conducted a research project under eScienceFund using allocations from MOSTI Fund totalling RM 383,667.66.

The Study of effectiveness commonly used rainfall measuring instruments in measuring rainfall intensity in Malaysia project is aimed at comparing equipment capabilities in measuring rain between three equipment namely OTT Laser Distrometer (OTT), Theis Laser Distrometer (Thies) and Vaisala Weather Transmitter (VXT) with a tipping bucket rain gauge which is the main reference of this study.

The research is done using the rainfall data of five different locations from January to July 2017 at the Main Meteorological Offices located in the Peninsula as follows:

Pejabat/ Office	Latitud	Longitud	Pemasangan Peralatan Equipment Installation			
			Tipping Bucket	Thies Laser Disdrometer (Thies)	OTT Laser Disdrometer (OTT)	Vaisala Weather Transmitter (VXT)
Kota Bharu	6.17° N	102.28° E	√		√	√
Sitiawan	4.22° N	100.70° E	√		√	
Subang	3.12° N	101.55° E	√	√		
Melaka	2.27° N	102.25° E	√	√	√	√
Mersing	2.45° N	103.84° E	√	√		

OTT Parsivel Laser Weather, Theis Laser Precipitation Monitor dan Vaisala Weather (VXT) di Pejabat Meteorologi Melaka (at Melaka Meteorological Office)

Kajian ini juga telah dibentangkan pegawai MMD di International Conference on Automatic Weather Station (ICAWS-2017) yang bertempat di Offenbach am Main, Jerman pada 24 -26 Oktober 2017.

The research was also presented by MMD officer at the International Conference on Automatic Weather Station (ICAWS-2017) held at Offenbach am Main, Germany on 24th -26th October 2017.

PENYELIDIKAN

RESEARCH

Lima kertas penyelidikan telah dihasilkan dan diterbitkan di bawah Perpustakaan Negara Malaysia (PNM). Kertas-kertas penyelidikan ini tertumpu kepada beberapa bidang termasuk trend iklim dan monsun, penggunaan teori statistik serta aplikasi radar untuk pemantauan cuaca di Malaysia.

Five research paper were completed and published under the National Library of Malaysia (PNM). These research papers covered various field including monsoon and climate trend, statistical theory and radar application in weather monitoring in Malaysia.

Senarai kertas penyelidikan tersebut adalah:

List of the research papers are as stated below:

Bil.	Tajuk/ Title
1.	Analysis of the Northeast Monsoon 2016/2017
2.	Determination of Z-R Relationship and Inundation Analysis for Kuantan River Basin
3.	The Impact of Explicit Convection on The Asian Monsoon and The Indian
4.	Ocean Wet Bias Influence of Winter Monsoon on Cloud Thermodynamic Phase Over Central and South-East Asia
5.	Pengelompokan Corak Taburan Hujan Dengan Kaedah Pengelompokan Siri Masa

Selain daripada kertas-kertas penyelidikan yang telah diterbitkan dalam jurnal PNM, beberapa kertas penyelidikan oleh pegawai MMD juga telah diterbitkan dalam jurnal antarabangsa. Senarai kertas penyelidikan tersebut adalah seperti berikut:

Other than published in PNM journal, some of the research papers by MMD officers are published at international journal. These papers are as listed at table below:

Bil.	Tajuk	Jurnal Antarabangsa & Tarikh
1.	*Characteristics of precipitation extremes in Malaysia associated with El Niño and La Niña events*	*International Journal of Climatology* diterbitkan pada 17 Mac 2017 *(published on 17 March 2017)*
2.	*Maritime Continent seasonal climate biases in AMIP experiments of the CMIP5 multimodel ensemble*	*Climate Dynamics* diterbitkan pada April 2017 *(published on April 2017)*
3.	*Extreme rainstorms that caused devastating flood over the east coast of Peninsular Malaysia during November and December 2014*	*Weather and Forecasting* diterbitkan pada Jun 2017 *(published on June 2017)*
4.	*Impact of temporal resolution of precipitation forcing data on modelled urban-atmosphere exchanges and surface conditions*	*International Journal of Climatology* diterbitkan pada 18 Julai 2017 *(published on 18 July 2017)*
5.	*Investigating the mechanisms of diurnal rainfall variability over Peninsular Malaysia using the non-hydrostatic regional climate model*	*Meteorology and Atmospheric Physics;* diterbitkan pada Julai 2017 *(published on July 2017)*
6.	*The Influence of El Niño–Southern Oscillation on boreal winter rainfall over Peninsular Malaysia*	*Theoretical and Applied Climatology;* diterbitkan pada September 2017 *(published on September 2017)*

