Country Report

MALDIVES

Maldives Meteorological Service

Ahmed Rashed

Email: rasheed@meteorology.gov.mv

Phone: +960-7768565

Joint Meeting of RA II WIGOS Project and RA V TT-SU

Jakarta, Indonesia / 11 October 2018

BMKG Headquarter

Outline

I. Abstract (updates on status and plan of satellite data access, processing, application and training)

II. Satellite data and product requirements, training needs and infrastructure

Appendix

a. Background

b. Short description of NMHS activities

c. Current observational system overview

d. Access, processing and application of satellite data and products

e. Satellite data to address regional challenges

Abstract

(updates on status and plan of satellite data access, processing, application and training)

- Maldives is in a highly remote location as far as GCOS Surface Network (GSN) is concerned. The only solution to address these challenges is to relay on satellite based weather observation over the region. Rapid update and Near Real Time data is crucial for early warnings. High resolution cloud pictures, precipitation estimate (QPE), lightning data etc. are some of the very important parameters in weather monitoring and forecasting if they are made available on near real time basis. Polar orbiting satellite data, especially ocean winds (ASCAT winds) are very important to monitor ocean state over the area. Special on-request basis, very high resolution satellite images could help in impact and damage assessment during and after severe weather events.
- Training required on discovery, utilization and visualization of various satellite data sets available over internet for local applications. Identification of weather systems (eg. Meso-scale Convective Systems and other synoptic scale features) and interpreting RGBs of the datasets. Data assimilation using satellite radiance data for NWP model ingestion.
- We wish to continue using CMACast System and receive updates and training on MICAPS and SWAP application. Also satellite data and images from INSAT (IMD website) and METEOSAT-8 could help us monitor the weather over the region.

Satellite data and product requirements, training needs and infrastructure

Satellite data and product requirements

- Multi spectral high resolution images in terms of spatial and temporal scale.
- Near Real Time ASCAT winds over Maldives region.
- Satellite based lightning detection Near Real Time datasets or products.
- Satellite based air pollution monitoring data.
- Special on-request basis, very high resolution images for impact and damage assessment due to severe weather condition.
- Include Maldives geographical map in satellite products over this region.

Satellite data and product requirements, training needs and infrastructure

- Training needs
  - Discovery of various satellite data sets available over internet.
  - Training on utilization and visualization techniques of such data sets for local application.
  - Identification of weather systems (eg. Meso-scale Convective Systems and other synoptic scale features) and interpreting RGBs of the datasets.
  - Satellite based lightning detection dataset and Near Real Time lightning monitoring techniques.
  - Satellite radiance data assimilation techniques for NWP model run, research and simulation.
- Technical infrastructure issues to access and process/visualize satellite data
  - Reception of high resolution and high frequency data and images from FY series and INSAT series of satellites, DVB-S2 reception (e.g. CMACast), internet service (http/ftp, data covering Maldives area), visualization (e.g. MICAPS, SWAP, SATAID))
  - Processed images and datasets at higher resolution and high frequency.

