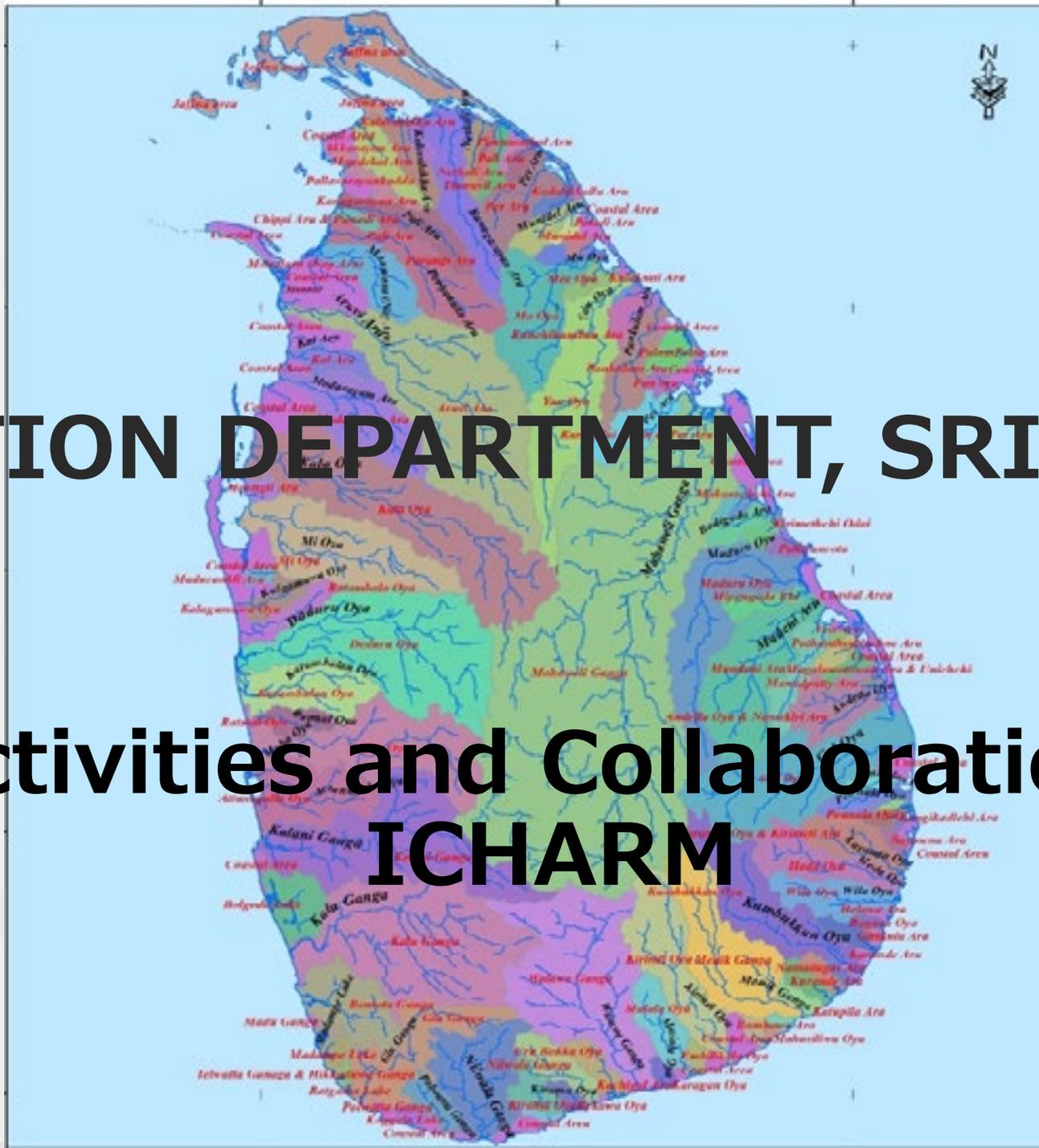




IRRIGATION DEPARTMENT, SRI LANKA

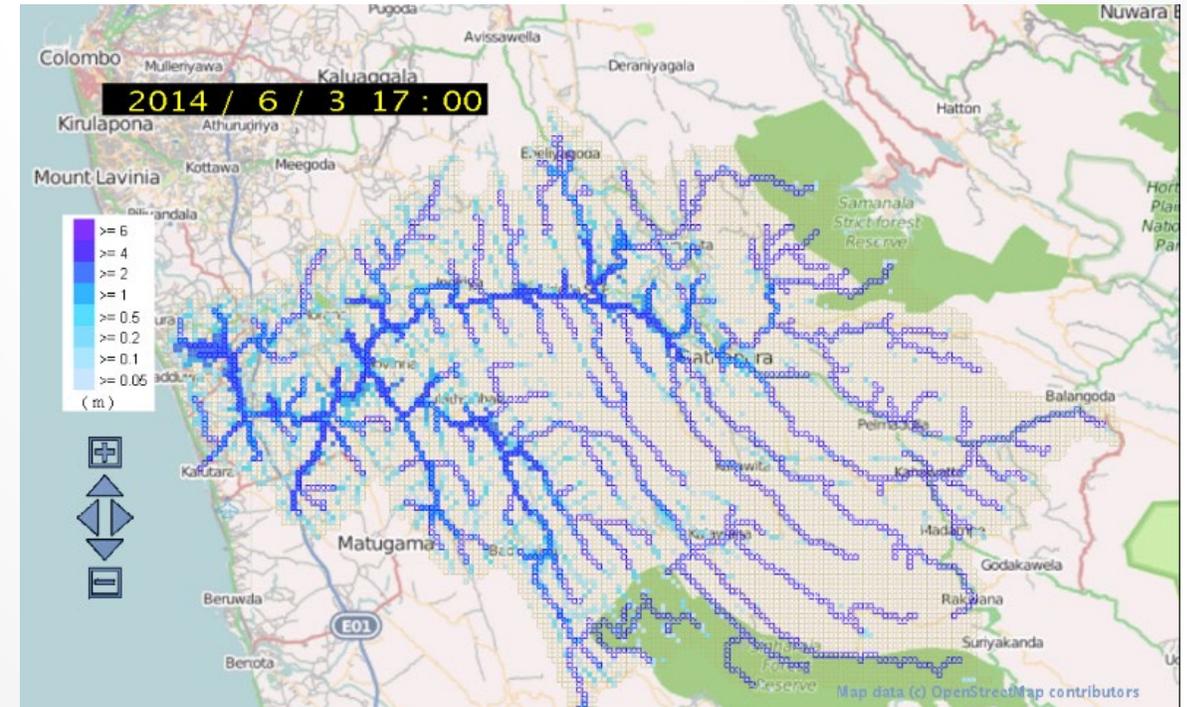
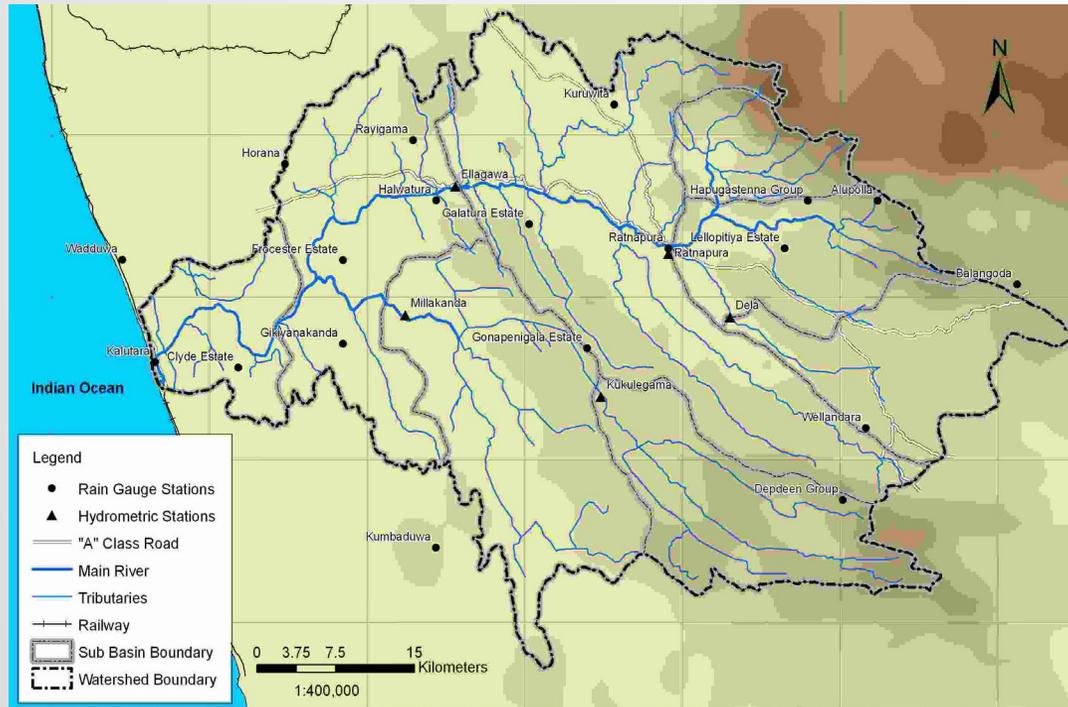
IFI Activities and Collaboration with ICHARM



NATIONAL REPORT ON THE PLATFORM ACTIVITY



✓ A Rainfall Runoff Inundation Model was prepared for Kalu River Basin with the support of ICHARM and a Web portal for dissemination to be developed



NATIONAL REPORT ON THE PLATFORM ACTIVITY



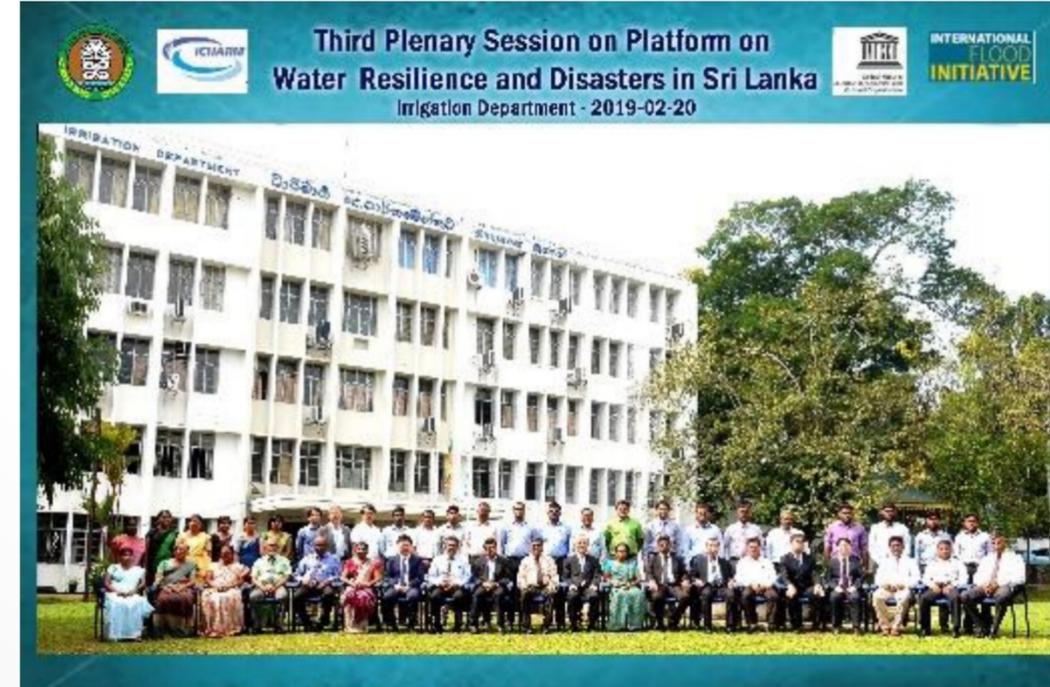
- ✓ 04 Flood **Modelling Training Programs** for Irrigation Engineers were conducted with resource personals from ICHARM
- ✓ One **Climate Change Prediction Training Program** were conducted by ICHARM to Irrigation Department, MASL, DMC, and NBRO officials



NATIONAL REPORT ON THE PLATFORM ACTIVITY



- ✓ 03 Plenary Sessions were conducted at Irrigation Department with all stakeholders and ICHARM



NATIONAL REPORT ON THE PLATFORM ACTIVITY



- ✓ South Asian Regional Hub of **RIMES** has been established in ID premises.
- ✓ We anticipate **ICHARM** also establish their division in the ID and to be linked with all stakeholder institutions in Sri Lanka
- ✓ IWMI want to collaborate with RIMES & ICHARM



PROPOSAL OF CAPACITY DEVELOPMENT



- Early Flood Warning Center has been established in ID premises, and this center will be fully equipped with all necessary resources with the assistance of World Bank under CResMP
- Need training especially for Young Engineers on,
 - **Flood modelling and forecasting**
 - **Whether forecasting including Rainfall**
- We propose all the stakeholders who own Weather Stations, Rainfall Stations and River Gauges to establish a common system for the purpose of forecasting while keeping their separate systems.
- Gauges fixed by ICHARM also to be linked in to that system

ROADMAP/STRATEGIC WAY FOR GLOBAL AGENDA

- ID's expectation is to **provide flood early warning with sufficient lead time** all over the Island in near future. This will contribute to reduce flood damages greatly.
- On the other hand ID is planning to implement **structural flood counter measures** under CResMP. As the first step flood protection works for Kelani River would be implemented with a large investment.
- We have studied 11 large river basins to prepare future **Development of Basin Investment Plans to mitigate flood and drought.**
- Water Resources Development by River Basin approach

Those steps are complying with Global Agenda (Sendai Framework, SDGs and Paris Agreement)

ROADMAP/STRATEGIC WAY FOR GLOBAL AGENDA

- **KnoWat (Knowing Water Better)** Project will be launched by the Irrigation Department with other stakeholders with the Assistance of FAO (Remote Sensing Technologies to assess water in the basin, Water Accounting and Auditing & Water Tenure)
- Adaptation Strategies to Climate shocks in the North Central Province of Sri Lanka by IWMI to be launched

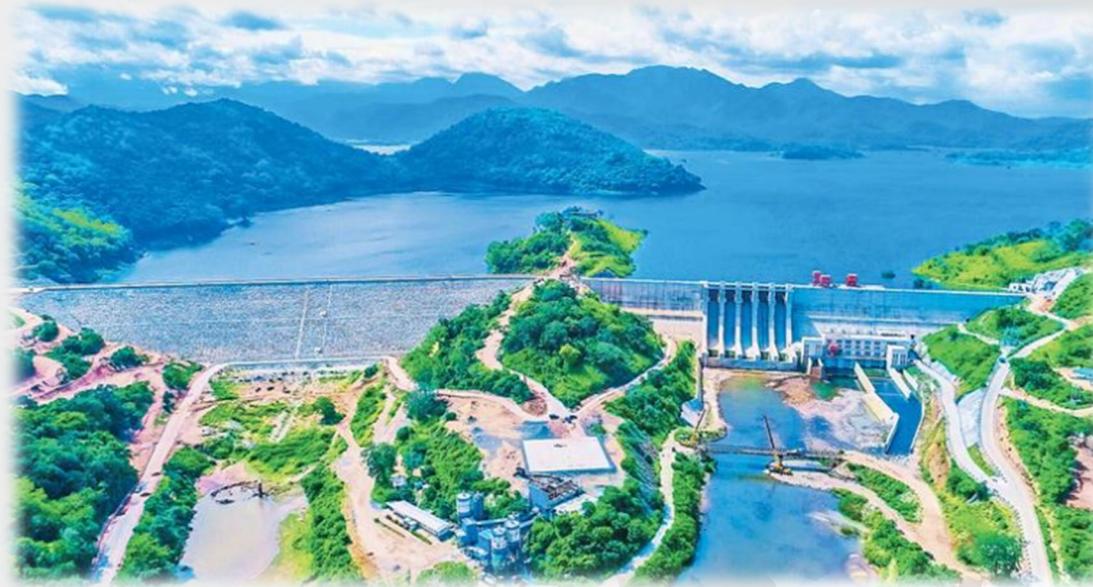
Those steps are complying with Global Agenda (Sendai Framework, SDGs and Paris Agreement)



THANK YOU !