MALAYSIAN METEOROLOGICAL DEPARTMENT (MMD)
MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATION (MOSTI)

Research Publication No.1/2017

ANALYSIS OF THE NORTHEAST MONSOON 2016/2017

Fadila Jasmin Fakaruddin, Yip Weng Sang, Mat Kamaruzaman Mat Adam, Nursalleh K Chang and Muhammad Helmi Abdullah

MALAYSIAN METEOROLOGICAL DEPARTMENT (MMD)
MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATION (MOSTI)

Research Publication No. 2/2017

Determination of Z-R Relationship and Inundation Analysis for Kuantan River Basin

Fauziana Ahmad, Tomoki Ushiyama and Takahiro Sayama

Kertas Penyelidikan
Research Publication

AKTIVITI ANTARABANGSA

INTERNATIONAL ACTIVITIES

AKTIVITI ANTARABANGSA DI LUAR NEGARA
INTERNATIONAL ACTIVITIES ABROAD

Seramai 72 orang pegawai telah menyertai pelbagai aktiviti di luar negara, antaranya mesyuarat di luar negara anjuran agensi atau badan pertubuhan antarabangsa, bengkel, persidangan, kursus, symposium dan forum.

Bagi tahun 2017, mesyuarat di luar negara mencatatkan bilangan penyertaan yang paling tinggi iaitu sebanyak 34 penyertaan manakala kursus mencatatkan bilangan penyertaan yang paling rendah iaitu satu penyertaan sahaja.

A total of 72 officers participated in various activities abroad, including meetings organized by agencies or bodies of international organizations, workshops, conferences, courses, symposiums and forums.