Appendix

Background

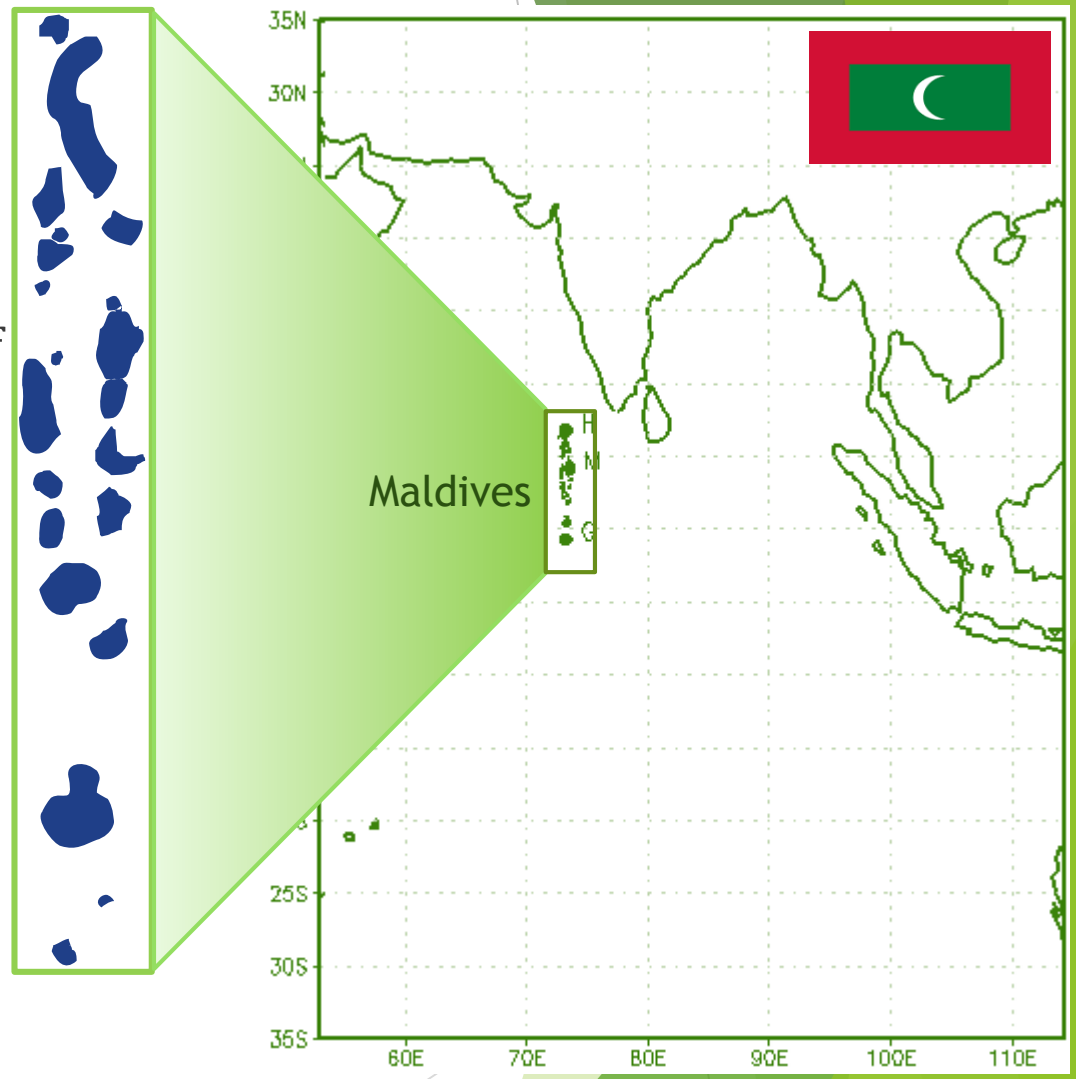
Country overview

Geography:

The Maldives is an island nation in the Indian Ocean composed of 26 ring-shaped atolls, which are made up of about 1,200 coral islands.

About 99% of the country's area is sea.

Average height of the islands are 2m above sea level. Hence, climate change, global warming and sea level rise are huge concern to Maldives.



Population

The population of the Maldives is 378,114 (as of Dec 2017)

Background

Country overview

Climate:

Maldives experiences tropical warm and humid climate.

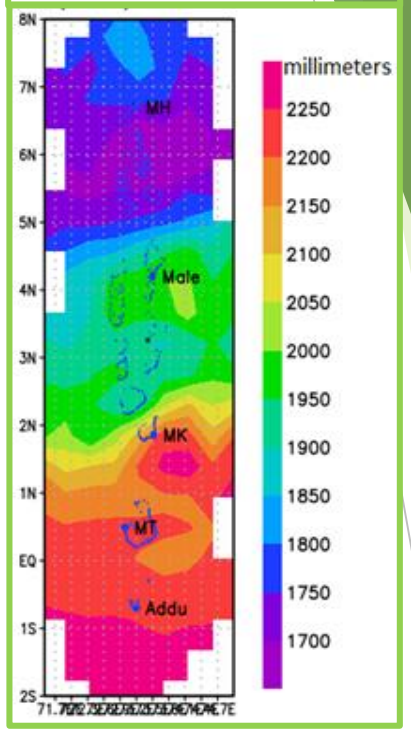
The fact that the Maldives is located over the equator, it receives plentiful of sunshine throughout the year.

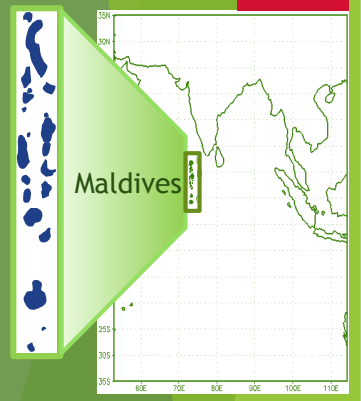
It has 2 distinct Seasons:

South-West Monsoon : mid-May to November

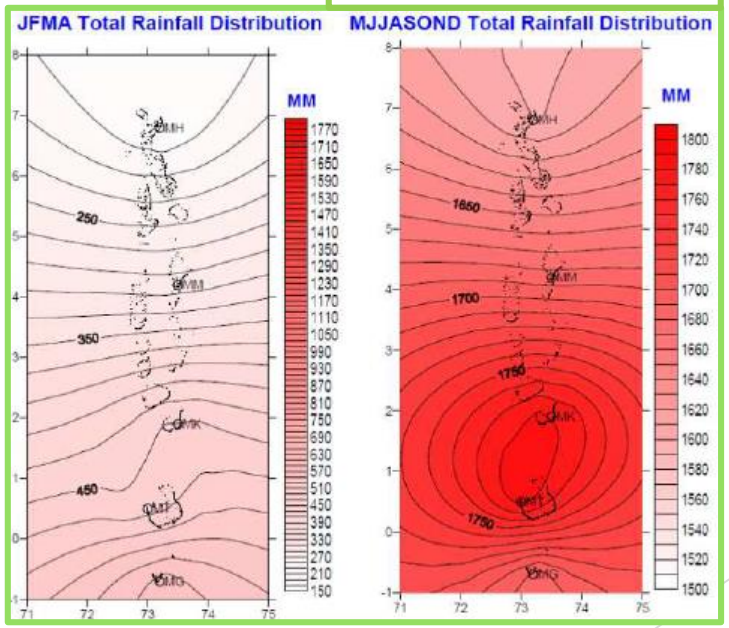
North-East Monsoon : January to March

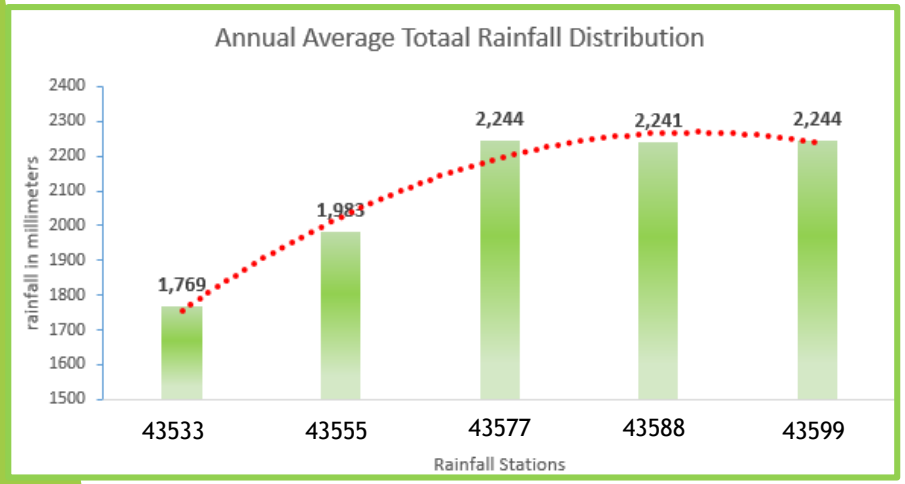
Annual Total rainfall distribution

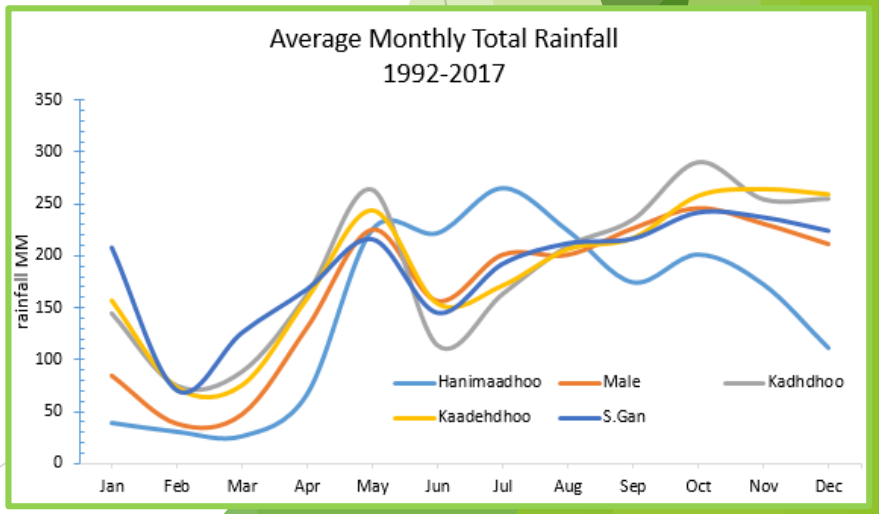




Seasonal Total rainfall distribution



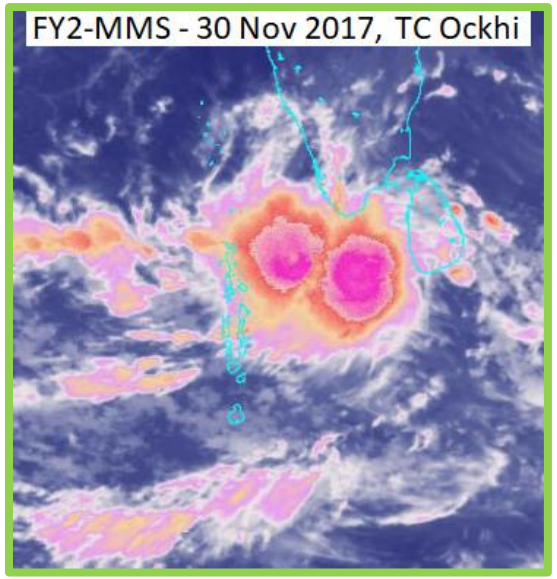




Background

Major historical hydrometeorological disasters

I. Tropical Cyclones
II. Heavy rain
III. Flood
IV. Thunderstorms
V. Gust Winds
VI. Tidal Waves
VII. Swell Waves
VIII. Funnel Cloud (Water Spout and Tornado)