WATER FOR SUSTAINABLE DEVELOPMENT (2018-2028) MAHAWELI AUTHORITY OF SRI LANKA

12TH AOGEO SYMPOSIUM 2019 CANBERRA, AUSTRALIA, 2-4 NOVEMBER 2019



**DR. D.M.S. DISSANAYAKE
DIRECTOR GENERAL
MAHAWELI AUTHORITY OF SRI LANKA**

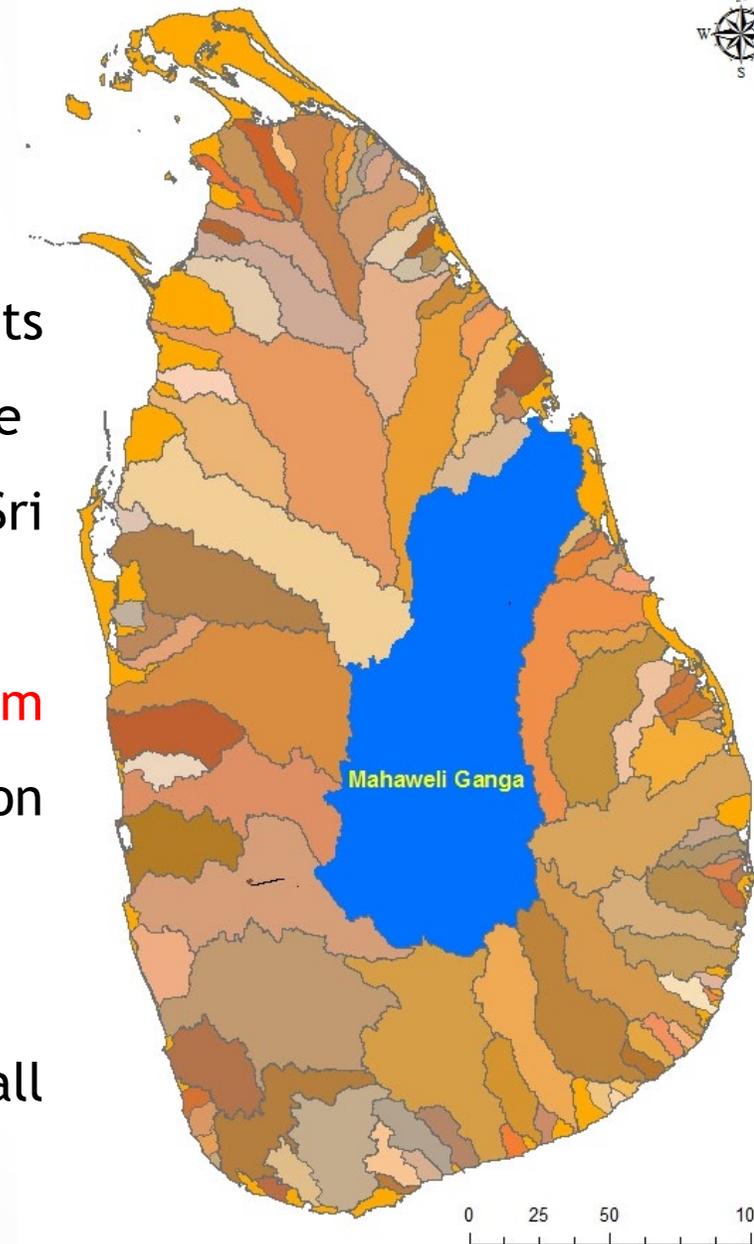


OUT LINE

- ✓ Basic Salient Data of Mahaweli Basin
- ✓ Basic Salient Data of Mahaweli Development
- ✓ National report on the platform activities
- ✓ Proposal of capacity development
- ✓ Roadmap/strategic way for global agenda(SDGs/PA/SFDRR)

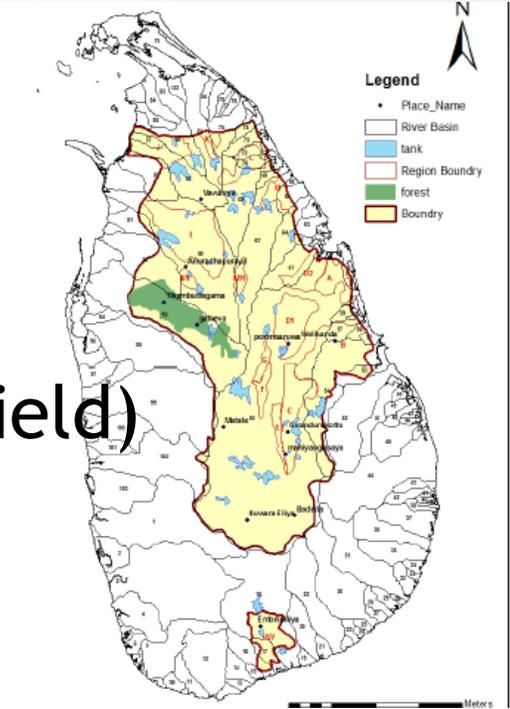
BASIC SALIENT DATA OF MAHAWELI BASIN

- ✓ Catchment area : **10,267** km²
- ✓ River length : **335 km**, enters sea at various places through its distributaries, but the main channel at Koddiyar Bay near Trincomalee
- ✓ Annual catchment yield : **11,000 MCM** (24% of yield (Total Water) of Sri Lanka)
- ✓ Upper areas in the Wet Zone with annual rainfall : **5,300 mm** (Upper basin crucial to the water resources for hydropower, irrigation in the Mahaweli Basin and for many areas outside the basin)
- ✓ Upper catchment receives rainfall from Southwest Monsoon
- ✓ Lower basin in the dry zone with MAR : **1,650 mm** Receives rainfall from Northeast Monsoon



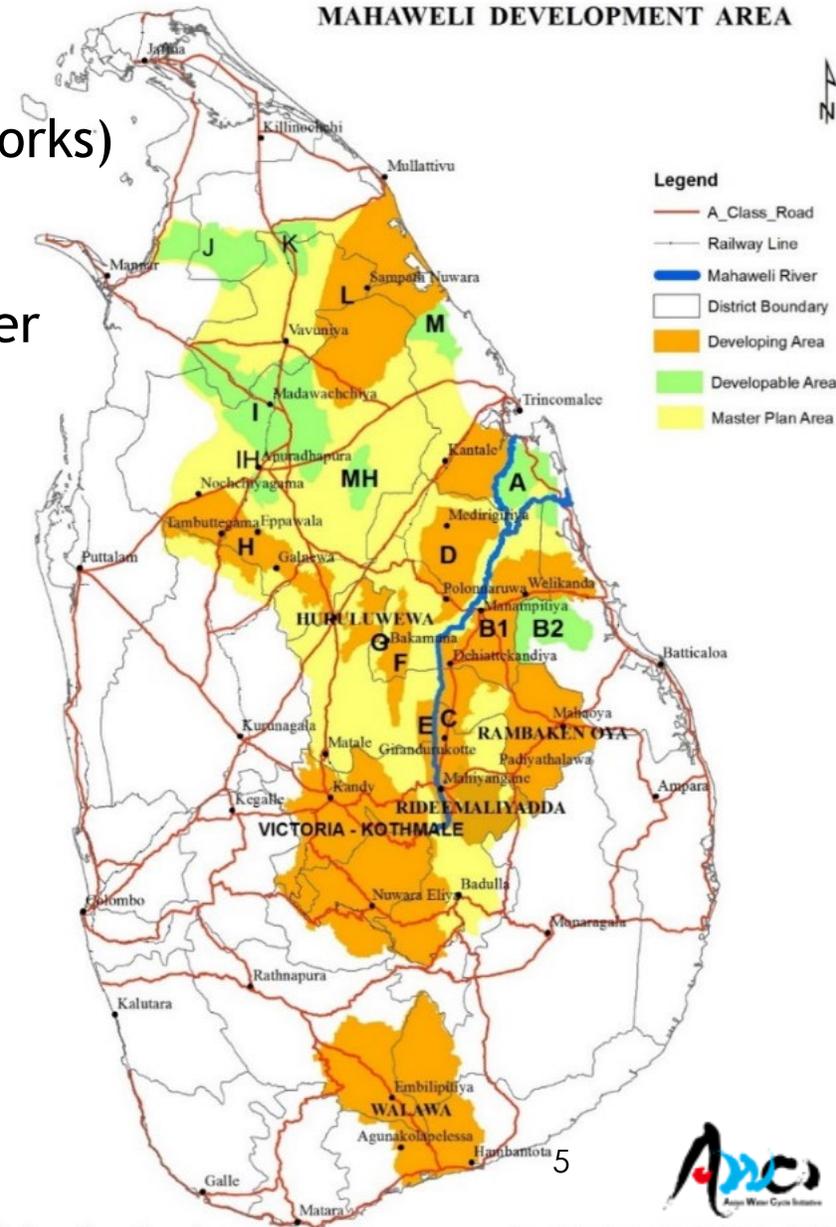
BASIC SALIENT DATA OF MAHAWELI DEVELOPMENT (MASL)

- ✓ Water Storages - 3500 MCM
- ✓ Hydro Electric Power - 750 MW
- ✓ Canal Structures - 15,000 km (Main+Branch+D+Field)
- ✓ Agricultural Development - 150,000 Ha



NATIONAL REPORT ON THE PLATFORM ACTIVITIES

- ✓ The generation of hydroelectric power (Moragahakanda and Head Works)
- ✓ Controlling floods (Reservoir Operations and Diversion Canals)
- ✓ Making irrigation facilities for dry zone cultivation and Drinking water (Diversion Canal)
- ✓ Water Management
- ✓ Settlement for landless people
- ✓ Developing physical and social infrastructure required for human habitation by using the water of the Mahaweli River
- ✓ Increase local agricultural production (Paddy and OFC)
- ✓ Environmental protection and improve the existing condition
- ✓ Create employment opportunities



PROPOSAL OF CAPACITY DEVELOPMENT

- ✓ Awareness Programme for officers (to achieve the SDGs)
- ✓ Local Training programme for officers based on their specialties
- ✓ Foreign Training programme for officers based on their specialties with assistance with ERD and Others organizations (Foreign experience, Knowledge, new Ideas ,etc)
- ✓ Holding Onsite workshops (Water Management, Survey, PRA, etc)
- ✓ Short Course for engineers (updating the knowledges with multi sustainable Development areas)
- ✓ Assistance and giving more opportunities for Postgraduate education (Part time /full time)
- ✓ Participation of CPD (Continue Professional Development) activities
- ✓ Working with foreign funded projects which belongs to different ministries (MWSIP/IW-WRMP/CRIP)
- ✓ Sharing experience with stakeholders
- ✓ Working and collaboration with international organizations and flat forms (NARBO,ICUN.IWMI)
- ✓ Research and Developments in multi disciplinary areas

ROADMAP/STRATEGIC WAY FOR GLOBAL AGENDA

1.SDGS



2.SFDRR

Sendai Framework for Disaster Risk Reduction 2015- 2030



3.PARIS AGREEMENT ON CLIMATE CHANGE





SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD

1 NO POVERTY



2 ZERO HUNGER



3 GOOD HEALTH AND WELL-BEING



4 QUALITY EDUCATION



5 GENDER EQUALITY



6 CLEAN WATER AND SANITATION



7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS



MASL ACTIVITIES UNDER SFDRR (SENDAI FRAMEWORK FOR DISASTER RISK REDUCTION SFDRR)

- ✓ Main Stakeholders of SFDRR in Sri Lanka as largest multi disciplinary organization (Focal Point)
- ✓ MASL is actively involving to achieve SFDRR 2015-2030 targets
- ✓ Closely works with Disaster Management Center (SL) and ID -Data sharing , Early warning issues, etc
- ✓ Awareness among the stakeholders and MASL officers
- ✓ Establishment of Dam monitoring unit at head works
- ✓ Involvement of Flood and Drought Mitigation Projects in MASL areas (CRIP/DSWRPP/MWSIP/MASL Annual)



Establishment of Dam monitoring unit at head works

MASL ACTIVITIES UNDER PARIS AGREEMENT ON CLIMATE CHANGE (Green House Gas Emissions Mitigation and Adaptation)

- ✓ Minimize development projects which leads deforestation
- ✓ Plant production program for enhance forest cover up to 32% in Sri Lanka (5 Million plants Programme)
- ✓ Reforestation projects, Awareness among the settlers, stakeholders and MASL officers
- ✓ Green Buildings, Cities (Moragahakanda & Laggala)
- ✓ Home gardens programme
- ✓ School children awareness programme
- ✓ Riverine programme and Bamboo Tree plantation along Mahaweli river
- ✓ Soil Conservation program with soil conservation practices as well as planting programs in upper and Lower Mahaweli catchment
- ✓ Green Energy Development project (Solar power on bare lands, Mini hydro power)



REFORESTATION AND GREEN BUILDINGS IN NEW MAHAWELI DEPLOYMENT AREAS



**“NOT ONE DROP OF WATER SHALL REACH THE
SEA WITHOUT FIRST SERVING MAN”**

BY. GREAT KING PARAKRAMABAHU (1153-1186)

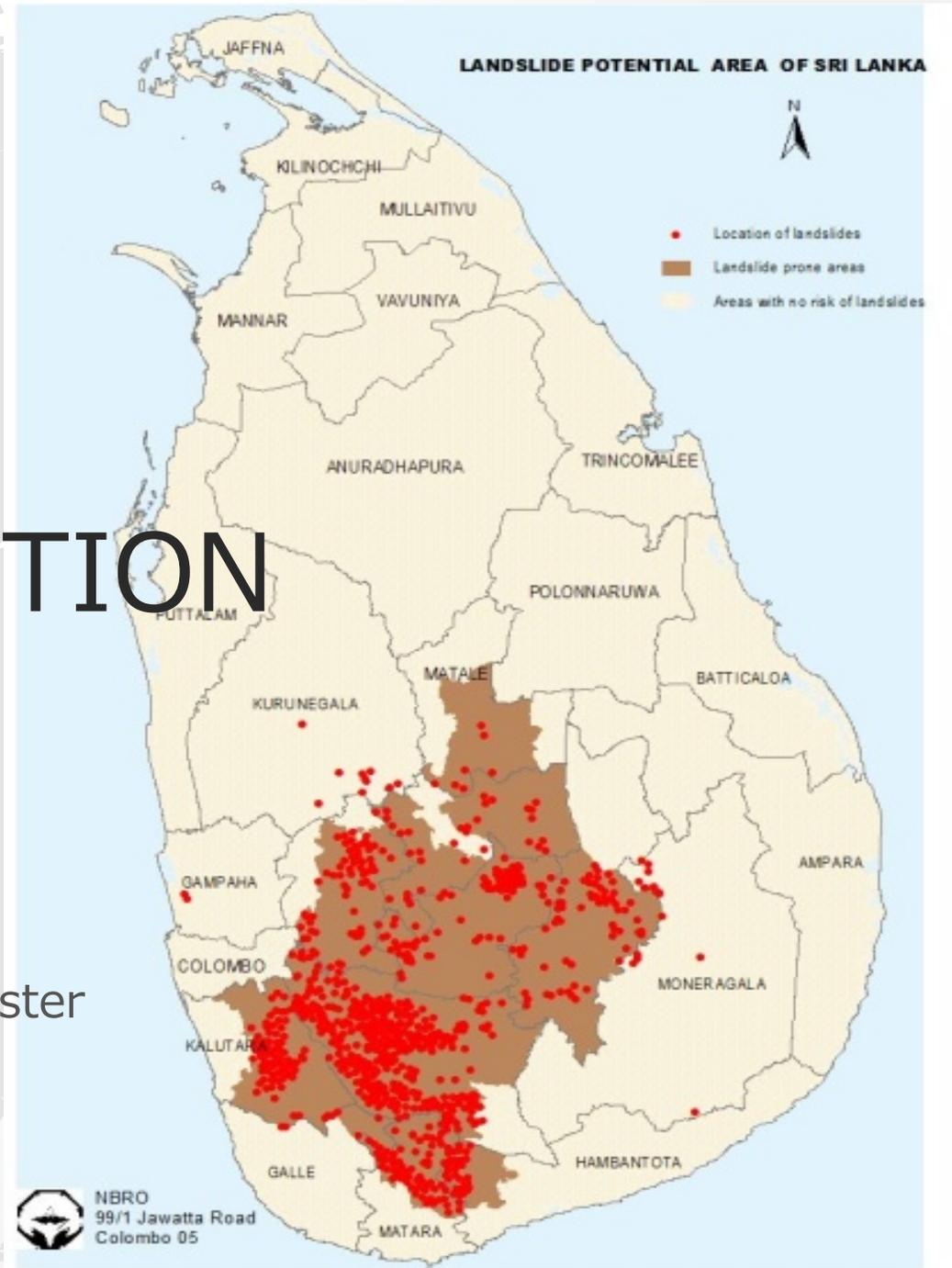
THANK YOU



LANDSLIDE RISK REDUCTION IN SRI LANKA

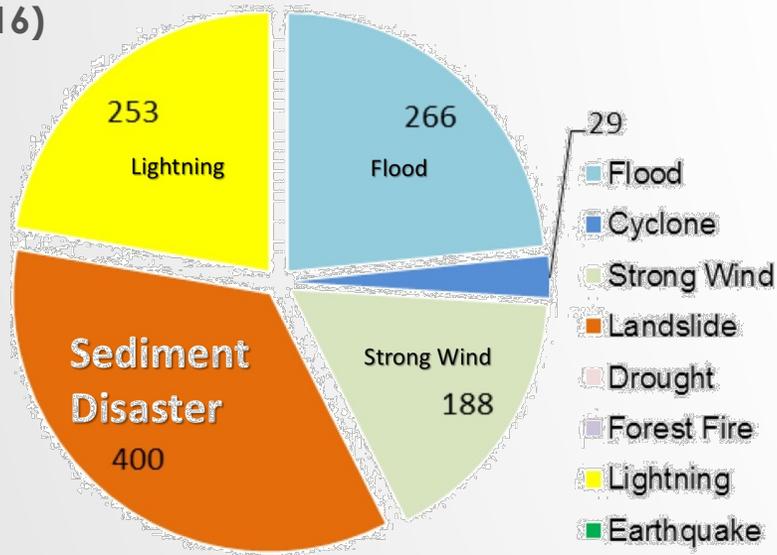
Eng.(Dr.) Asiri Karunawardena
Director General

National Building Research Organization- Ministry of Disaster
Management, Sri Lanka