For the year 2017, overseas meetings recorded the highest participation rate of 34 entries while the course recorded the lowest participation of one entry only.
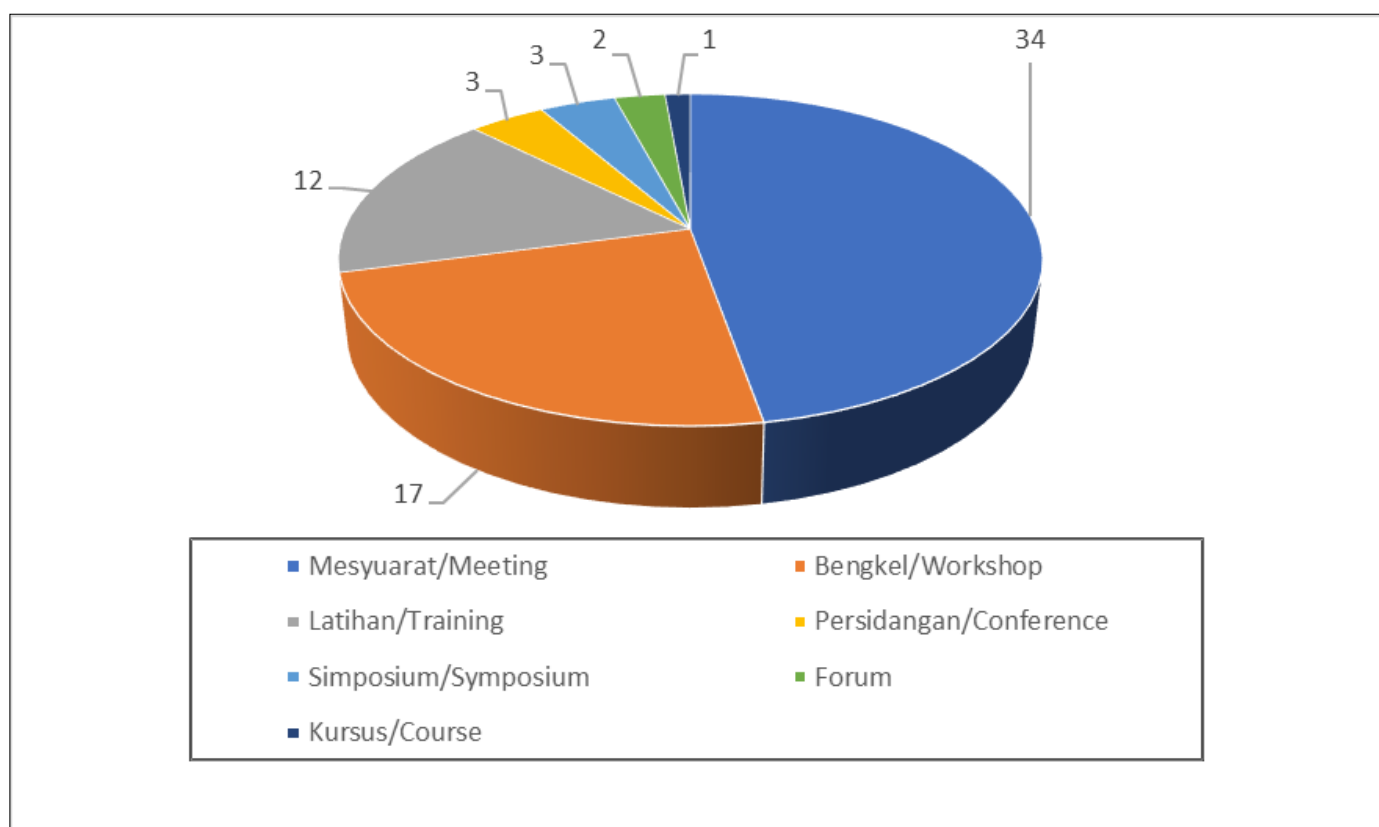
Manakala, bengkel mencatatkan sebanyak 17 penyertaan, diikuti oleh latihan sebanyak 12 penyertaan. Persidangan dan simposium masing-masing mencatatkan tiga penyertaan dan forum mencatatkan dua penyertaan.

Meanwhile, workshops recorded 17 entries, followed by training sessions 12 entries. Conferences and symposium each recorded three entries and forum recorded two entries.

SENARAI AKTIVITI ANTARABANGSA DI LUAR NEGARA

LIST OF INTERNATIONAL ACTIVITIES ABROAD

NO	TARIKH DATE	PERKARA DETAIL	TEMPAT VENUE
1.	11-13/01	The 9th GEOSS Asia-Pacific Symposium	Tokyo, Japan
2.	06-10/02	Asia-Pacific Network or Global Change Research (APN), Low Carbon Asia Research Network (LoCARNet) and Asian Institute of Technology/Regional Research Center for Asia and the Pacific (AIT/RRC.AP) Capacity Building Workshop and Science Policy Dialogue on Climate Change: Low Carbon and Adaptation Initiatives in Asia 9th Southeast Asian Sub-Regional Cooperation Meeting (SEA-SRC) of the Asia-Pacific Network for Global Change Research (APN)	Bangkok, Thailand
3.	21/02-24/02	49th Session of the ESCAP/WMO Typhoon Committee	Tokyo, Japan
4.	27-28/02	2nd Task Force Meeting: Future Development of Asia-Pacific Network for Global Change Research (APN)	Kobe, Japan
5.	27/02-03/03	First Training Workshop on Subseasonal to Seasonal Predictions for Southeast Asia (S2S-SEA 1)	Singapore
6.	01-17/03	Sixth Meeting of the ICG/PTWS Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea Region (ICG/PTWS-WG/SCS-VI)	Shanghai, China
7.	06-08/03	ASEAN Next 2017 - Workshop on Establishing ASEAN Hydro informatics & Climate Change Data Center (AHC)	Bangkok, Thailand
8.	13-24/03	Pembangunan Bersama Produk Himawari 8/9 dengan Pakar Satelit Japan Meteorological Agency	Tokyo, Japan
9.	14-16/03	Task Team Meeting for Development of Tc Forecast Competency in the Typhoon Committee Region	Guam, USA
10.	20-24/03	Fifteenth Meeting of the Asia/Pacific Meteorological Information Exchange Working Group (MET/IE WG/15) and Seventh Meeting of The Asia/Pacific Meteorological Services Working Group (MET/S WG/7)	Bangkok, Thailand
11.	27/03-29/03	SIGMET Coordination Meeting in Southeast Asia	Singapore
12.	28-30/03	The 10th Meeting of the Ozone Research Managers of the Parties to the Vienna Convention	Geneva, Switzerland
13.	28-31/03	Twenty Seventh Session of the Governmental Coordination Group for the Pacific Tsunami Warning & Mitigation System (ICG/PTWS-XXVII)	Tahiti, France
14.	10-13/04	GAW 2017 Symposium	Geneva, Switzerland
15.	12-13/04	First Southern China Monsoon Rainfall Experiment (SCMREX)	Beijing, China