Heavy Rain and Flood

Swell Surge

Water Spout an Tornado

Background

Major national economic sectors using weather services provided by MMS

I. Aviation Sector

II. Sea transport

III. Tourism Sector (recreational activities)

Aviation Weather Services

Sea Transportation

Tourism and Recreational Activates

Short Description of MMS Activities

MMS Mandates:

- **M**onitor atmosphere/ ocean, disseminate advisories/ warnings of hydro-meteorological hazards and provide timely and accurate weather forecasts and climate reports to the public for the safety and protection of life and property.
- **P**rovide Aeronautical Meteorological Services for National, International Air Navigations as per the provisions by International Civil Aviation Organization (ICAO) and World Meteorological Organization (WMO) standards & recommended practices.
- **D**evelop and sustain an efficient early warning mechanism accessible to all Maldivians.
- **I**dentify, monitor and assess risks and threats associated with natural disasters.
- **M**onitor and record seismological activity in the country.
- **C**ontribute to emergency operations in the event of natural disasters.

Short Description of MMS Activities

Vision

Provide accurate, timely and reliable meteorological information to minimize the impact on life and property while supporting sustainable socio-economic development of the Maldives

Mission

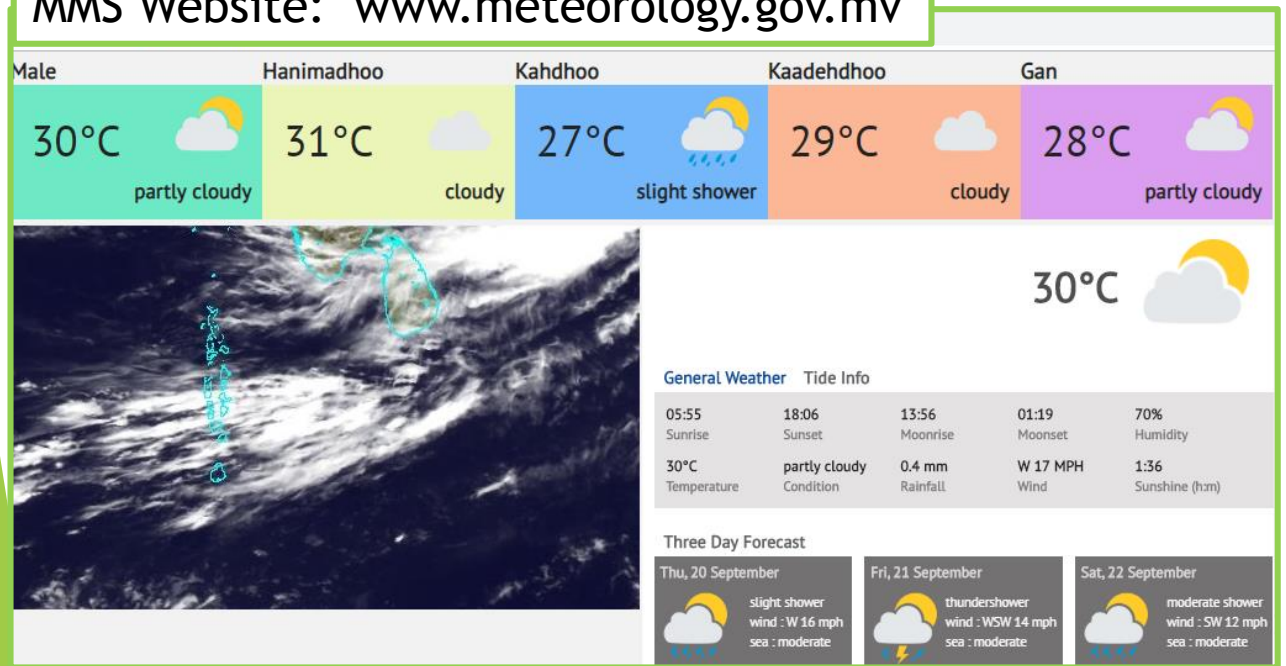
Timely dissemination of alerts and advisories on all natural disasters.
Expansion and maintenance of weather observation net-work in accordance with international standards and best practices with well trained professionals.
Enable easy access of high quality historical meteorological data to the user community for Sustainable National Socio-Economic Development.
Develop meteorological services and capacity building for the national requirement, and contribute to regional and international community.