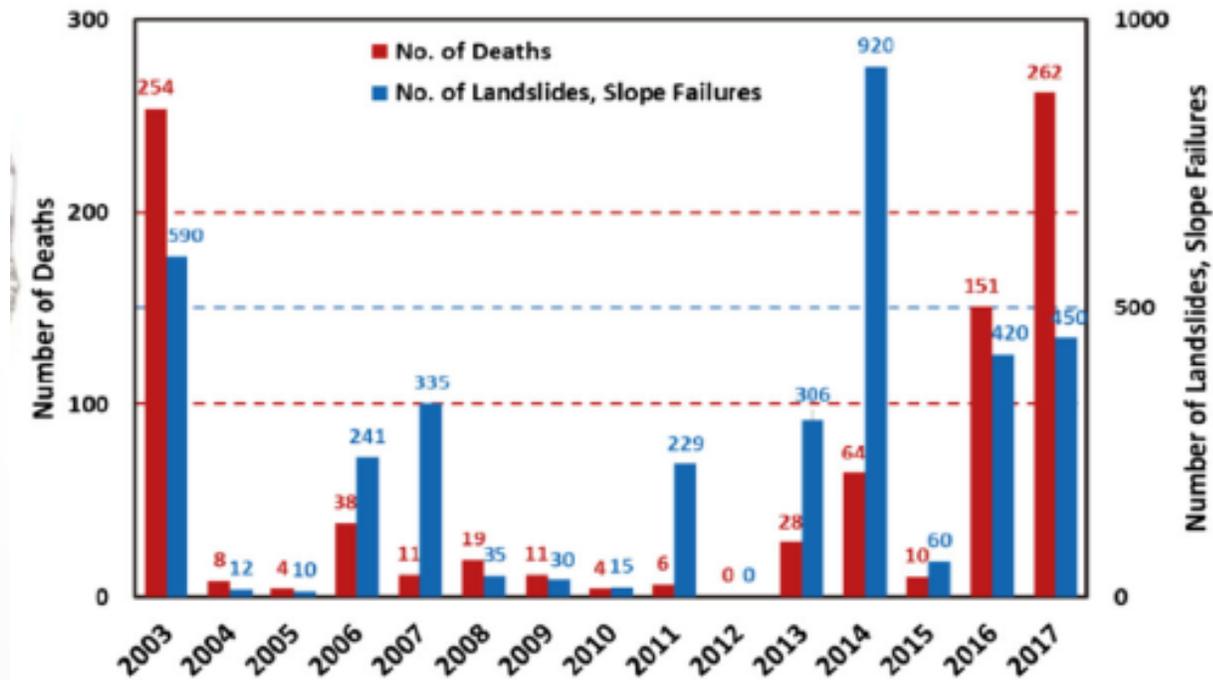


LANDSLIDE SITUATION IN THE COUNTRY

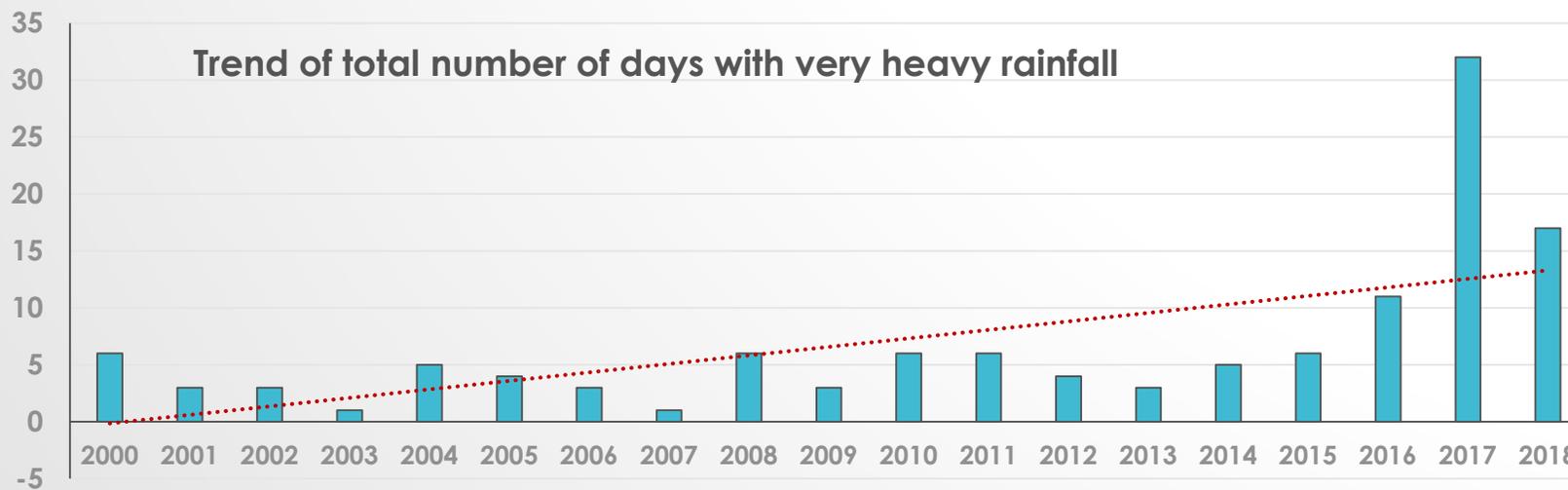
Deaths & Missing by Natural Disasters in 10 years (2007-2016)



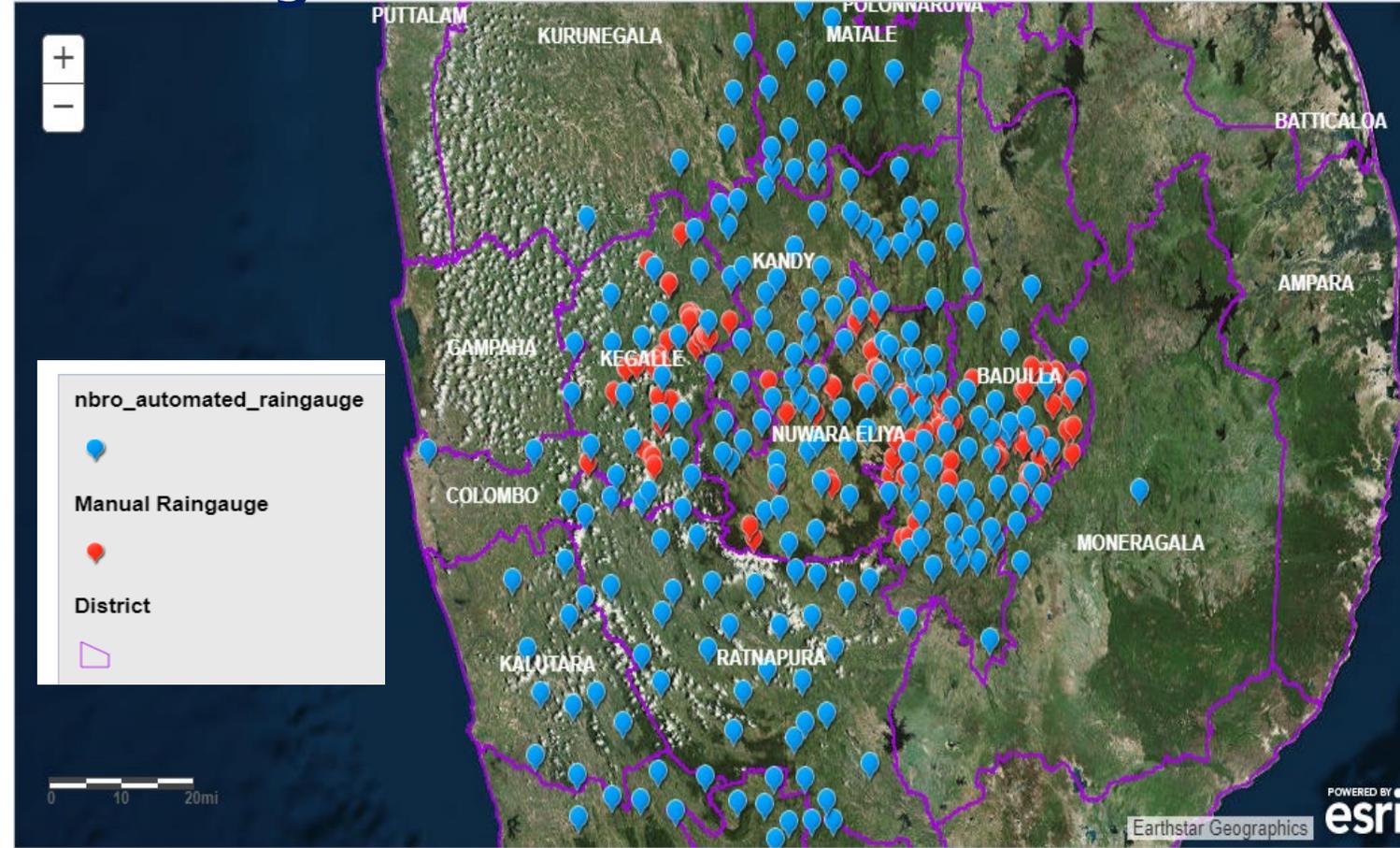
The most victims are from Sediment Disasters



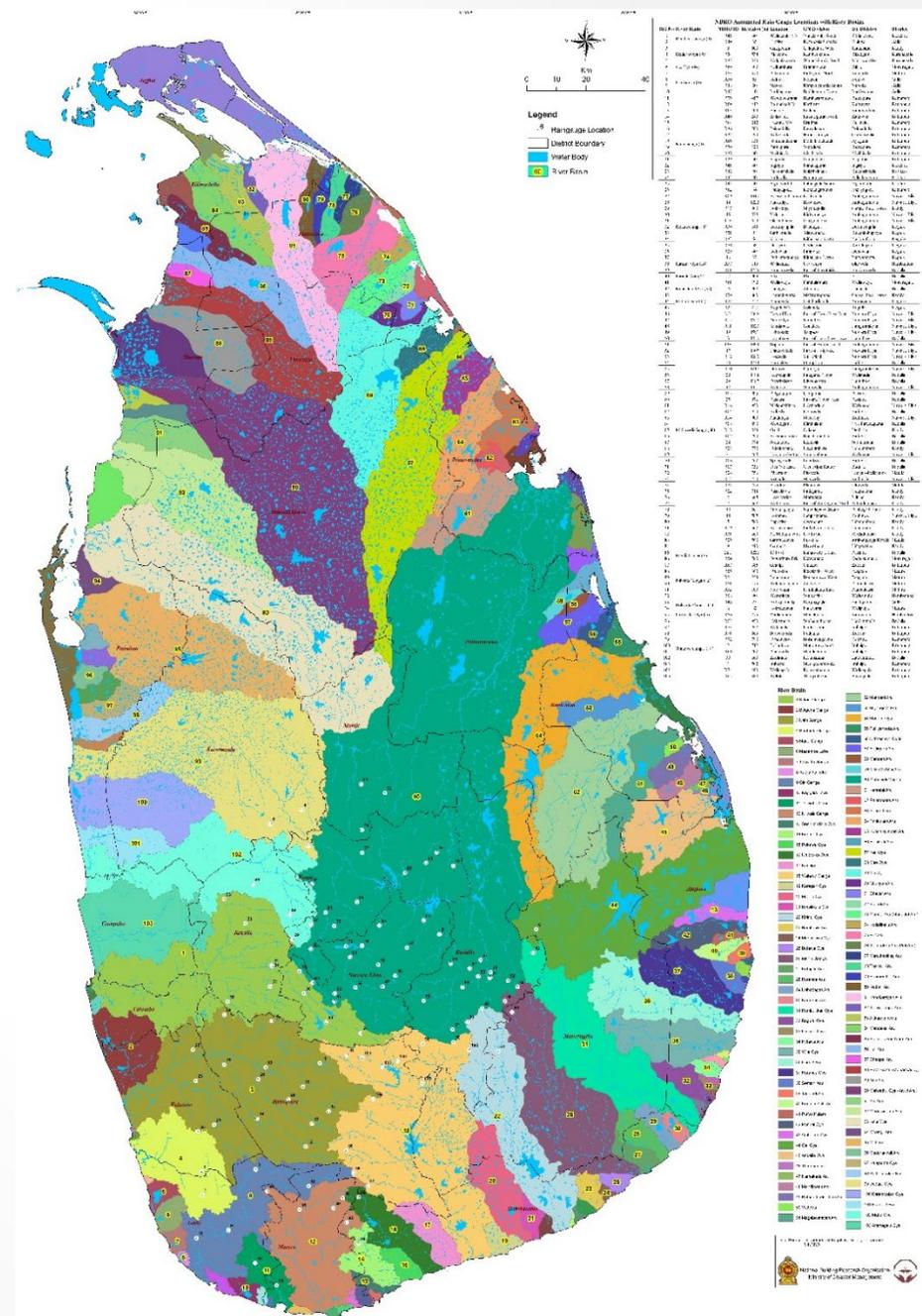
Number of lives lost due to landslides/slope failures : 2000-2017



Rain gauge Network for landslide early warning

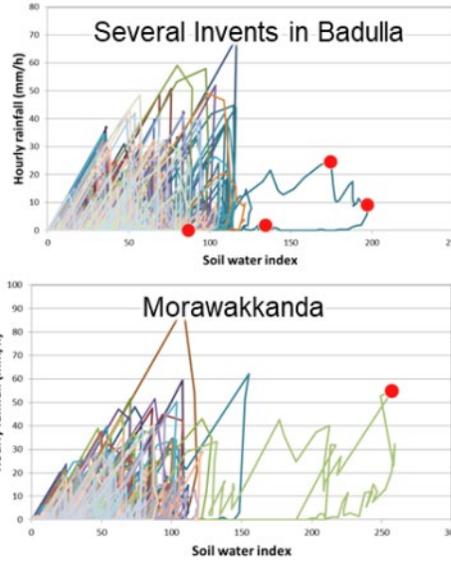


About 250 Nos of Automated Rain gauges have been installed in catchment area



Landslide Early Warning

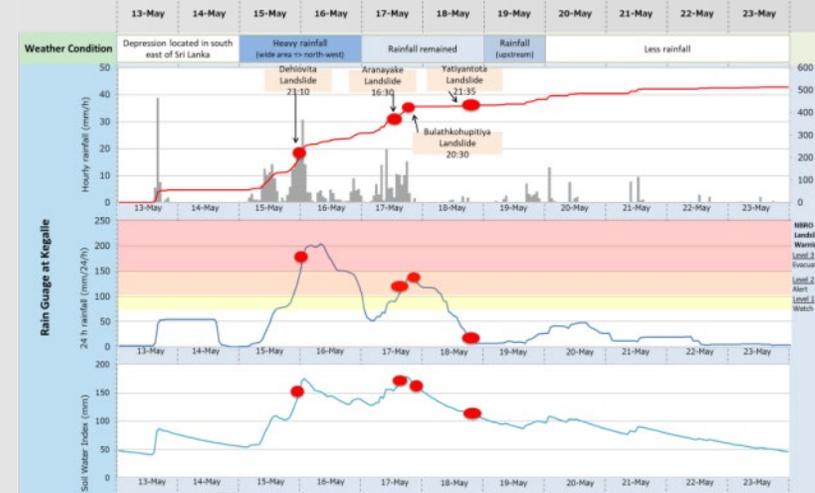
Improvement of Warning Criterial (Rainfall Threshold)



Analysis of rainfall and disaster occurrence

Alert	75 mm/day
Warning	100 mm/day
Evacuation / Off-limit	75 mm/hour or 150 mm/day

Current Warning Criteria (Rainfall Threshold)



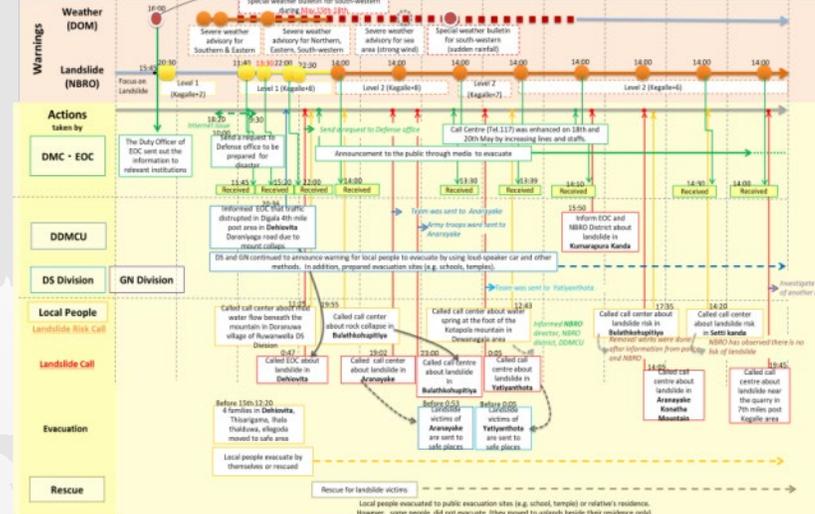
Effective Early Warning Dissemination



Interview at Morawakkanda

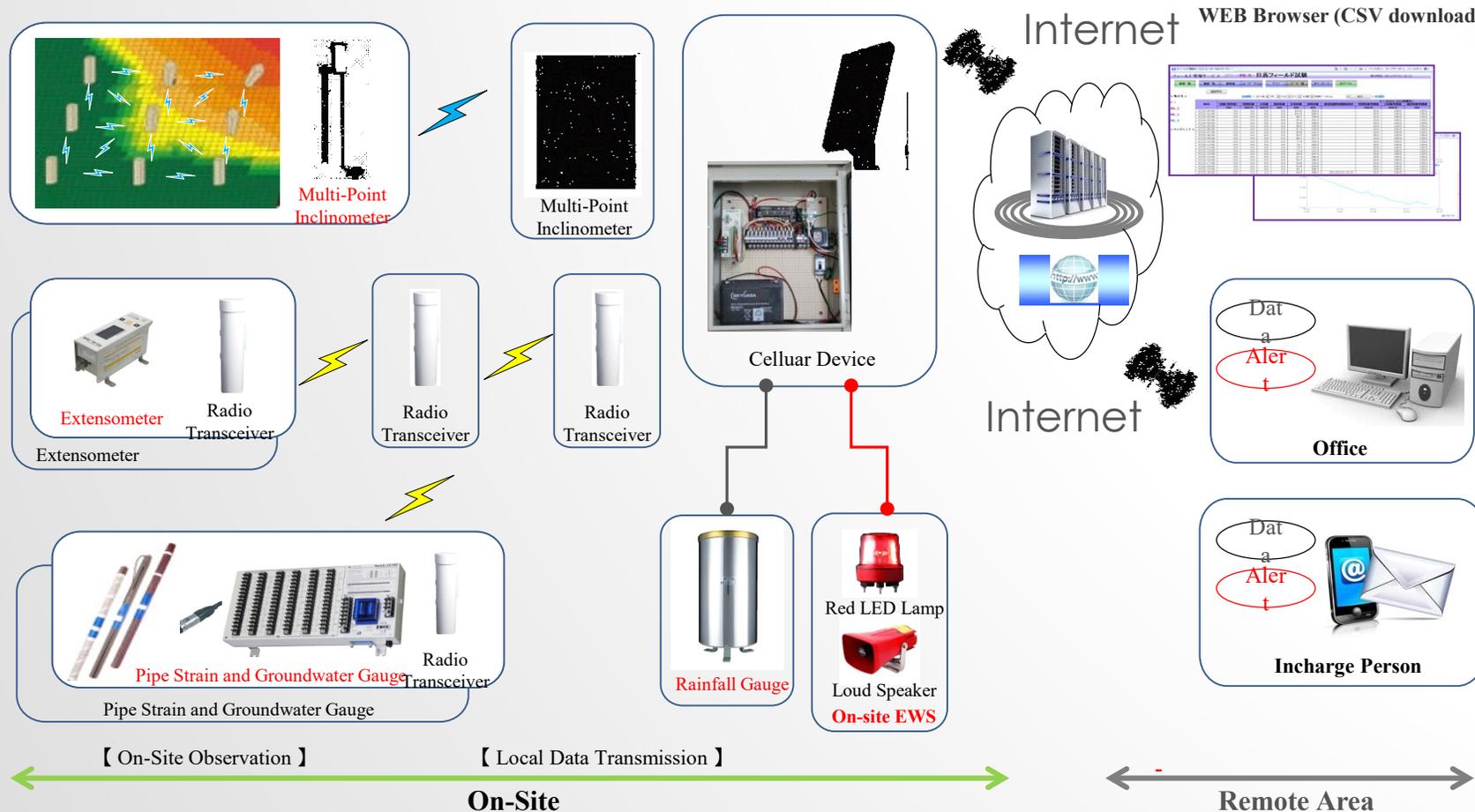


Interview at Weeriyapura



Improvement of landslide early warning system – site specific warning

- Development of the Landslide Remote Monitoring System (LRMS) - this is able to transmit on-site monitoring data using a radio communication network.
- Confirmation of landslide deformation based on several monitoring data such as extensometer, rainfall gauge and other instruments.
- determination of the reference value of appropriate landslide early warning in Sri Lanka