NO	TARIKH DATE	PERKARA DETAIL	TEMPAT VENUE
16.	13-21/04	NOAA-USAID-WMO Ninth International Training Workshop Climate Variability and Predictions (9ITWCVP)	Pune, India
17.	30/04-13/05	32nd Global Atmosphere Watch Training and Education Centre (GAWTEC) Training Course	Germany
18.	02-04/05	2017 APEC Typhoon Symposium – The Challenges and Opportunities for Typhoon and Flood Forecasting	Chinese Taipei
19.	03-05/05	39th Session of ASEAN Sub-Committee on Meteorology and Geophysics (SCMG)	Manila, Philippines
20.	04/05	Social Infrastructure with Wireless Technology Exhibition and Seminar	Bangkok, Thailand
21.	10/05-11/05	International Panel for the Director General of Islamic Countries	Istanbul, Turkey
22.	15-19/05	Sixth Meeting of The Asia/Pacific Meteorological Requirements Working Group (MET/R WG/6)

The Meteorology Air Traffic Management (MET/ATM) Seminar | Fukuoka, Japan |
23.	29/05-01/06	Twenty-First Meeting of the Meteorological Sub – Group (MET SG/21) of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG)	Bangkok, Thailand
24.	05-16/06	International Training Course on the Application of Meteorological Satellite Products	Beijing, China
25.	07-09/06	APCC Training Workshop for the Climate Information Toolkit (CLIK)	Bangkok, Thailand
26.	12-23/06	International Training Course on Weather Radar Operation	Seoul, Korea
27.	03-14/07	Short Course on Weather Forecasting Using Numerical Weather Prediction Models	Ahmedabad, India
28.	10-12/07	First Steering Committee Meeting of the Southeastern Asia-Oceania Region Flash Flood Guidance Project	Jakarta, Indonesia
29.	24-28/07	Mesyuarat Kumpulan Meteorologi Projek Newton-Ungku Omar (NUO) dengan University of Cambridge dan UK MET Office: Disaster Resilient Cities: Forecasting Local Level Climate Extremes and Physical Hazards for Kuala Lumpur	United Kingdom
30.	25-26/07	China Cool City Liupanshui Forum- Better Climate, Health and Tourist Resources	China
31.	11-12/08	Working Group on Weather Services (WG-WXS) Meeting	Honiara, Solomon Islands
32.	21-26/08	Program on User - Oriented Statistical Downscaling of Climate Information in Agriculture and Water Resources	Busan, Korea
33.	24-25/08	18th Senior Technical Managers' Meeting of the Acid Deposition Monitoring Network in East Asia (STM18)	Ha Long City, Vietnam
34.	27-31/08	19th WMO/IAEA Meeting on Carbon Dioxide, Other Greenhouse Gases and Related Measurement Techiques (GGMT-2017)	Duebendorf, Switzerland