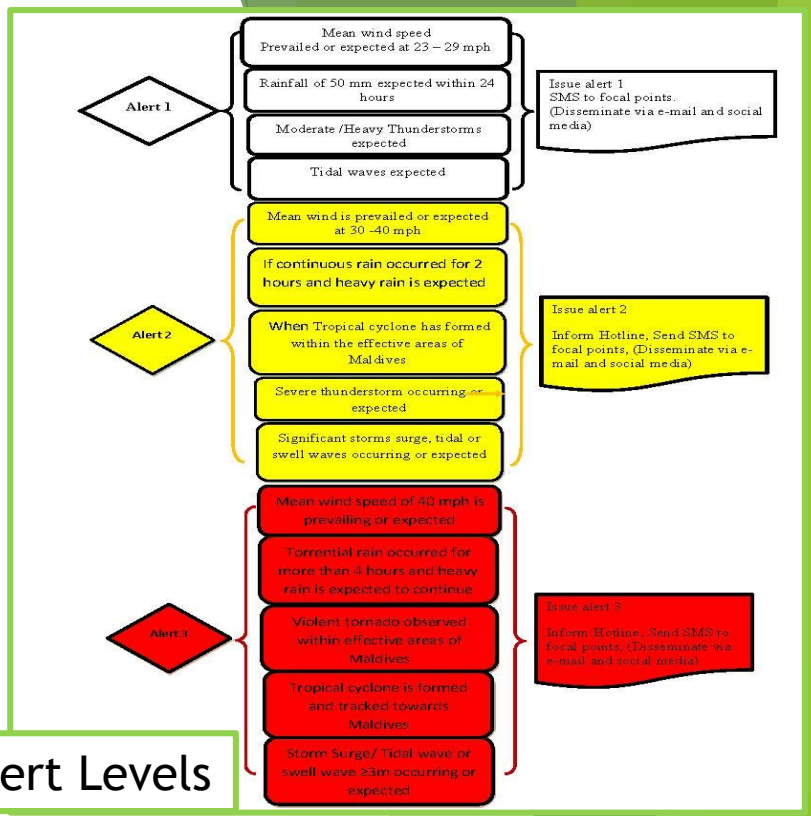
Short Description of MMS Activities

Public Weather Service :

- MMS provides daily weather forecasts & marine forecasts.
- Forecasts posted on website, social media and broadcast on radio and on television.
- MMS applies SOPs in operations to provide warnings on extreme weather.
- MMS use 4 different alerts:
- WHITE (white- for information), YELLOW (yellow- as Advisory),
- RED (red- as Warning) and Green (cancellation of warning).

MMS Website: www.meteorology.gov.mv





Weather Alert Levels

TV Weather Presentation

Short Description of MMS Activities

Aviation Weather Service of MMS is ISO 9001:2015 QMS Compliant.

CERTIFICATE

This is to Certify that the Quality Management System of

Aeronautical Meteorological Services of Maldives Meteorological Service

Velana international Airport, Hulhule'22000, Republic of Maldives

has been independently assessed and is compliant with the requirements of

ISO 9001:2015

This Certificate is applicable to the following product or service ranges:

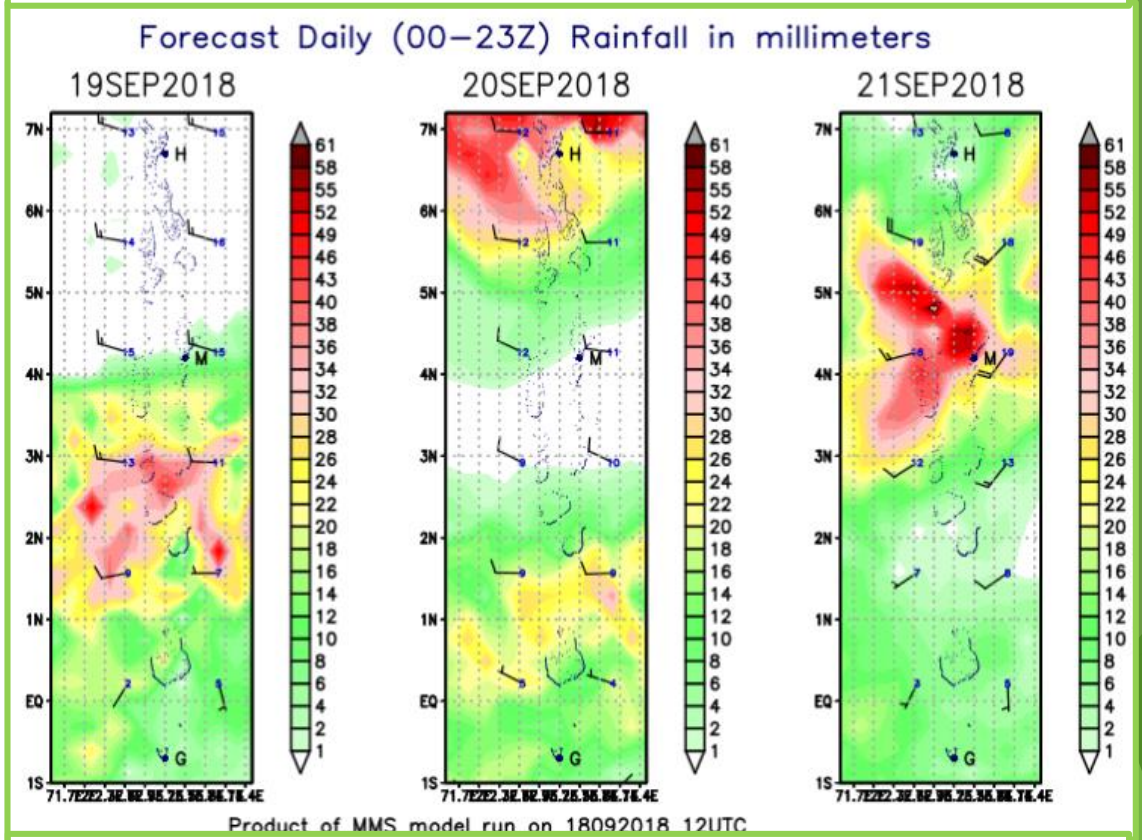
Provision of meteorological servicesto the aviation industry for safety, regularity And efficiency of national and international air navigation.