Landslide remote monitoring system

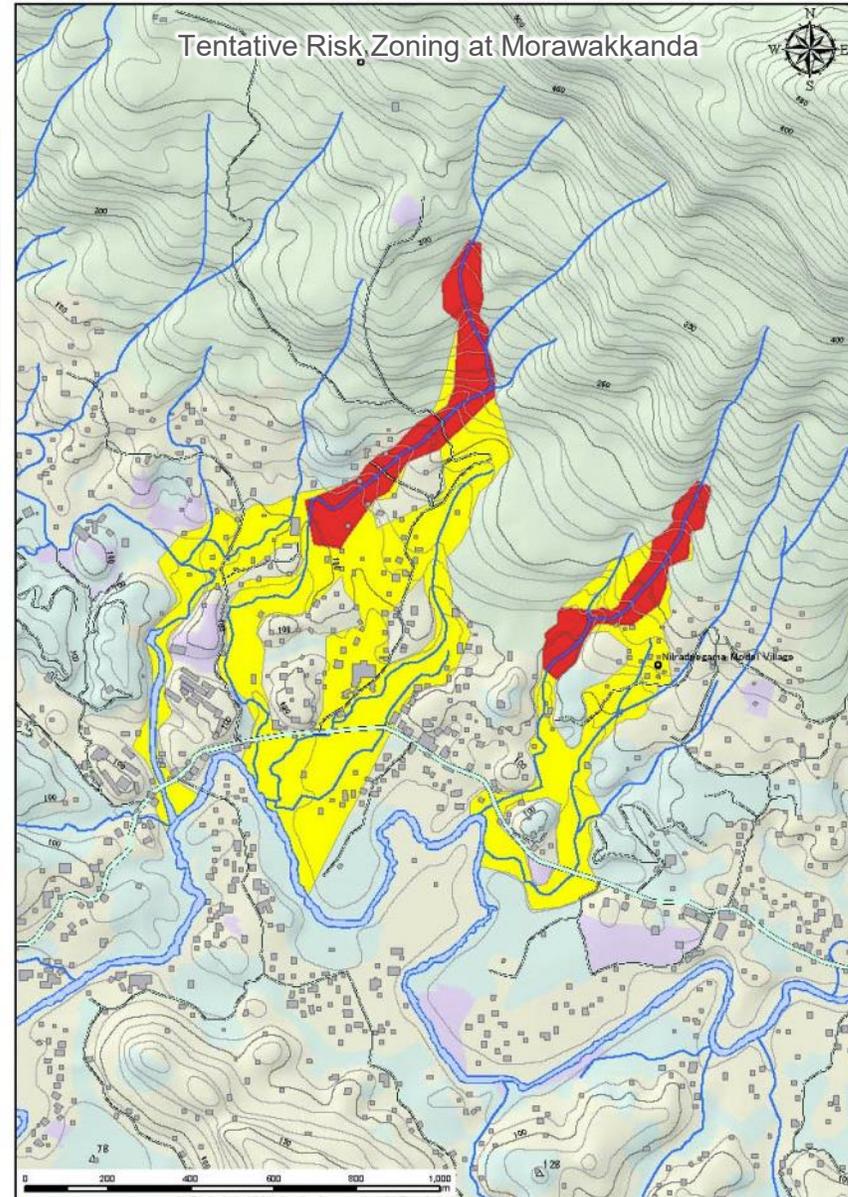
Preparating of Manual for Land Use Regulation / Development Standards



Meeting with Kotapola PS



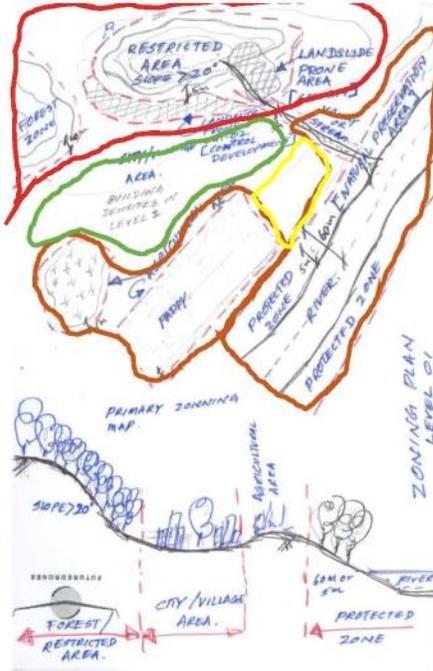
Meeting with Bulathkohupitya PS





Zoning Guide Plan [Draft]

- **Restricted Zone**
 - Slope >20 Deg.
 - Landslide prone (Cate. 4)
 - Forest zone
- **Protected Zone**
 - Landslide Prone (Cate. 3)
 - Areas near to environmental sensitive areas; 60 m from river center or 5m from river bank
 - Agricultural zones
 - Valley & Stream (5m from the stream bank or Valley ...?)
- **Warning Zone**
 - Landslide Prone (Cate. 2)
 - Flood prone (Warning zone)
- **Development Zone**
 - City/ Village Zone
 - Landslide prone (Cate. 1)



PROPOSAL OF CAPACITY DEVELOPMENT/FUTURE WORK

- Development of Real Time Risk Map for Landslide Disaster (by considering the rain fall, infiltration , soil water characteristic of soil, soil properties and geology)
Saturation of soil in the catchment area will be estimated using Hydrological model → Possibility of using Rainfall- Runoff- Inundation(RRI) model develop by ICHARM will be investigated

STRATEGIC WAY FOR GLOBAL AGENDA

- Sendai Framework for Disaster Risk Reduction 2015-2030
“Priority 1: Understanding disaster risk” through risk assessment and early warning of Landslides
- Contribution to Sustainable Development Goals (SDGs)
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable.
Goal 13. Take urgent action to combat climate change and its impacts.

Towards a safer Sri Lanka: road map for disaster risk management

We face risk



Changing risks



**Department of Meteorology
Sri Lanka**

12th Asia-Oceania Group on Earth Observations (AOGEO) Symposium

Canberra, Australia on 2nd – 4th November 2019

**Increasingly complex and
unpredictable risks**



Athula Karunanayake

Director General

Department of Meteorology

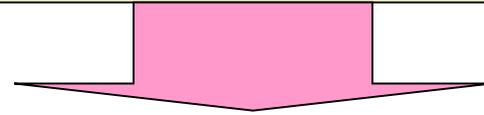
athu1970@yahoo.com

0773050535

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Missions of DOM

To protect life and property from natural disasters such as floods, landslides,, storms, etc.



Development of a Numerical Weather Prediction system

Based on physical laws

Beyond several hours

Accurate prediction of timing and location of severe weather events

Accurate prediction of typhoon tracks

Development of a Nowcast system

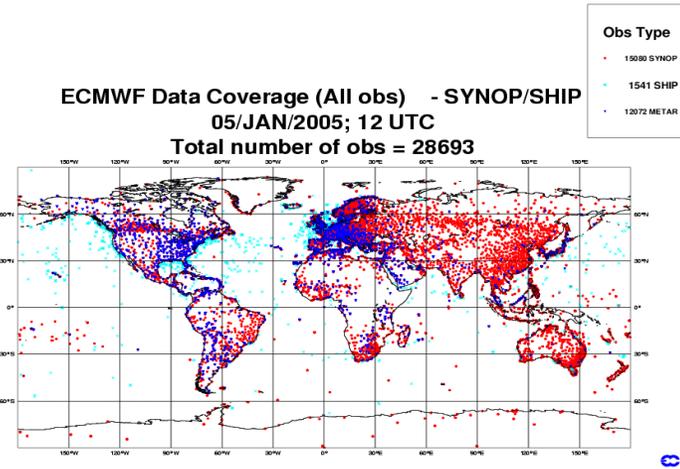
Based on a heuristic method

Up to a few hours

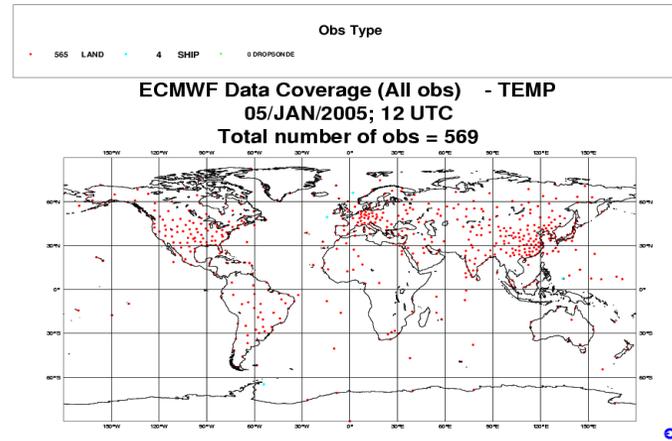
Accurate prediction of timing and location of precipitation

Global Observing System

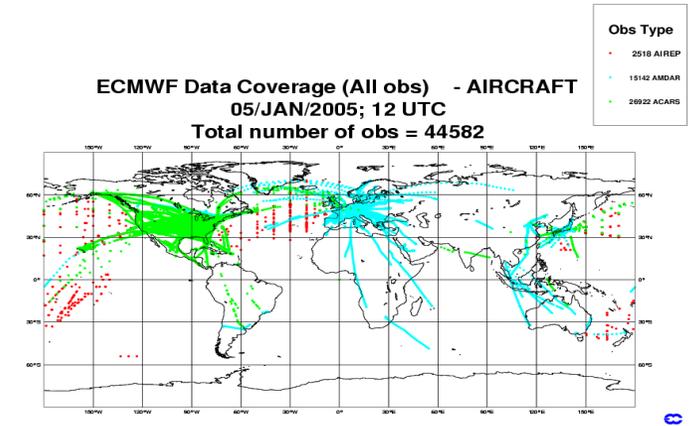
❖ SURFACE OBSERVING SYSTEM (Observations from land stations and ships)



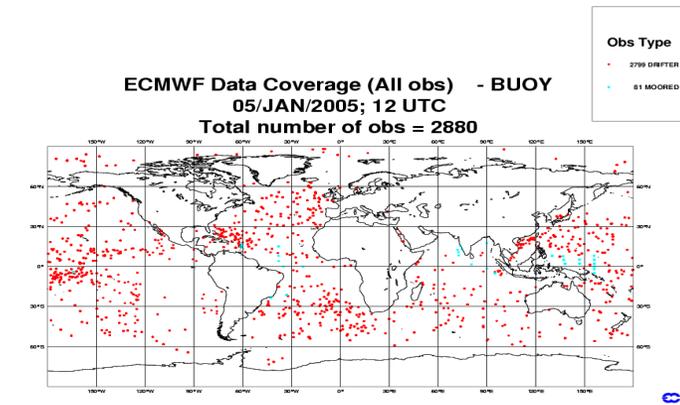
❖ UPPER-AIR OBSERVING SYSTEM (Observations from upper-air stations)



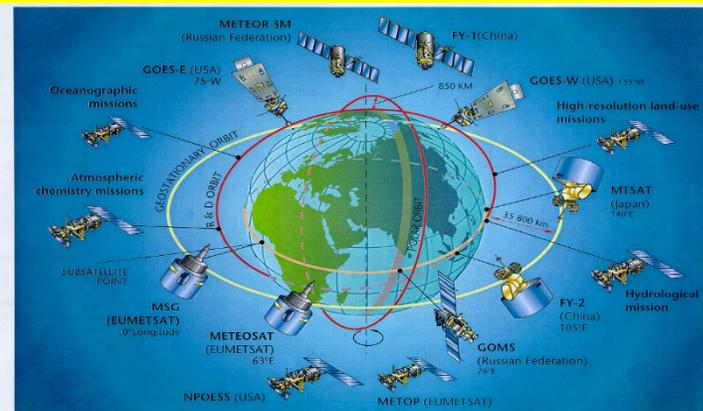
❖ UPPER-AIR OBSERVING SYSTEM (Observations from aircraft)



❖ SURFACE OBSERVING SYSTEM (Observations from buoys)



❖ Space segment of GOS

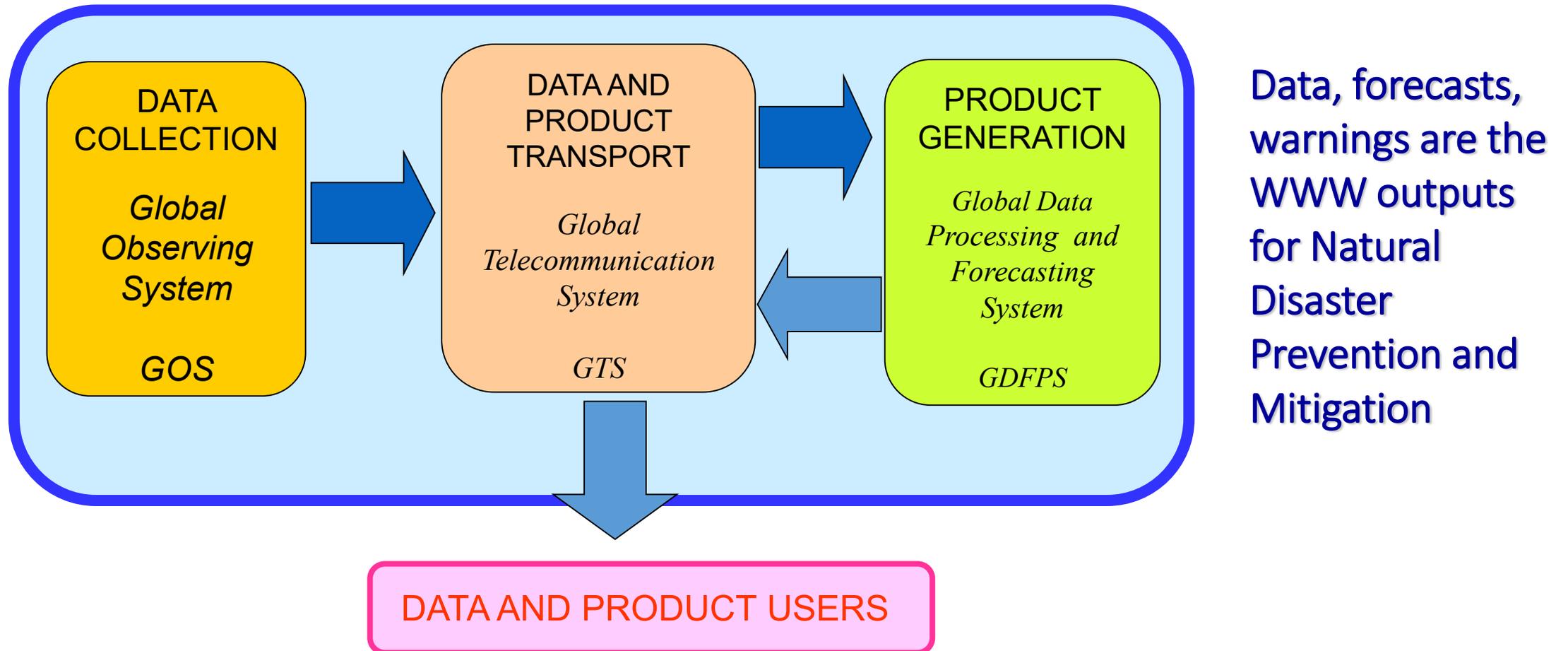


Other observation platforms

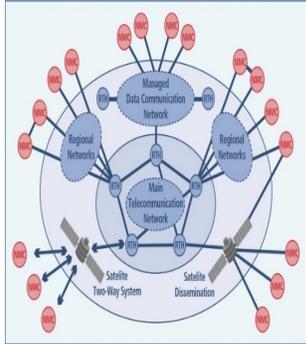
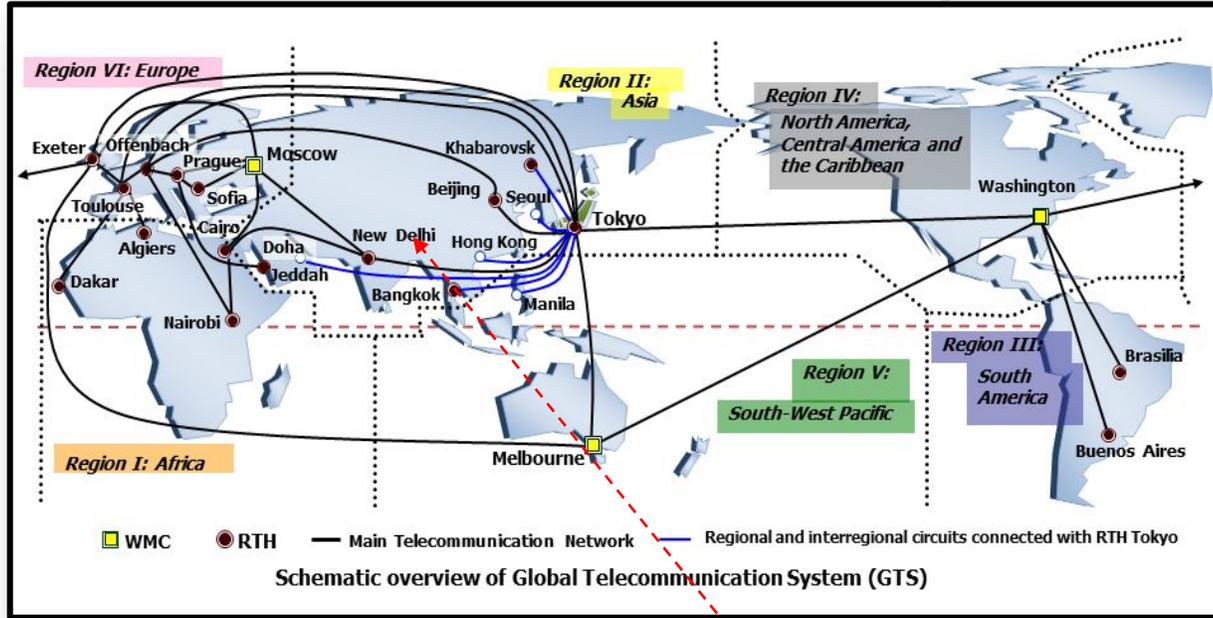
- Doppler radars
- solar radiation observations
- lightning detection measurements
- tide-gauge measurements