NO	TARIKH DATE	PERKARA DETAIL	TEMPAT VENUE
35.	04-09/09	16th WMO-GAW Brewer Operator Course – Asia/Pacific	Sydney, Australia
36.	04-17/09	Research Fellowship of Working Group on Disaster Risk Reduction (WGDRR) Project	Shanghai, China
37.	18-20/09	Tenth GEOSS Asia-Pacific Symposium	Hanoi, Vietnam
38.	02-05/10	IBL User Group Meeting 2017	Split, Croatia
39.	10-12/10	WMO VCP Workshop on Implementation of the ICAO Meteorological Information Exchange Model (IWXXM) for the Exchange of Operational Meteorological (OPMET) Data	Hong Kong, China
40.	12-13/10	3rd Task Force Meeting: Future Development of Asia-Pacific Network for Global Change Research (APN)	Kobe, Japan
41.	16-21/10	Eighth Asia/ Oceania Meteorological Satellite Users' Conference (Aomsuc-8) And Associated Events	Vladivostok, Russia
42.	21-22/10	Women's Marine Leadership Workshop	Bali, Indonesia
43.	23/10-03/11	Juelich Ozone Sonde Intercomparison Experiment 2017 SHADOZ Campaign	Juelich, Jerman
44.	24-26/10	International Conference on Automatic Weather Stations (ICAWS-2017)	Offenbach, Germany
45.	29/10-11/11	International Short Course on Disaster Risk Management	Taiwan
46.	30/10-03/11	United Nation Eco. and Social Commission for Asia and the Pacific (ESCAP)/WMO TC 12th Integrated Workshop	Jeju, Republic Korea
47.	06-17/11	23rd Session of the Conference of Parties (COP-23) 13th Session of the Cop the Meeting Parties to the Kyoto Protocol (CMP-13) 2nd Session of the 1st Part of the Conference of the Parties Serving to the Paris Agreement	Bonn, Germany
48.	07-09/11	Meeting of the Regional Association V Working Group on Infrastructure (RA V WG-INFR)	Singapore
49.	09-10/11	China-ASEAN Meteorological Disaster Prevention Workshop	Haikou, China
50.	09-22/11	International Training Course on the Adaptation to Climate Change	Beijing, China
51.	13-23/11	Training of Tsunami Evacuation Maps, Plans and Procedures (TEMPP)	Citeko, Indonesia
52.	15-17/11	Ninth Session of the ASEAN Regional Climate Outlook Forum	Hanoi, Vietnam
53.	04-06/12	Training Workshop on SIGMET Coordination	Hong Kong, China
54.	05-07/12	Tsunami Threat Assessment for Tsunami Warning Centre of APEC Economic Workshop	Santiago, Chile
55.	12-15/12	Technical Meeting on Radar Quality Control (QC) and QPE	Tokyo, Japan
56.	13-15/12	International Roundtable on 'The Impact of Extreme Natural Events: Science and Technology for Mitigation (IRENE)	Sri Lanka

GAMBAR AKTIVITI ANTARABANGSA DI LUAR NEGARA
PICTURES OF INTERNATIONAL ACTIVITIES ABROAD

49th Session of the ESCAP/WMO Typhoon Committee dari 21 hingga 24 Februari 2017 di Tokyo, Jepun
(from 21st till 24th February 2017 in Tokyo, Japan)

Mesyuarat Penyelarasan SIGMET di Asia Tenggara dari 27 hingga 29 Mac 2017 di Singapura
SIGMET Coordination Meeting in Southeast Asia from 27th to 29h March 2017 in Singapore

Simposium GAW 2017 dari 10 hingga 13 April 2017 di Geneva, Switzerland
GAW 2017 Symposium from 10th till 13th April 2017 in Geneva, Switzerland

39th Session of ASEAN Sub-Committee on Meteorology and Geophysics (SCMG)
dari 3 hingga 5 Mei 2017 di Manila, Filipina
(from 3rd till 5th May 2017 in Manila, Philippines)

Panel Antarabangsa bagi Ketua-Ketua Pengarah Negara-Negara Islam
dari 10 hingga 11 Mei 2017 di Istanbul, Turki
International Panel for the Director Generals of Islamic Countries
from 10th to 11th May 2017 in Istanbul, Turkey