:: Certificate No :: MV34262A

Date of initial registration	05 December 2016
Date of this Certificate	11 December 2017
Surveillance audit on or before	04 December 2018
Recertification Due / Certificate expiry	04 December 2019

This Certificate is property of LMS Certifications and remains valid subject to satisfactory surveillance audits.

MMS WRF Model products.



Model run on daily basis. Initial and boundary condition are taken from NCEP GFS data set.

- In addition, MMS uses NWP model products from ECMWF, RIMES, IMD website and INCOIS etc. These are used for preparing daily weather forecast.

Current Observational System Overview

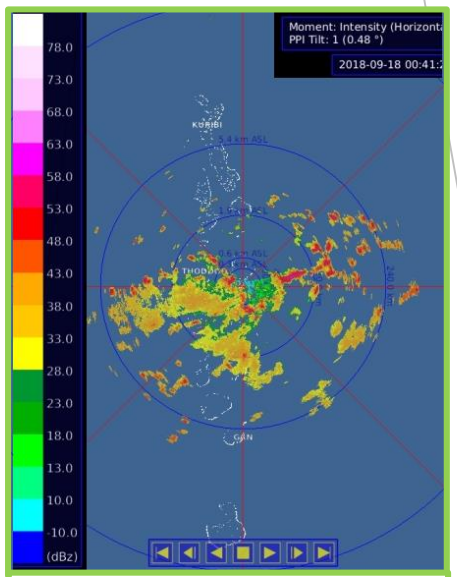
I. Surface observations
   - ❖ Manned Observation Stations = 5
   - ❖ Automatic Weather Stations = 36

II. Upper-air observations = 1

III. Doppler Weather Radar = 1

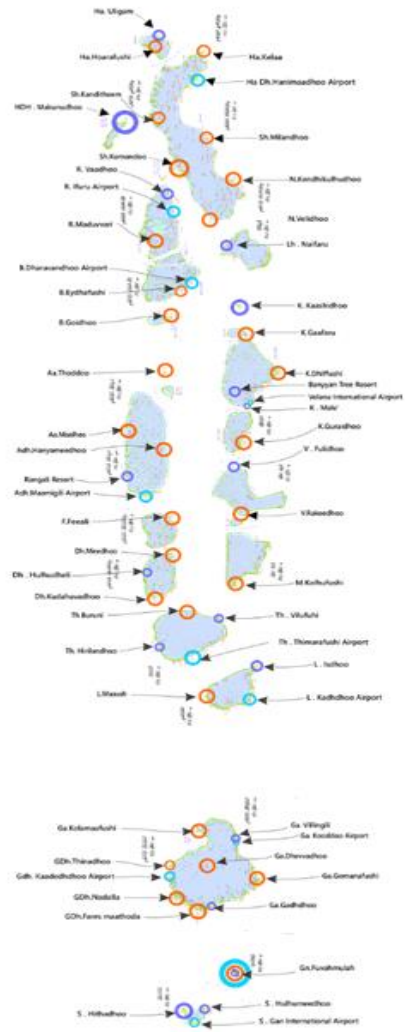
IV. Other observation platforms
   - ❖ Tide gauge observation = 3

Manned station



Doppler Weather RADAR

AWS Network



Tide station

AWS

Upper Air Observation Radiosonde

Access, Processing and Application of Satellite Data and Products

I. List of satellites/instruments currently used operationally for NWP, nowcasting and other applications

- ✓ FY-2E and FY-2G satellite data and products (CMACast recieving system)
- ✓ INSAT-3D images from IMD website (http://satellite.imd.gov.in/)
- ✓ Meteosat-8 images from EUMETSAT website (https://eumetview.eumetsat.int/mapviewer/)

II. Current capabilities of access, processing and archiving of satellite data and products

- ✓ CMACast data receiving system, MICAPS, SWAP.
- ✓ Satellite images from IMD website.

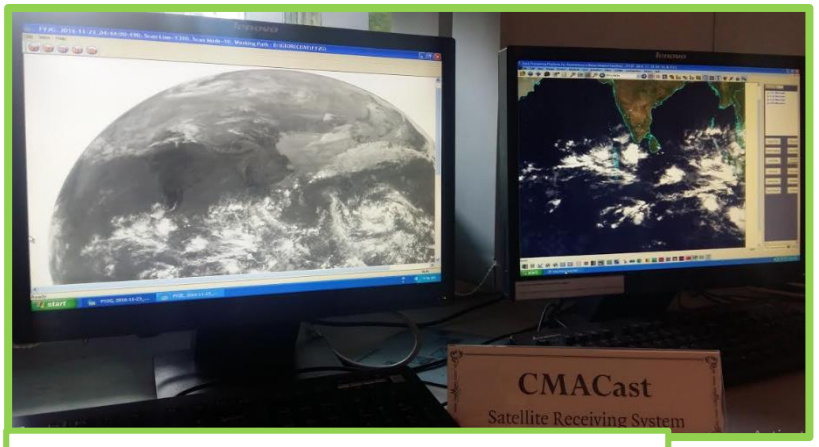
III. Current satellite data applications

- ✓ Key application areas : Weather Forecasting, Nowcasting,
- ✓ Satellite-based products :
  - Satellite pictures to identify cloud type and area of cloud formation
  - ASCAT winds for monitoring and forecasting sea state.
  - TRMM data download and plot using GrADS for forecast varification.