FLOW OF INFORMATION

The World Weather Watch consists of observing systems, telecommunication facilities, and data-processing and forecasting centres - owned and run by WMO Members countries - to generate and distribute meteorological and related geophysical observations, forecasts and early warnings

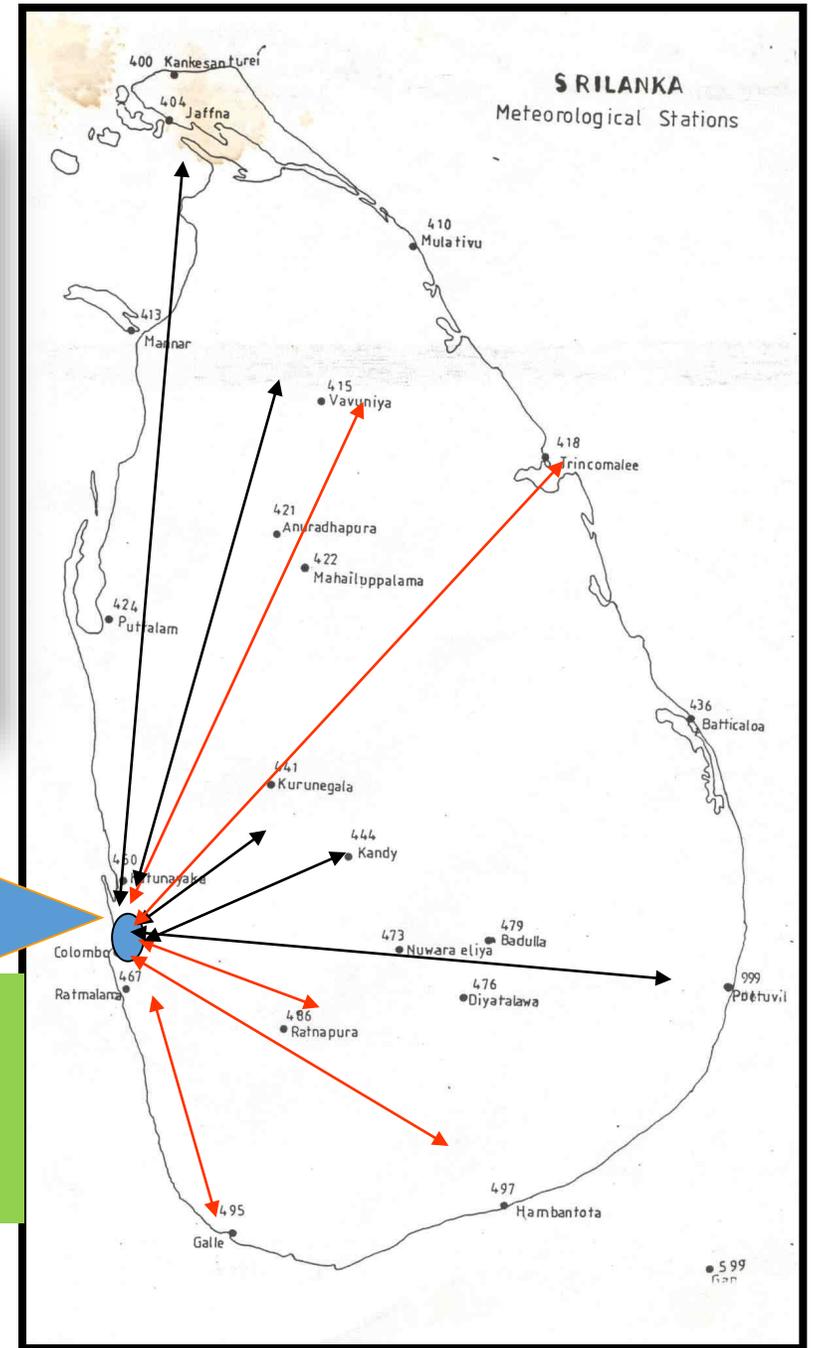


Data communication-GTS/MSS



Global Data Processing and Forecasting System

Centres with geographical specialization:
New Delhi

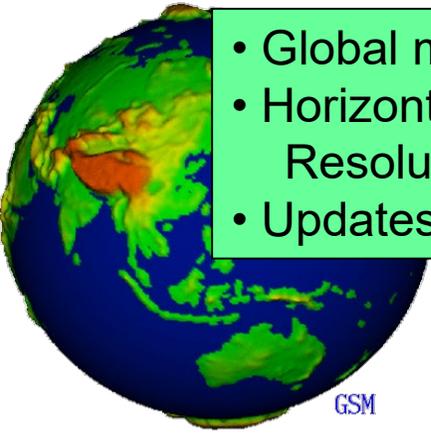


World Meteorological Centers(WMCs)
 (ලෝක කාලගුණික මධ්‍යස්ථානය)

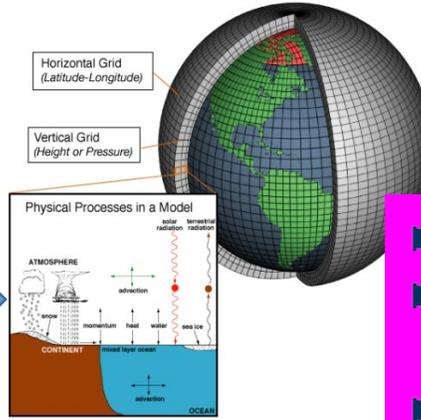
- ❖ Melbourne
- ❖ Moscow
- ❖ Washington

Regional Specialized Meteorological Centers (RSMCs)
 (කලාපීය කාලගුණික මධ්‍යස්ථානය)

Current Operational Numerical Models

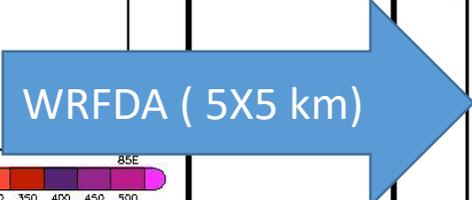
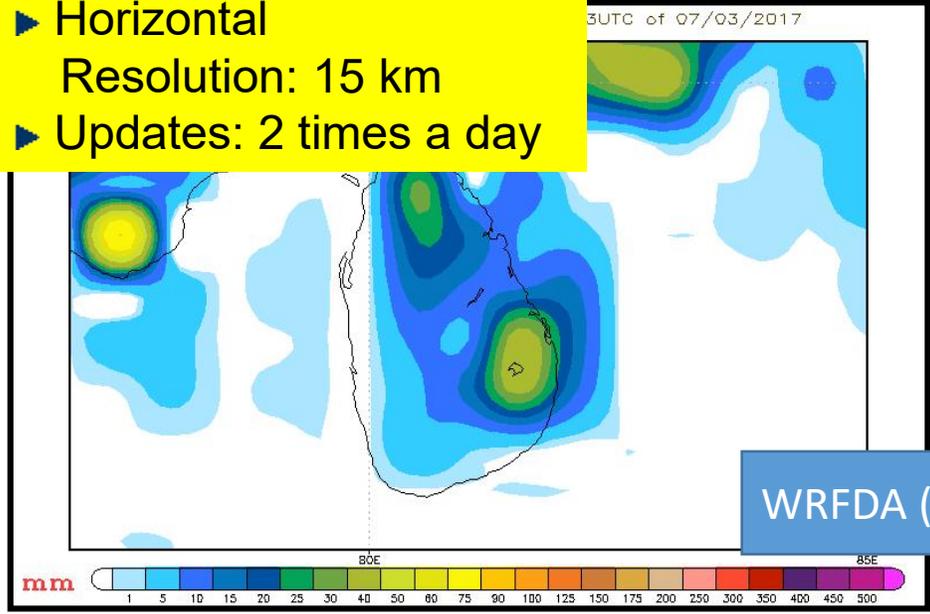


- Global model
- Horizontal Resolution: 60 km
- Updates: 2 times a day

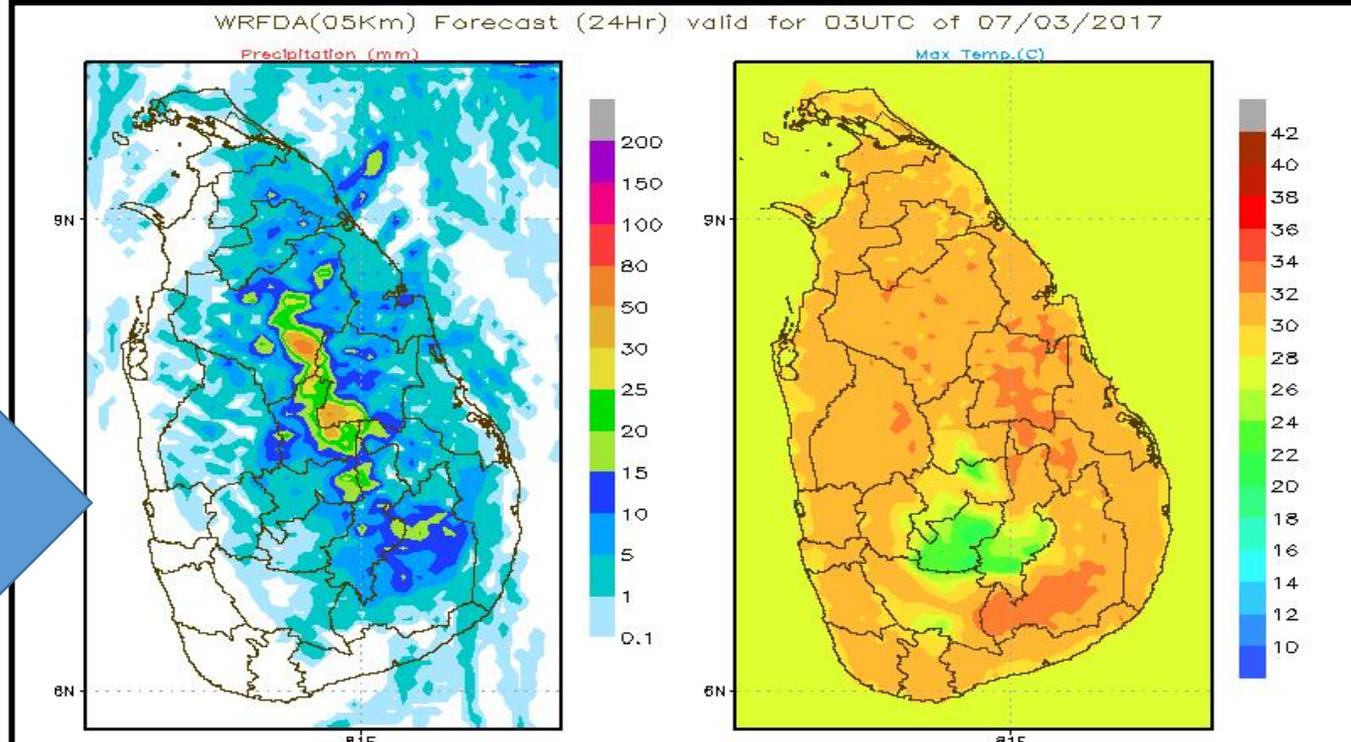


- ▶ Mesoscale model
- ▶ Horizontal Resolution: 10 km
- ▶ Updates: 4 times a day

- ▶ Regional model
- ▶ Horizontal Resolution: 15 km
- ▶ Updates: 2 times a day



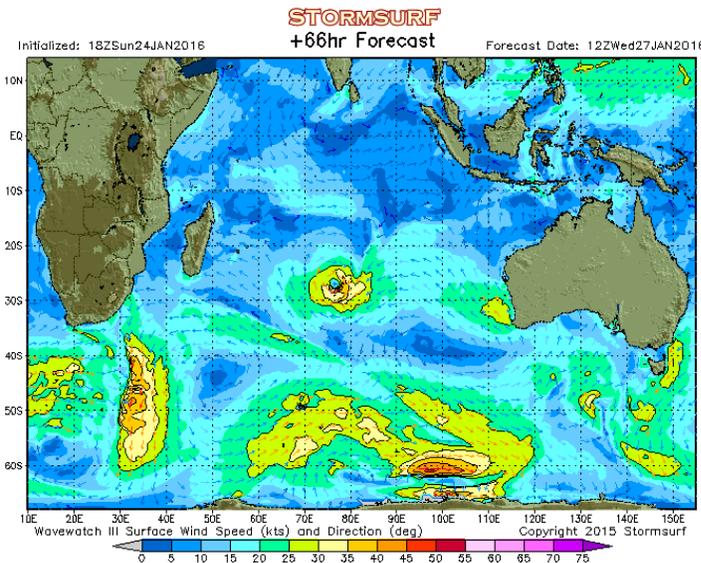
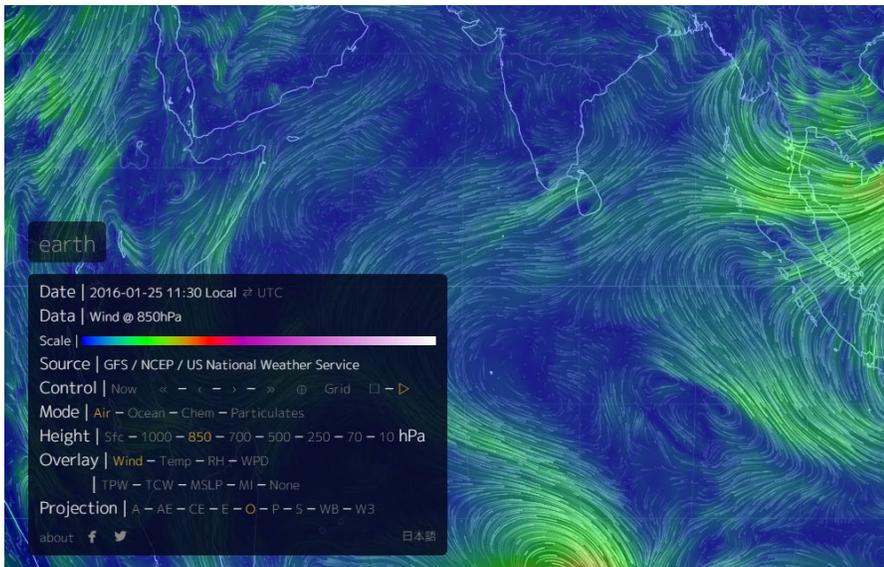
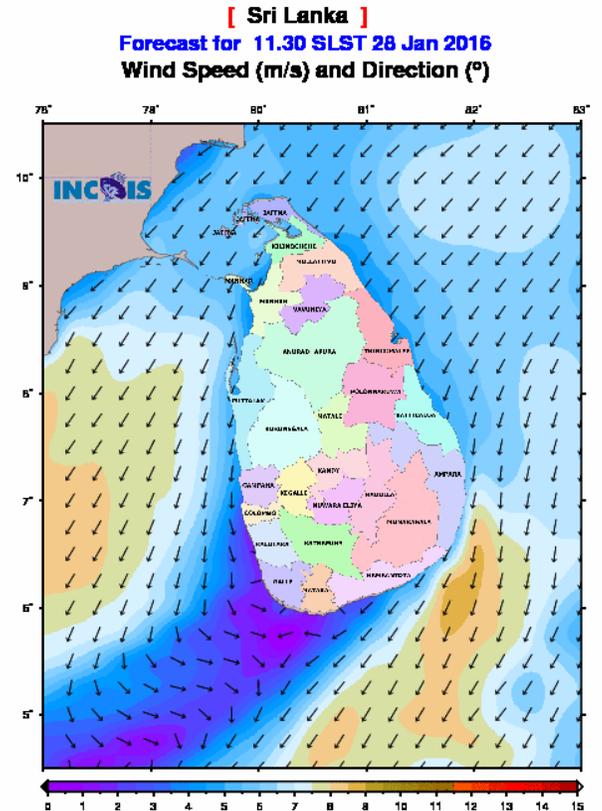
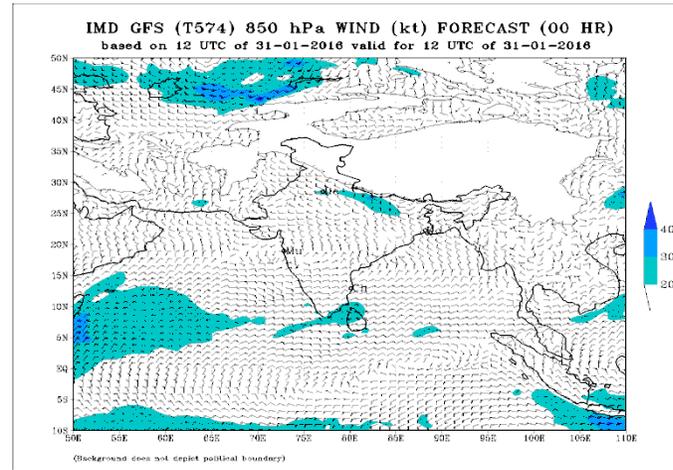
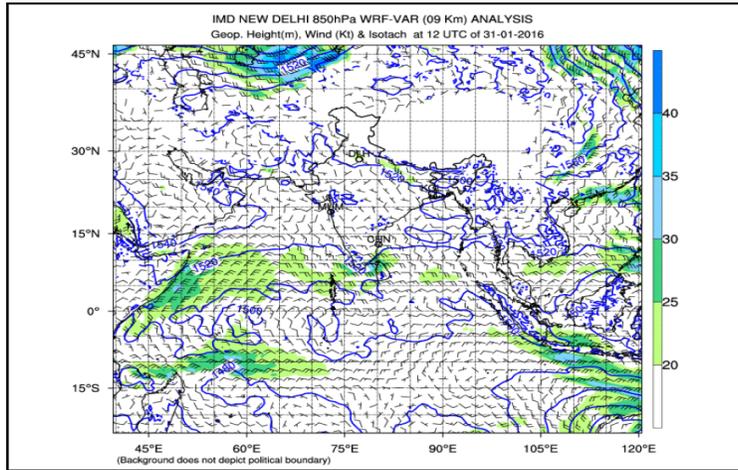
WRFDA (5X5 km)



GFS(0.5X 0.5 degree ~ 50km X 50km) Initial image

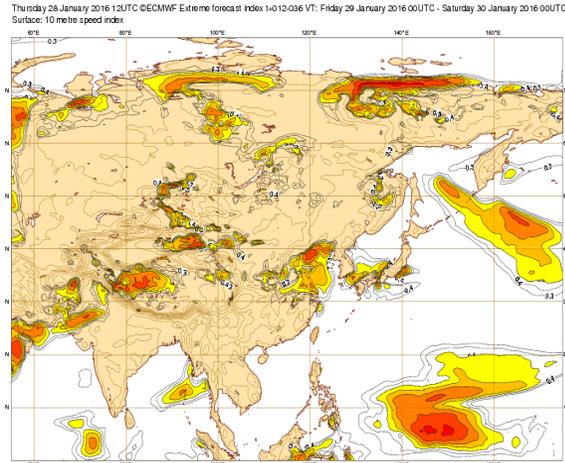
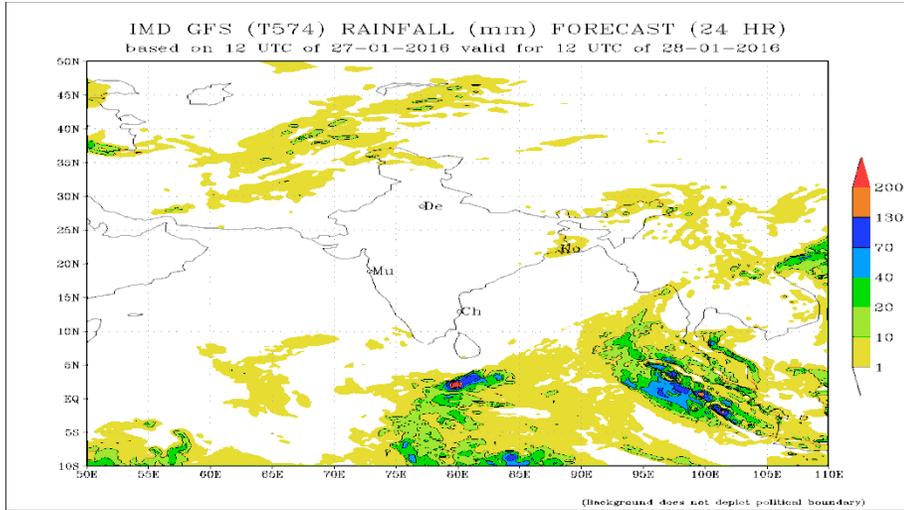
Study model forecasts (eg: [Stormsurf](#), [Earth nullscloud](#), [India meteorological website](#), [INCOIS](#) etc.)