18th Senior Technical Managers' Meeting of the Acid Deposition Monitoring Network in East Asia (STM18)
dari 24 hingga 25 Ogos 2017 di Ha Long City, Vietnam
(from 24 to 25 August 2017 in Ha Long City, Vietnam)

19th WMO/IAEA Meeting on Carbon Dioxide, Other Greenhouse Gases and Related Measurement Techiques (GGMT-2017) dari 27 hingga 31 Ogos 2017 di Duebendorf, Switzerland
(from 27th till 31st August 2017 in Duebendorf, Switzerland)

16th WMO-GAW Brewer Operator Course – Asia/Pacific dari 4 hingga 9 September 2017 di Sydney, Australia
(from 4th till 9th September 2017 in Sydney, Australia)

Research Fellowship of Working Group on Disaster Risk Reduction (WGDRR) Project
dari 4 hingga 17 September 2017 di Shanghai, China
(from 4th till 17th September 2017 in Shanghai, China)

Juelich Ozone Sonde Intercomparison Experiment 2017 SHADOZ Campaign
dari 23 Oktober hingga 3 November 2017 di Juelich, Jerman
(from 23rd October till 3rd November 2017 in Juelich, Jerman)

Ninth Session of the ASEAN Regional Climate Outlook Forum
dari 15 hingga 17 November 2017 di Hanoi, Vietnam
(from 15th till 17th November 2017 in Hanoi, Vietnam)

Technical Meeting on Radar Quality Control (QC) and QPE dari 12 hingga 15 Disember 2017 di Tokyo, Japan
(from 12th till 15th December 2017 in Tokyo, Japan)

AKTIVITI ANTARABANGSA DI MALAYSIA
## INTERNATIONAL ACTIVITIES IN MALAYSIA

International Workshop on Rocket-Based Cloud Seeding System
dari 23 hingga 27 Oktober 2017 di Ibu Pejabat MMD, Petaling Jaya
(from 23rd till 7th October 2017 in MMD Headquarters, Petaling Jaya)

LAWATAN ANTARABANGSA
INTERNATIONAL VISIT

Pada 27 Februari 2017, tiga orang wakil dari *Canadian Forest Service telah melawat MMD* untuk memperkenalkan perisian *Canadian Fire Information Toolbox* (CFIT).

On 27th February 2017, three representatives from the Canadian Forest Service visited MMD to introduce the Canadian Fire Information Toolbox (CFIT).
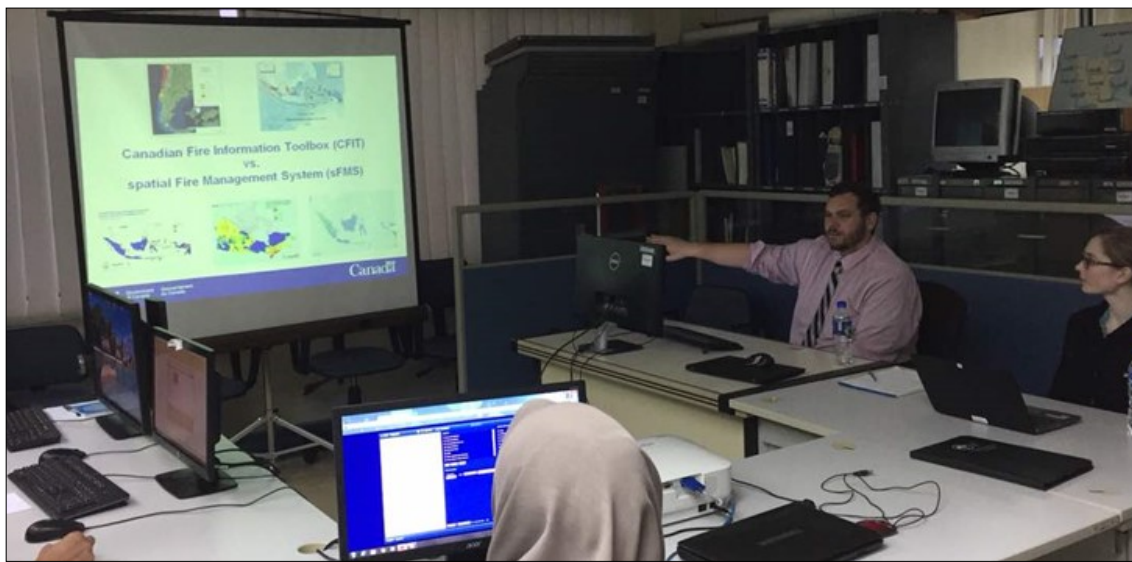
Pada 23 hingga 24 November, tiga orang pakar Agensi Meteorologi Jepun (JMA) ke PMPN telah melawat MMD bagi memperkenalkan maklumat dan alat bantuan baru JMA untuk pengeluaran SIGMET dan arahan teknikal mengenai analisis imej Himawari-8 yang akan membantu penyediaan SIGMET.