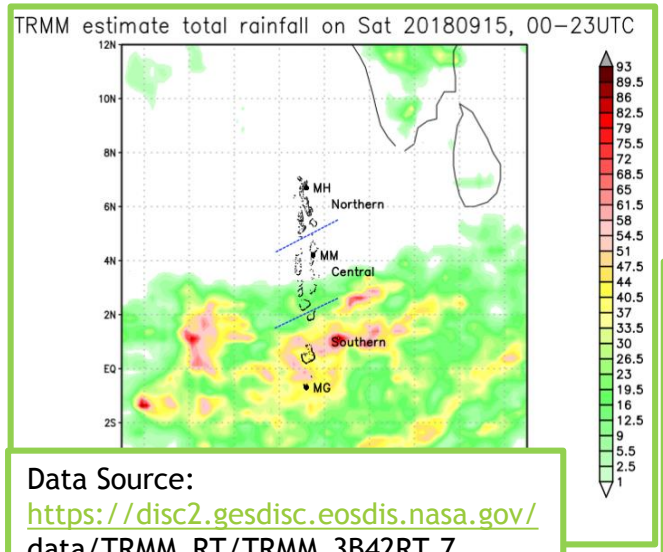
Satellite Data to address Regional Challenges

- ✓ With very limited local weather observation stations, geographically Maldives is in a highly remote and data(observation) sparse area, as such there is no routine weather observation data available from East, West and South of Maldives in its vicinity.
- ✓ The only solution to address these challenges is to relay on satellite based observation for deriving weather parameters over the region.
- ✓ Rapid update and Near Real Time(NRT) data is crucial as far as early warnings are concerned.
- ✓ Polar orbiting satellite data, especially ocean winds (ASCAT winds) are very important to fill the data gaps over the area.
- ✓ High resolution cloud pictures, precipitation estimate, wind vector at different levels of the atmosphere, area of divergence and convergence, wind sheer zones and turbulence are some of the parameters useful in weather forecasting if they are made available on near real time basis at higher temporal scale.
- ✓ Data assimilation using satellite radiance data could improve NWP model performance. Such data assimilation techniques need to be taught to the local NWP modeling team.

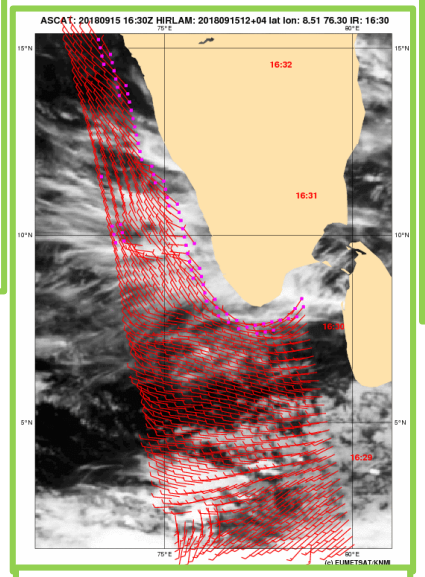
Satellite Data to address Regional Challenges