Wind forecast models

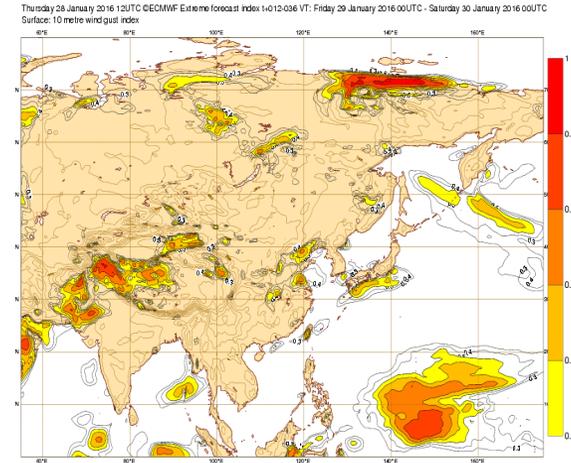


Rainfall forecast

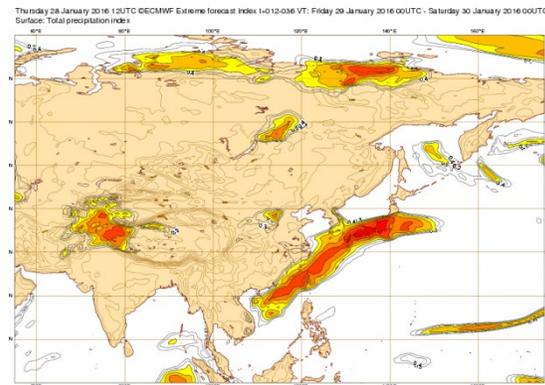
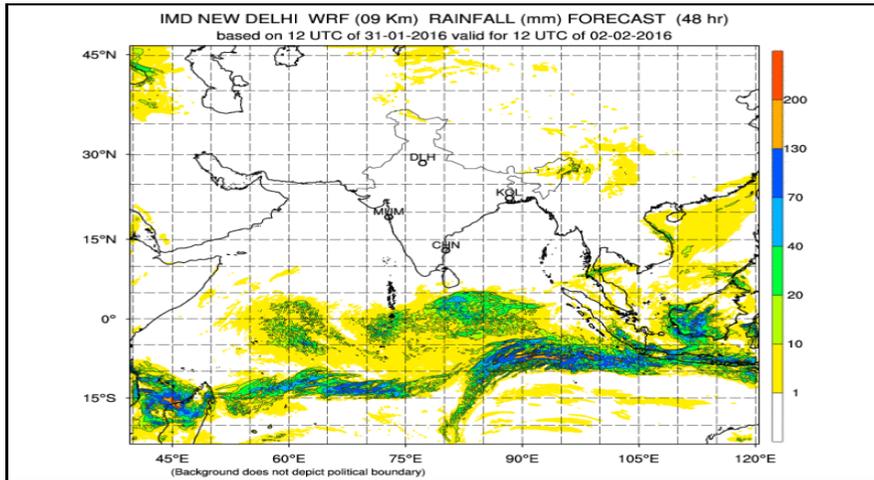
ECMWF model – extreme weather forecast



Wind speed

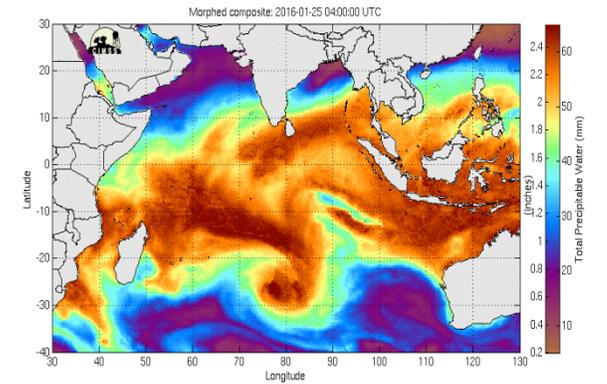


Wind gust



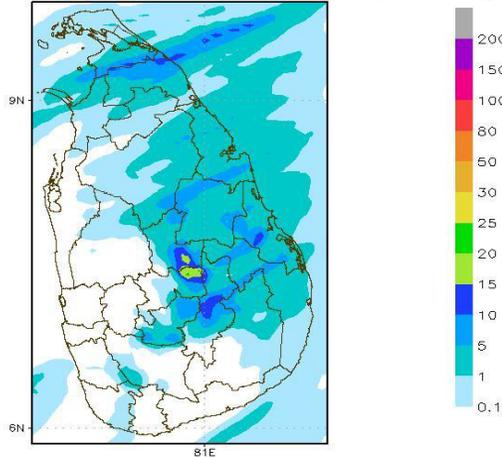
Precipitation

Total precipitable water

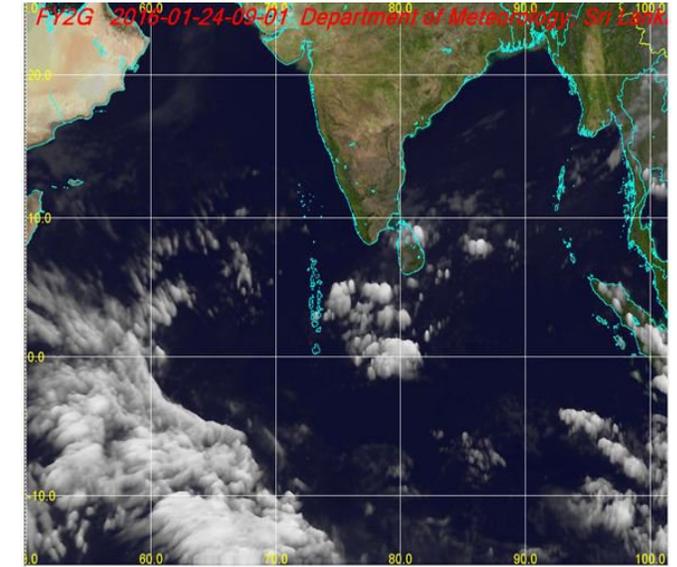
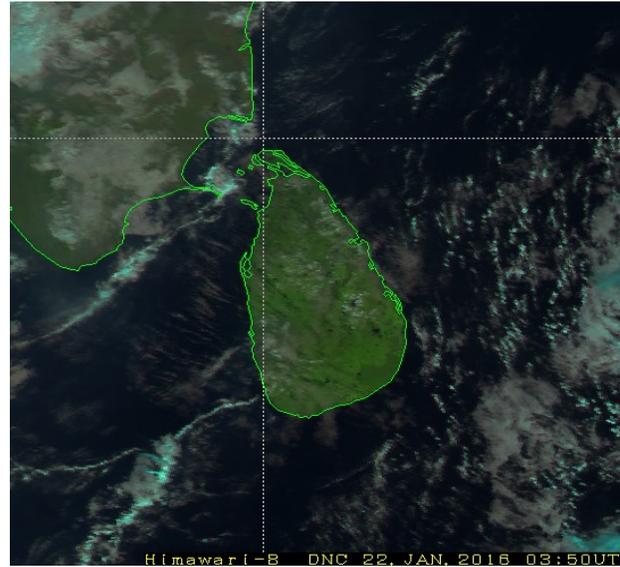


Numerical Weather Predictions (NWP)

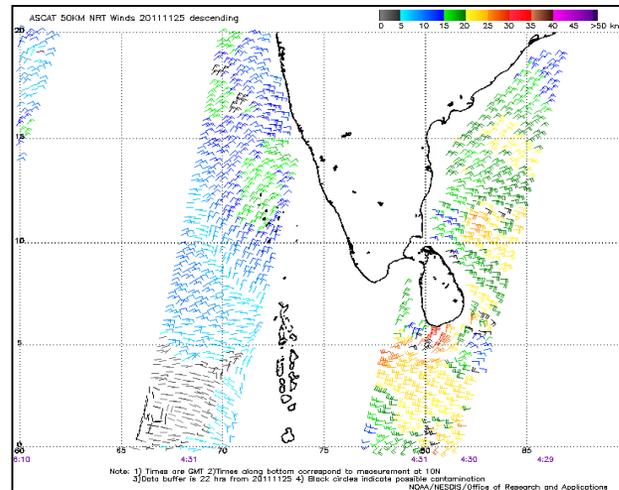
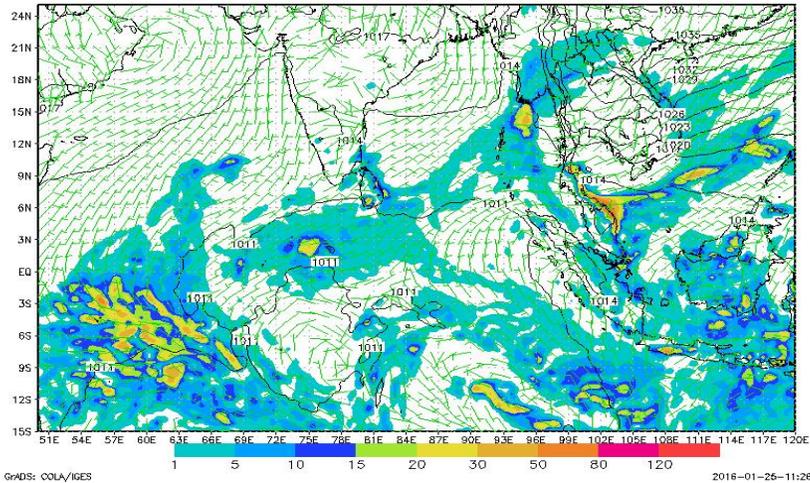
WRFDA(5KM) Rainfall(mm) valid 03UTC 24/01/2016 (24Hours)



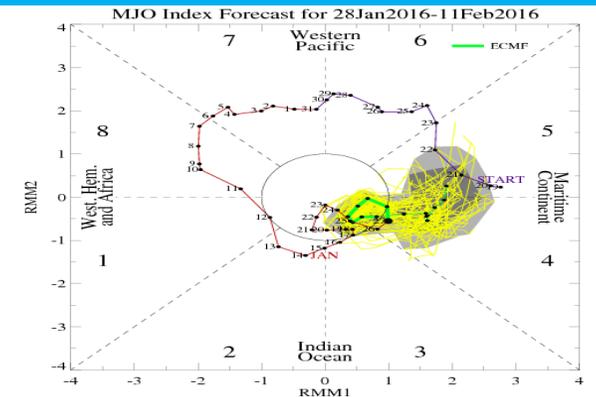
Analyze satellite images (eg: [Himawari 8](#), FY2G, [ASCAT](#), ect.)



12_Hours RainFall(Region)_12Z25JAN2016



Maddern - Julian Oscillation monitoring



National Meteorological Centers

The NMCs prepare:

❖ Forecasting

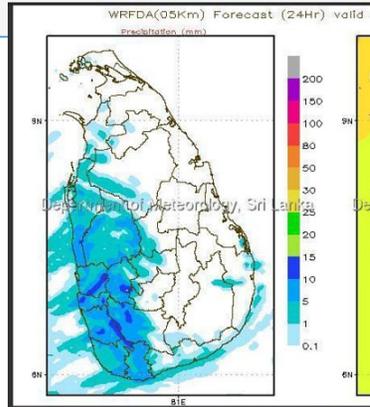
- Weather forecasting, advisory and warning issue and Tsunami monitoring
- Marine forecasting
- Numerical weather prediction
- Now casts and very short-range forecasts ?

❖ **Short, medium, extended- and long-range** forecasts based on products received from WMCs and RSMCentres, or by integrating regional models using boundary conditions based on these products;

❖ Special application-user products, including **warnings of severe weather, climate and environmental quality monitoring and prediction products;**

❖ Non-real-time climate-related analyses and diagnosis

Short Range



Western, Sabaragamuwa, Central, North-western and Uva provinces and Galle, Matara, Welisara and Kilinochchi districts.

PLEASE BE AWARE

Heat Weather Advisory Issued by the Natural Hazards Division At 12.00 p.m. 25 April 2018 for the Western, Sabaragamuwa, Central, North-western and Uva provinces and Galle, Matara, Welisara and Kilinochchi districts.

Bulletin No: 01
COLOR: Amber

Caution level is expected in the Western provinces and in some parts of the northern side of the Badulla, Matara and Welisara districts will experience well.



Summary : Consensus Seasonal Rainfall outlook for June, July, August (JJA) Season 2018

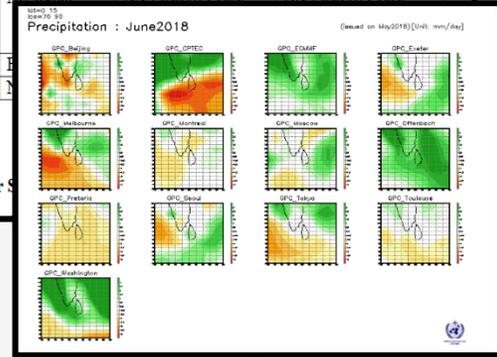
Table 2: SUMMARY of Model Forecasts for Seasonal Rainfall Outlook for JJA 2018

Season	WMO LC MME	WMO GPC	CPT	Final
JJA season 2018	N Northern and No signal elsewhere	No signal	No signal	No signal
June 2018	N Northern and No signal elsewhere	No signal	BN Eastern Coast	BN Eastern Coast
July 2018	BN	BN	BN	BN
August 2018	No signal	No signal	No signal	No signal

Seasonal forecast

BN: Below Normal N: Normal

Summary of Model Forecasts for Seasonal Rainfall Outlook for JJA 2018



Meteorological Services

Medium Range

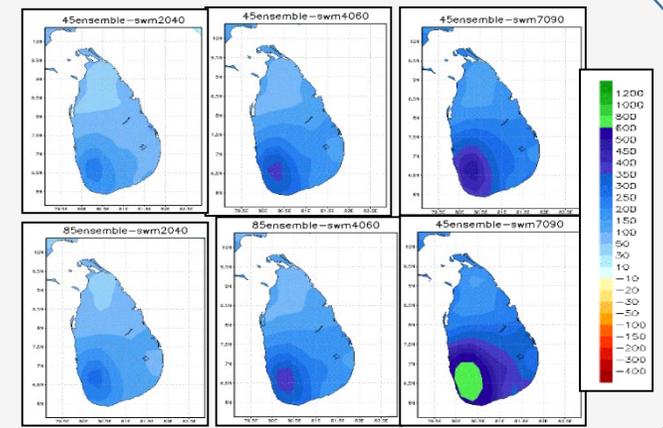
10 DAY FORECAST FOR COASTAL AREAS AROUND SRI LANKA

Issued at 3.00 p.m. on 08th June 2018

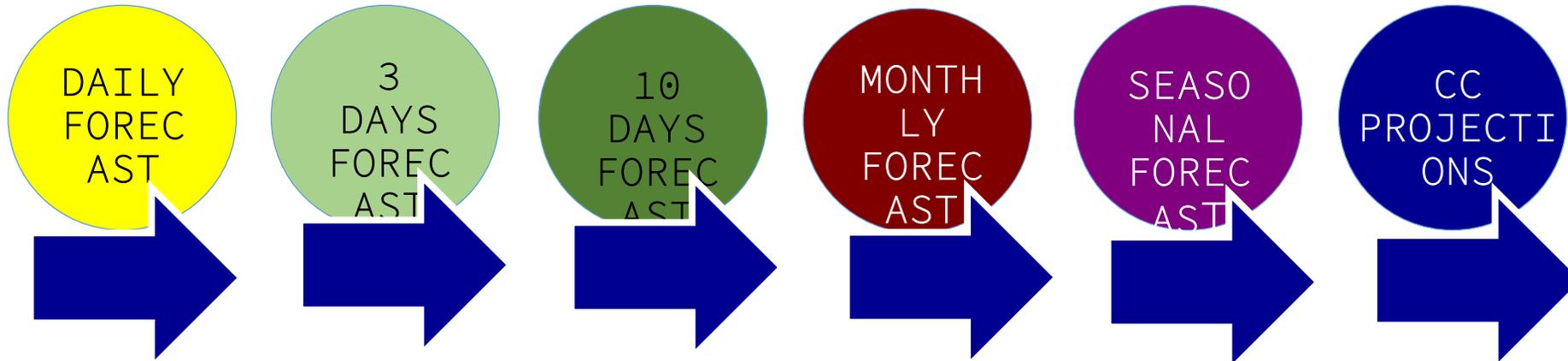
Maritime Weather Division, National Meteorological Centre, Department of Meteorology