On 23rd till 24th November, three experts from the Japan Meteorological Agency (JMA) have visited MMD to introduce JMA's new support information and tools for SIGMET and coordination and technical instructions on Himawari-8 image analysis which is useful for the preparation of SIGMET.

SENARAI PEJABAT METEOROLOGI NEGERI

LIST OF
STATE METEOROLOGICAL OFFICES

IBU PEJABAT

Jabatan Meteorologi Malaysia

Jalan Sultan

46667 Petaling Jaya

SELANGOR

Tel   : 03-7967 8000

Faks   : 03-7954 9372

PUSAT METEOROLOGI PENERBANGAN NASIONAL

Aras 1, Pusat Pengurusan Lapangan Terbang

Lapangan Terbang Antarabangsa Kuala Lumpur

64000 KLIA

SELANGOR

Tel   : 03-8787 2110/2388/2162

Faks   : 03-8787 1019/1020

PEJABAT METEOROLOGI SARAWAK

Lot 319 Jalan Lapangan Terbang Lama

93667 Kuching

SARAWAK

Tel   : 082-617 761

Faks   : 082-617 756

PEJABAT METEOROLOGI SABAH

Tingkat 7, Wisma Dang Bandang

88995 Kota Kinabalu

SABAH

Tel   : 088-256 054

Faks   : 088-211 019

PEJABAT METEOROLOGI PULAU PINANG

Lapangan Terbang Antarabangsa Pulau Pinang

Gate 16

11900 Bayan Lepas

PULAU PINANG

Tel   : 04-643 8301

Faks : 04-644 9076

PEJABAT METEOROLOGI PAHANG

Batu 9, Jalan Gambang

26070 Kuantan

PAHANG

Tel   : 09-538 4216

Faks : 09-538 4673

PEJABAT METEOROLOGI TERENGGANU

KM 8, Jalan Kuala Besut

22000 Jertih

TERENGGANU

Tel   : 09-690 2460

Faks : 09-690 2461

PEJABAT METEOROLOGI KELANTAN

Lot 1244 Jalan Maktab

Pengkalan Chepa

16100 Kota Bharu

KELANTAN

Tel   : 09-774 5867

Faks : 09-773 5646

PEJABAT METEOROLOGI JOHOR

Lapangan Terbang Antarabangsa Senai

81400 Senai

JOHOR

Tel : 07-599 4739

Faks : 07-599 4521

PEJABAT METEOROLOGI SELANGOR

Terminal 2

Lapangan Terbang Sultan Abdul Aziz

47600 Subang

SELANGOR

Tel : 03-7846 3114

PEJABAT METEOROLOGI PERAK

Jalan Datuk Ahmad Yunus

32000 Sitiawan

PERAK

Tel : 05-691 1516

PEJABAT METEOROLOGI WP LABUAN

Jalan Pulau Buah

87008 Labuan

WILAYAH PERSEKUTUAN LABUAN

Tel : 087-425 114

Faks : 087-412 109

PEJABAT METEOROLOGI KEDAH

Kepala Batas

06200 Alor Setar

KEDAH

Tel   : 04-714 0061

Faks : 04-714 4212

PEJABAT METEOROLOGI PERLIS

Mata Ayer

02500 Kangar

PERLIS

Tel   : 04-938 4394

Faks : 04-938 2158

PEJABAT METEOROLOGI NEGERI SEMBILAN

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