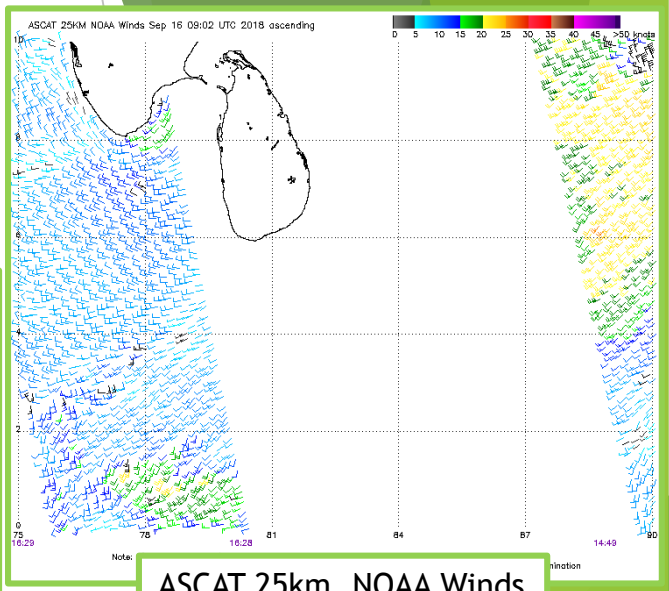
FY-2, Satellite Data receiving system



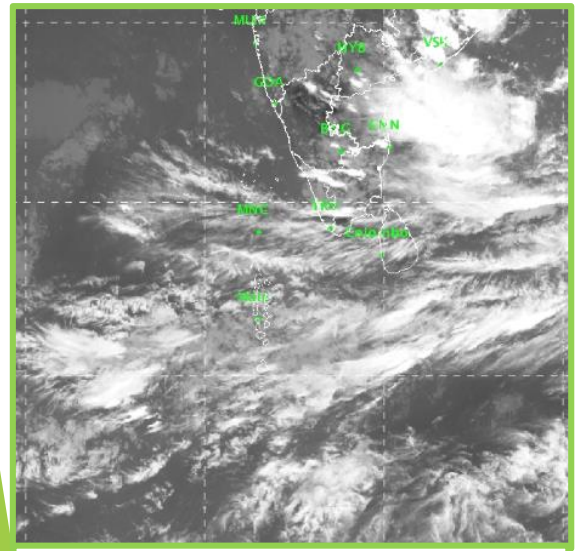
Data Source:
https://disc2.gesdisc.eosdisc.nasa.gov/
data/TRMM_RT/TRMM_3B42RT.7



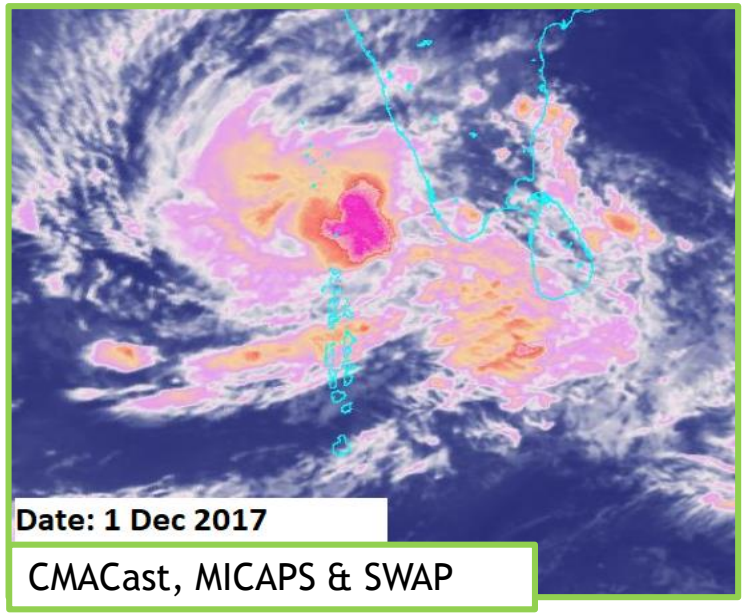
OSI SAF ASCAT-A 25-km



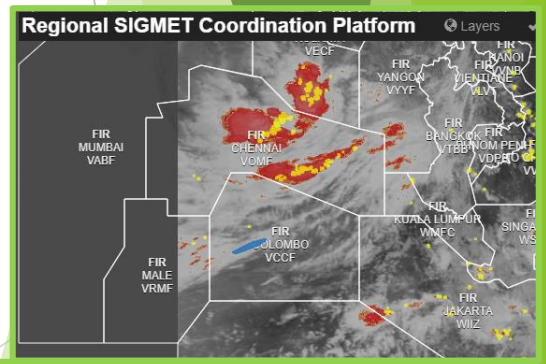
ASCAT 25km, NOAA Winds



INSAT-3D image from IMD
http://satellite.imd.gov.in/



CMACast, MICAPS & SWAP



The satellite used in this SIGMET coordination platform is Himawari-8, which does not cover Maldives FIR. If FY series or INSAT series of satellite could be incorporated to this platform, it will help us to generate SIGMET and contribute to the regional SIGMET coordination platform.

Link > https://sigmet.hko.gov.hk/

Satellite Data to address Regional Challenges

- ✓ Discovery of various regional satellite data sets available over internet.
- ✓ Training on utilization and visualization techniques of such data sets for local application.
- ✓ Satellite radiance data assimilation techniques for NWP model run, research and simulation.

- ➢ *Other challenges in weather observation network.*
  - Inadequate consumables (balloon and radio-sonde) in one and only upper air station in the Maldives, interrupts routine daily observations from time to time. Due to its strategic location, this GUAN station(43599) is an important data point locally as well as globally.
  - AWS maintenance and calibrations (frequent data gaps due to AWS failures).
  - Limited spare parts for AWS maintenance.
  - No marine observation station at present.(*One ocean buoy donated by FIO has been drifted away from its anchored location*)
  - Limited coverage of the only one Doppler weather Radar in the country.
  - Limited human resources and technical expertise to maintain observation network.

Satellite Data to address Regional Challenges

- We hope that by increase in the launching of new-generation geostationary satellites that cover Maldives' region would enable us to access and utilize more satellite data at high resolution in terms of spatial and temporal scale.
- This will help us overcome many shortcomings and challenges currently we face in providing weather forecasts, advisories and warnings.

Thank You