Date	Wind and Rainfall Forecast	Significant wave height	Wind Gust
08.06.18

Climate Projections



Responding to User Requirements: Forecast of Various Timescales



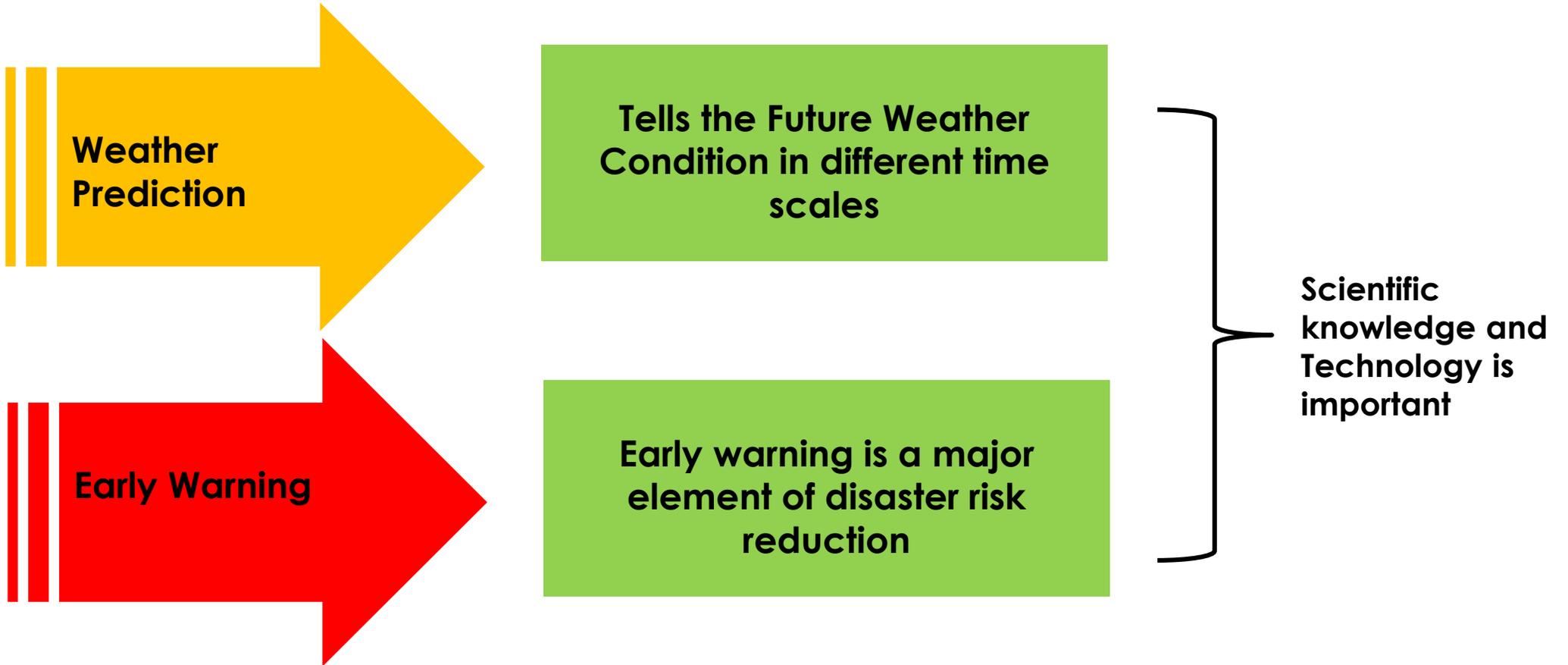
DEVELOPMENT OF FORECAST OF DIFFERENT TIMESCALES IN SRI LANKA BASED ON STAKEHOLDER DEMANDS

Analyze synoptic data , Study model forecasts, Rainfall forecast, ECWMF model – extreme weather forecast, Total precipitable water, Analyze satellite images (eg: [Himawari 8](#), FY2G, [ASCAT](#), ect.), Numerical Weather Predictions (NWP)

ENHANCEMENTS IN SPATIAL RESOLUTION WERE ALSO INTRODUCED BY DOM; FORECAST FOR SPECIFIC SECTORS EVOLVED

Where We Are Now?

(Department of Meteorology)



Our target is to achieve these two for better service for general public and different sectors to contribute economy of Sri Lanka

To minimize the hazards



- **Next 6 hours** (Very Short Range Weather Forecast)
- **Next 1 hour to 3 hour** (Now-casting)

To prepare Weather Forecast in above time scales

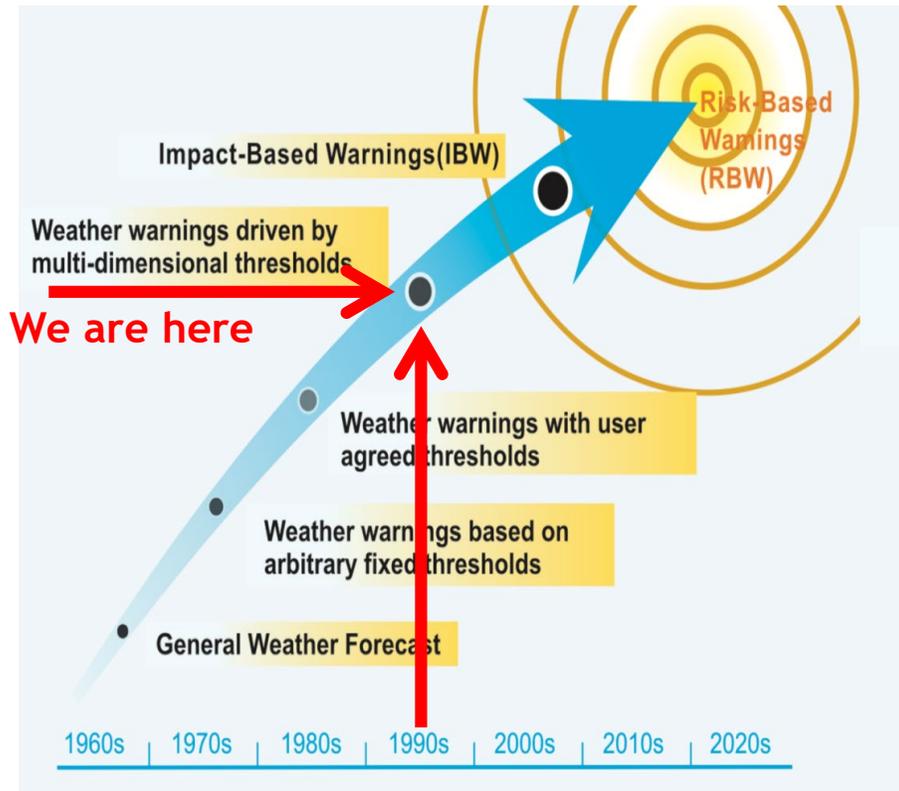
- Doppler Weather Radar
- Dense AWS network
- Analyze satellite images data (eg: [Himawari 8](#), [FY2G](#), [ASCAT](#), ect.),**
 - We need help from ICHARM**
- Speed Data Communication Technology
- Latest technology with instruments
- High speed computers
- More sophisticated, accurate and reliable Climate data Measuring instrument
- Mathematical and Scientific knowledge about Atmosphere and its motion

Roadmap/Strategic way for Global Agenda

Important for better Public Weather Service (PWS) / Early Warnings for DRR

DEPARTMENT OF METEOROLOGY - SRI LANKA

Three important global agreements Sri Lanka has recently committed to



Source : WMO

- **Sendai Framework for Disaster Risk Reduction**

At the 3rd UN World Conference on DRR in March 2015 countries adopted the SFDRR, a 15-year, voluntary, non-binding agreement that aims for the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.

- **Sustainable Development Goals**

In September 2015, countries adopted a set of goals to end poverty, protect the planet, and ensure prosperity for all as part of a new sustainable development agenda.

- **UNFCCC/Paris Agreement**

At the Paris climate conference (COP21) in December 2015, 195 countries adopted the first-ever universal, legally binding global climate agreement. The agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to below 2° C.

Challenges and Gaps

Integrated Forecasting System

Output from different meteorological observation systems, numerical weather products, satellite imagery and forecast tools are analyzed separately in arriving at the weather forecast.

Accuracy of the forecast can be improved by developing an integrated forecasting system

Data Collection, Quality Control and Archival system

Meteorological/climatological processing and archival system based on personal computer environment is based on WMO supported CLICOM and CLIMSOFT database management systems.

Public Weather Service

Public Weather Service is to strengthen the capacity and skill to meet the needs of the users through delivery of comprehensive weather services.

Necessary to establish a public weather service system capable of delivering the user required services.

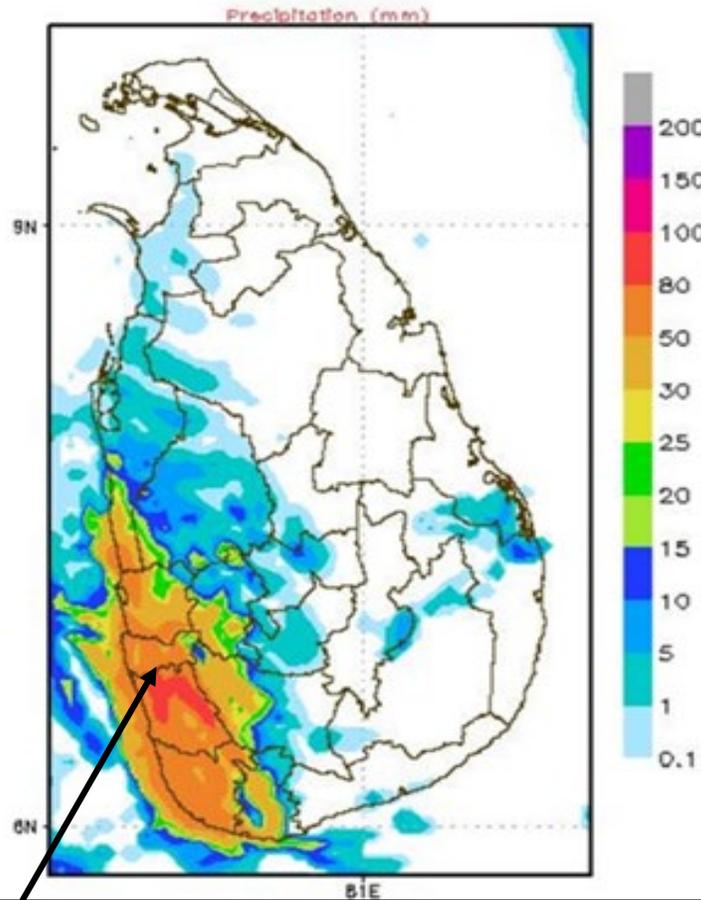
User Services for Major sectors

Quality of meteorological data and forecast is crucial to ensure the safety of flights.

To enhance the services provided to aviation sector a pilot briefing system with direct web based access is required to be installed at Katunayake International Airport

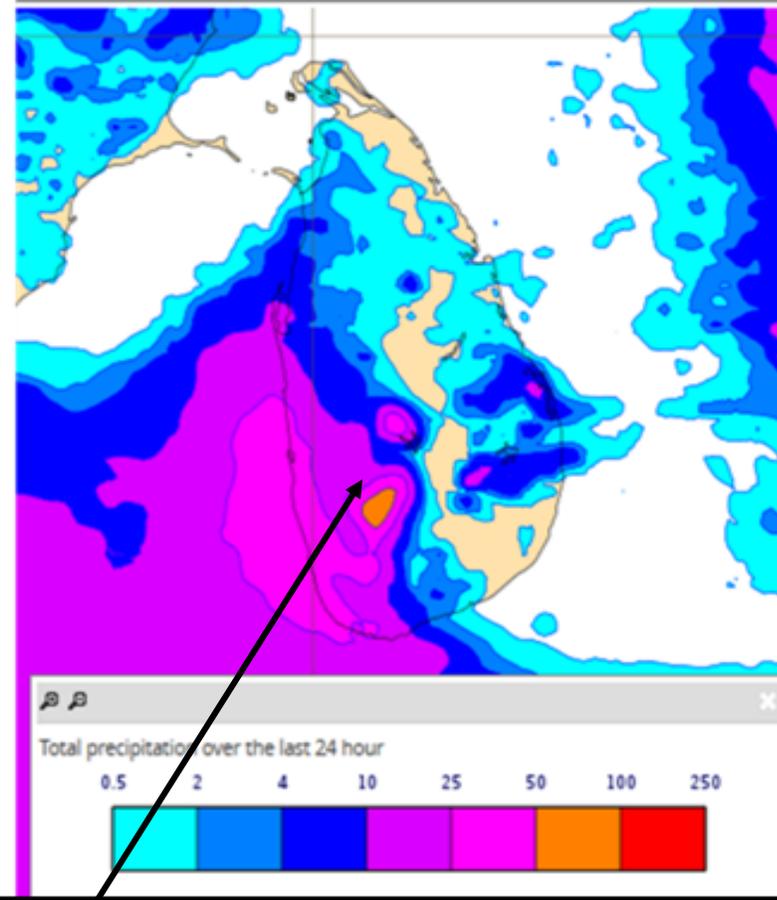
DoM need correct Now casting of Precipitation method

Forecast (WRF)



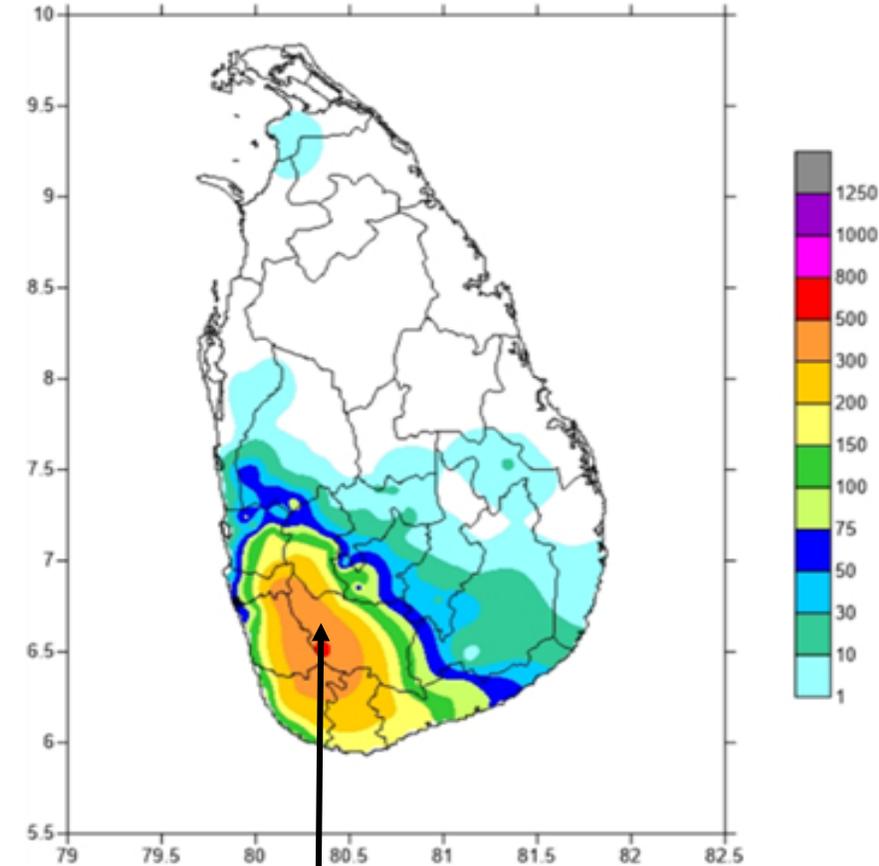
Predicted Maximum rainfall for 25th
80-100 mm

Forecast (ECMWF)



Predicted Maximum rainfall for 25th
50-100 mm

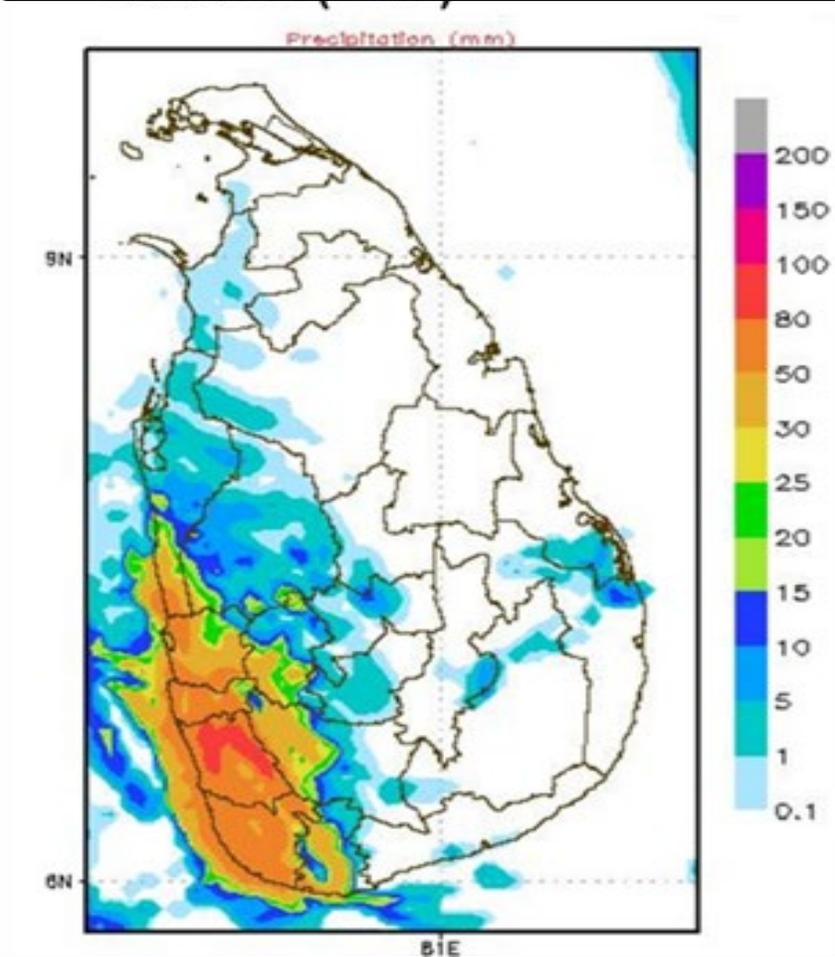
Observation 2017-05-25



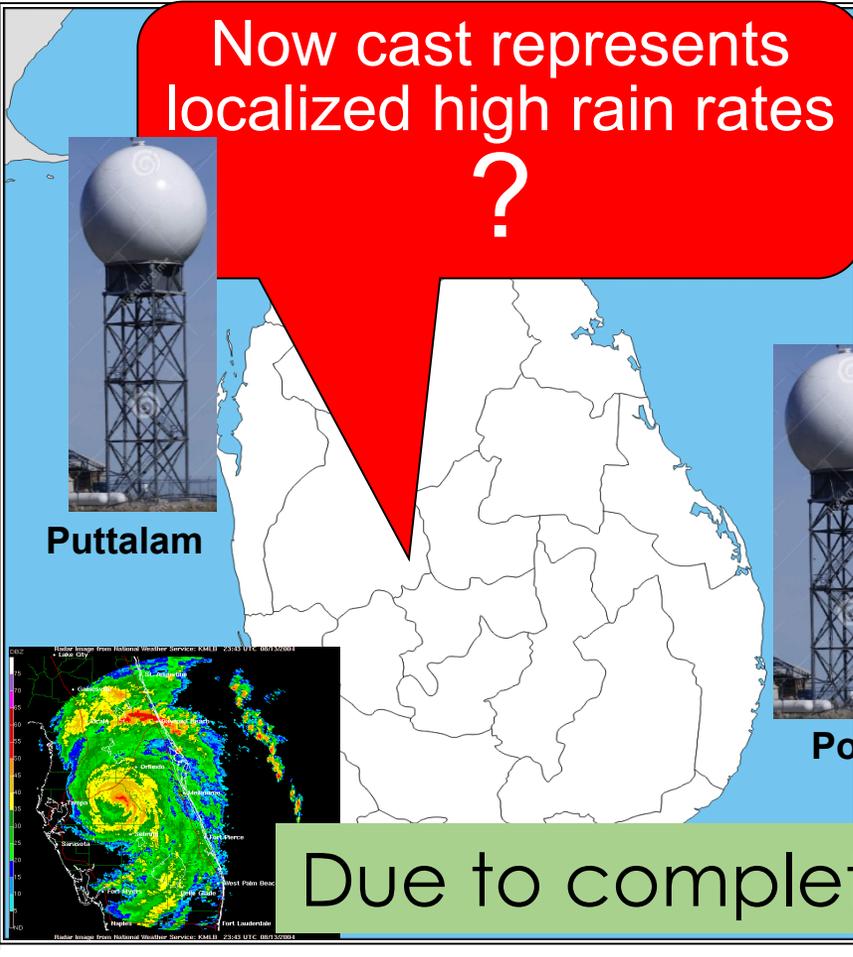
Observed rainfall on 25th
553.5 mm

- ❖ DOM Need To calibrate Rain Gauge network &
- ❖ capacity building training for meteorological staff and supporting services

Very Short Range Forecast



Nowcast



Two Doppler radars will be granted by JICA

Due to complete in 2024

Predicted Maximum rainfall for 25th May 2017

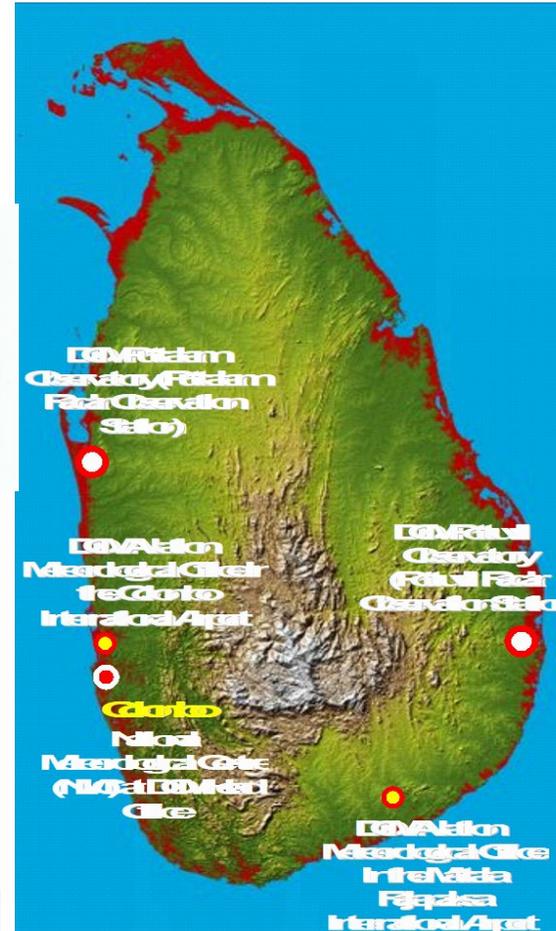
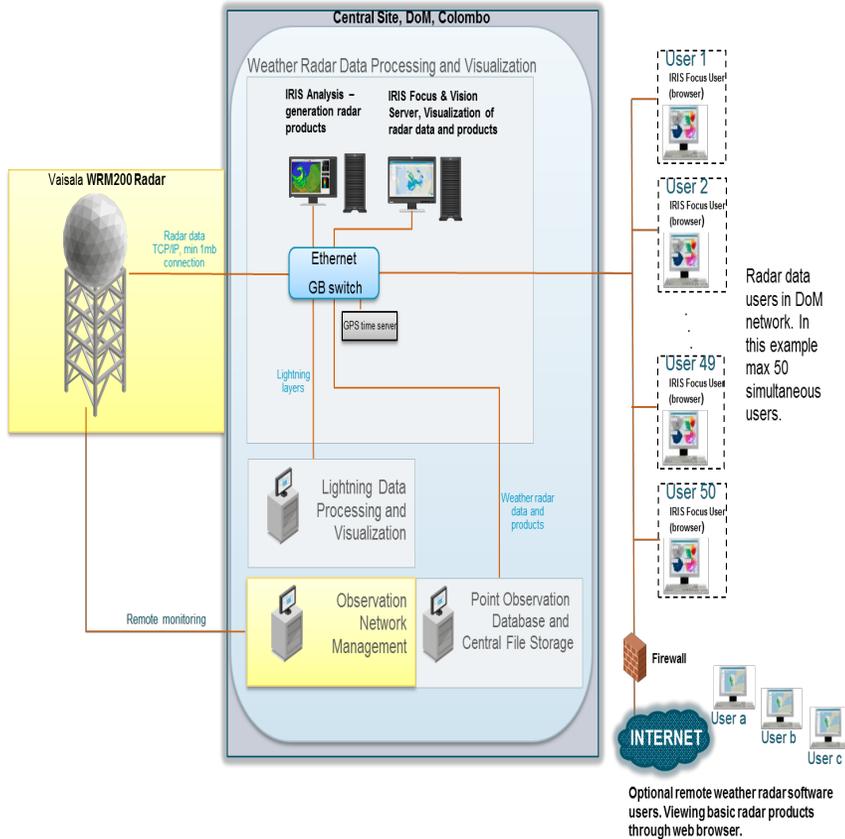
80-100 mm

Disaster prevention and mitigation

- Urban flood caused by a rapidly developing rain cloud

proposed weather radar network system

Doppler Radar Project (Grant Aid Project by Japanese Govt)



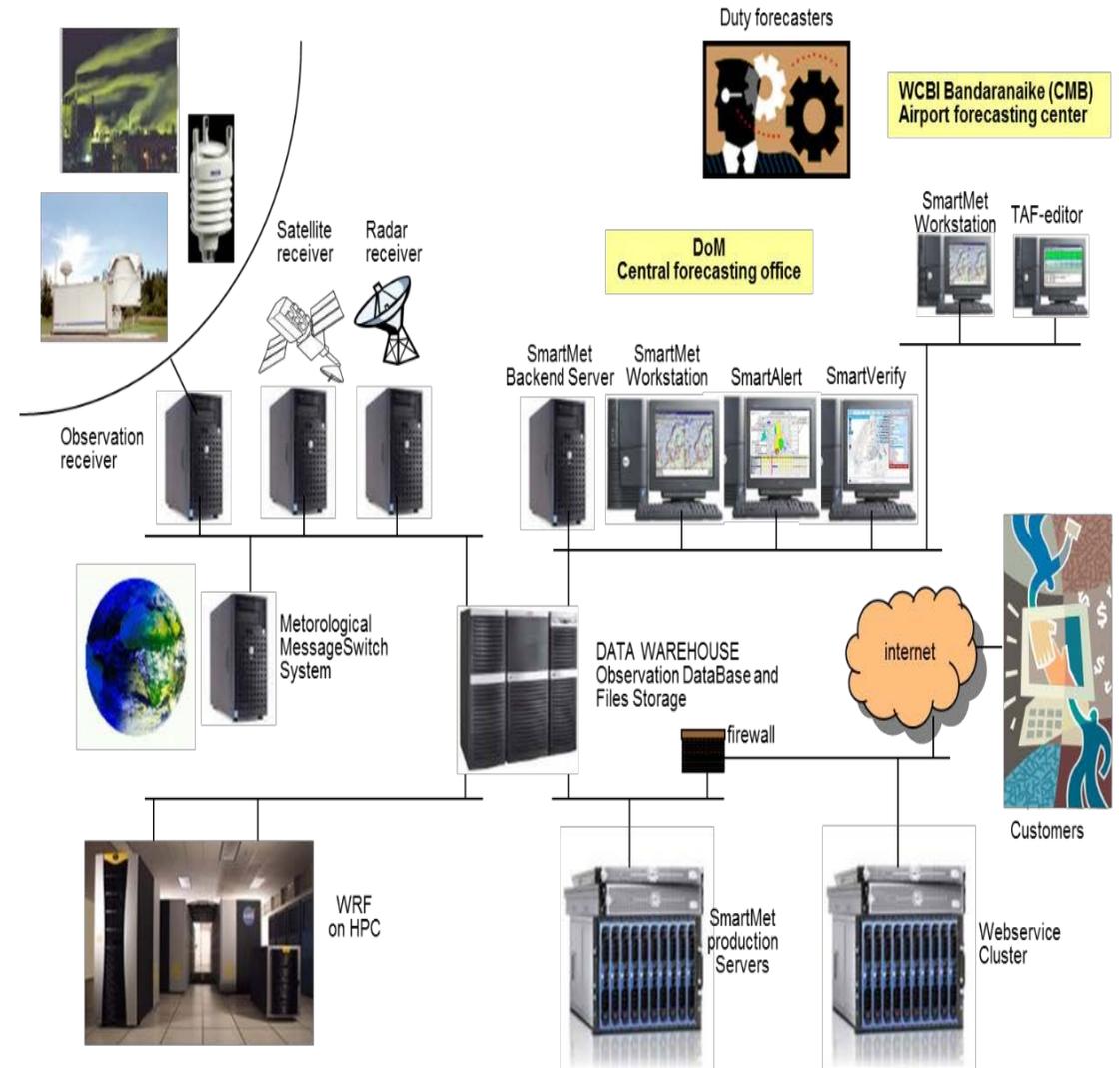
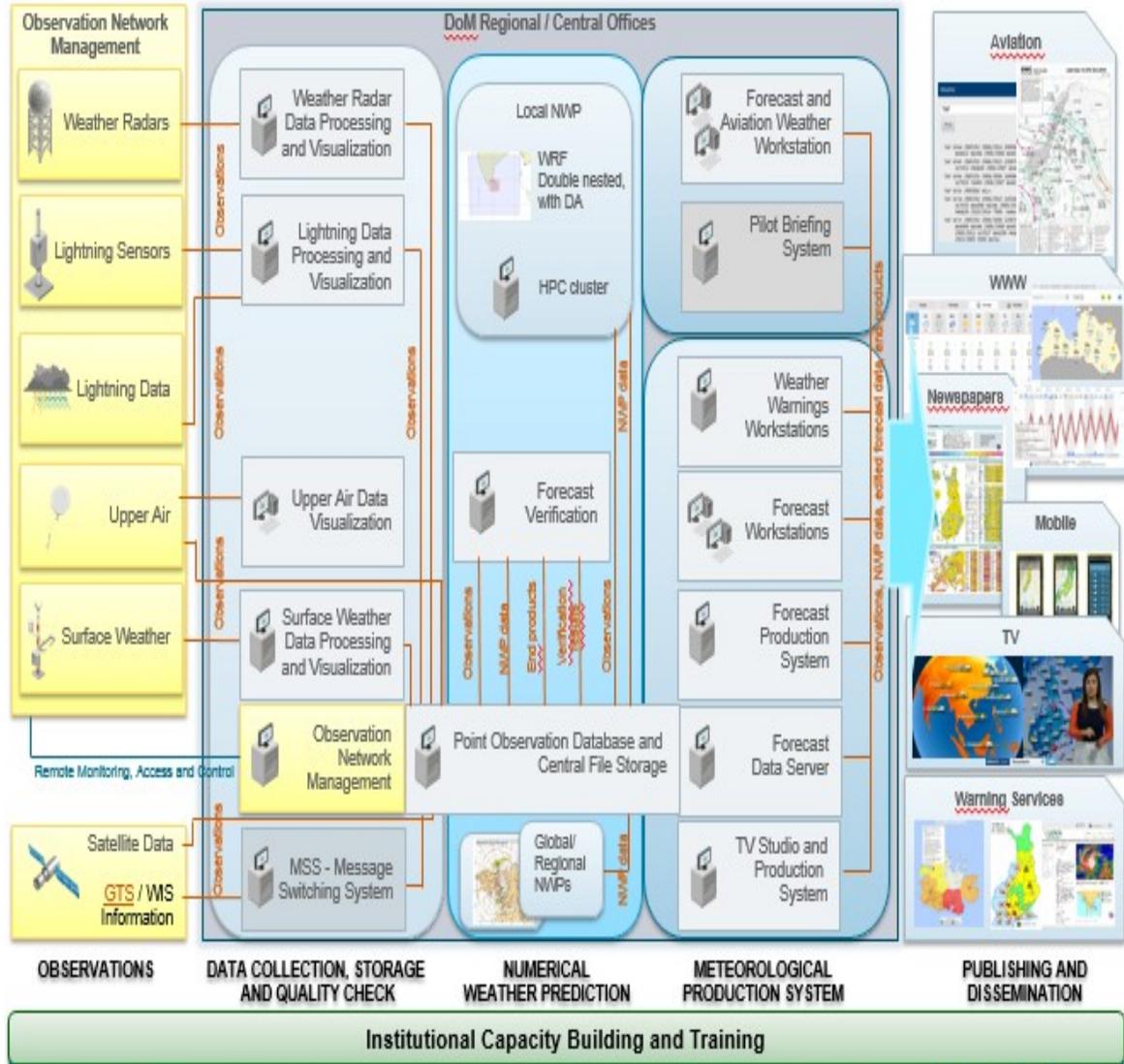
Source of Finance	<p>Government of Japan: Two Billion Five Hundred and Three Million Japanese Yen (JPY 2,503,000,000) Government of Sri Lanka: 486,650,000 Rupee</p>



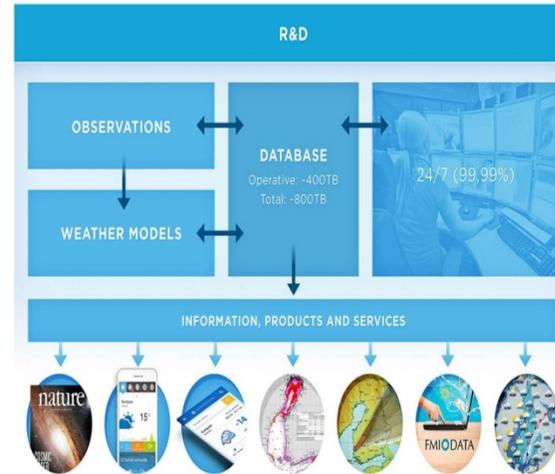
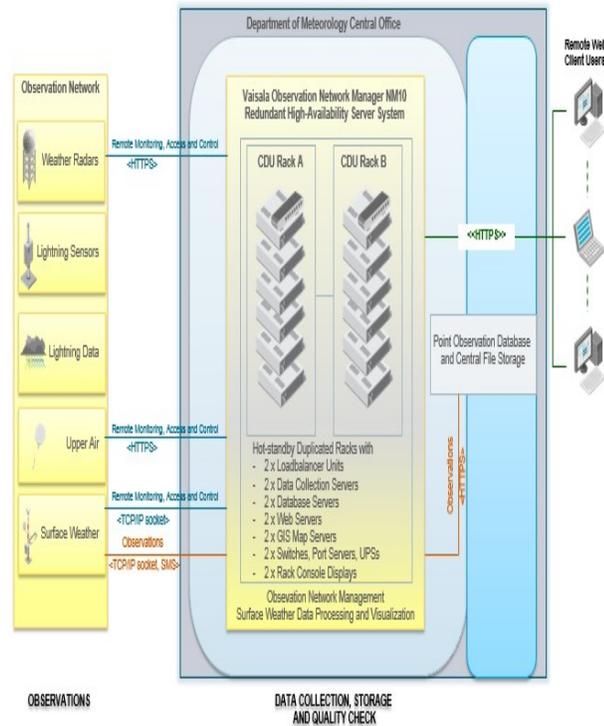
G/A

Signed date: June 30, 2017
Duration: December 31, 2023

Department of Meteorology need Meteorological data Network Integration system



Meteorological Data Visualization and Forecast Production System (Smart Met for Public Weather and Early Warning Services)



DOM need Weather Information and Forecast Production System



mobile weather application, data produced with Smart Met and warning information with Smart Alert

Overview of Observation Network Manager



Proposal of Capacity Development

- Action has been taken to Implementation of Modernization Project of the Department of Meteorology with the assistance of World Bank
- Need training of officials especially Young Meteorology to train on forecasting including:
 - ✓ Numerical Weather Prediction
 - ✓ Forecast verification theory & basics
 - ✓ Radar Meteorology & satellite imagery and forecast tools are analyzed separately in arriving at the weather forecast.
 - ✓ Public Weather and Early Warning Service training
- Gauges fixed by ICHARM also to be linked with Cres MP assisted by World Bank
- DOM wanted to collaborate with ICHARM



Thank you