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Meteorological Hazards and Current Approach to Observing, Modelling and Predicting Severe Events in Sri Lanka

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Presentation Layout

> Introduction

- > Weather related Hazards
- Disaster Management in Sri Lanka
- Early Warning System of Sri Lanka

Introduction Topography and Climate



Topography:

- Sri Lanka Locates Between
- (5 to 10) N and (79 to 82) E
- Characterized by South Central Highlands
 - Mt. Pidurutalagala 2524 m



Mild ClimateAverage Rainfall:1860 mm/yearRange of rainfall:950 – 6000 mm

Mean Temperature: 27.5 C (lowlands) Lower Temperatures in the highlands

Introduction Climate in Sri Lanka



Introduction Climate in Sri Lanka cont.



Hazards in Sri Lanka

Over 80% of the natural disasters in Sri Lanka occurred due to the weather based phenomena





Hazards in Sri Lanka

Sri Lanka being in the path of two monsoons is mostly affected by weather related hazards





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People affected by different disasters in Sri Lanka (1974-2004) Source: Disaster Management Center - Sri Lanka

Observation Network



23 Surface observation stations
 3 Pilot balloon
 1 Radiosonde

Observation Network Observation Network (37 AWS and 400 Rain gauges)





Satellite Products used in weather Forecasting activities



METEO-7







ASCAT

Truces is research (an 2) immes drang bottom correspond to medisurement at 20 3) Data buffer is 22 hrs from Nev 21 03:02 UTC 2016 4) Black wind barbs indicate possible contamination NOAC/NESDIS/Center for Satellite Analications and Research

SCOPE-Nowcasting



NWP out puts use in Short and medium range weather forecasting in DOM



Disaster Management in Sri Lanka

In July 2005 the Disaster Management Centre (DMC) was established as the implementing arm of the National Council for Disaster Management (NCDM). As mandated by the Act, the National Council for Disaster Management (NCDM), chaired by H.E. the President is the apex body for disaster management.



Composition of the National Council for Disaster Management (NCDM)

Stakeholders Agencies of the National Council for Disaster Management (NCDM)

Disaster Management in Sri Lanka

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The national focal point for all DRR activities in Sri Lanka is the Disaster Management Centre(DMC) which is functioning under the Ministry of Disaster Management.

The Disaster Management Act No. 13 of 2005 was enacted in the Parliament in May 2005

In terms of the Act following hazards come under the purview of Disaster Management

- ➤ Flood
- Landsides
- > Drought
- ➤ Tsunami
- Earthquakes
- > Air Hazards
- ➤ Fire
- > Epidemics
- Coastal Erosion

- > Explosions
- > Acid Rains
- Civil or Internal Strife
- Chemical Accidents
- Radiological Emergency
- > Oil Spills
- > Nuclear Disaster
- ➢ Urban and Forecast Fire
- Cyclone, Tornadoes, Thunderstorms and Lighting Strikes

Early Warning System of Sri Lanka Separate agencies are responsible for early warning in the case of different disasters.

| Disaster | Responsible Agency for Early Warning |
|--|---|
| Cyclones and heavy rainfall/strong winds | Department of Meteorology |
| Floods | Irrigation Department |
| Landslides | National Building Research Organization |
| Tsunami | Department of Meteorology (with the consultation of Geological Survey and Mines Bureau) |
| Earthquakes | Geological Survey and Mines Bureau |

Early Warning Dissemination System



Early Warning System of Sri Lanka Cyclone





Early Warning System of Sri Lanka Warning criteria for cyclone

| Signal No | Colors | Description | Action Required | |
|--------------|--------|---|--|---|
| 1 | white | Potential area of possibility to development of vortex /disturbance / Cyclone has formed | Information only, Vessels at sea to be vigilant and avoid the area, Listen to media | |
| 2 | Yellow | Cyclone has formed in the vicinity, raining and windy, sea rough (30-40kts, 50-80kmph) | Stay away from beach/sea, vessels in danger/be inside building | Data Source: IE |
| 3 | Orange | Cyclone has formed in the vicinity, very heavy rain with very strong winds, very rough seas (V > 40kts, 80kmph) | Be ready to leave weak buildings and low lying areas (flood prone areas), secure your home valuables | Movement dis Every 12hrs for (Movement, D |
| 4 | Red | Cyclone is expected to cross land, Very heavy rain/very strong winds (v>50kts,100kmph) | Evacuate to predesignated areas | Movement dist |
| 5 | Brown | Severe cyclone is expected to cross Very severe weather expected | Evacuate to predesignated areas | (Movement, Di |
| 6 | green | Cyclone warning cance | llation/withdrawal bulletin | Movement dis Every 3hrs for (Movement, D |

Tropical Cyclone Track - Near Sri Lanka ISBO - 2014 SIL TC. Track SIL TC. Track

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Movement distance from the coast < 600km Every 12hrs for 48 -72hrs Movement, Distance, Magnitude and Max Wind)

Movement distance from the coast < 500km Every 6hrs for 36-48hrs (Movement, Distance, Magnitude and Max Wind)

Movement distance from the coast < 300km Every 3hrs for 18hrs (Movement, Distance, Magnitude, Max Wind Landfall pt, Landfall time and affecting areas)

We issue this type of special weather bulletins during cyclone with the help of SWFDP – ECMWF model outputs



Seasonal rainfall distribution of Sri Lanka



| Warning Criteria | | | | | |
|--|--------------|--|--|--|--|
| Amount /Intensity | Alert status | | | | |
| Rainfall > 50 mm in 6hrs Rainfall > 100 mm in 24hrs | Alert | | | | |
| Rainfall > 150 mm in 24hrs | Warning | | | | |

Determine the thresholds or QPE (Quantitative Precipitation Estimation) is a challenging task ???

| Sl. No | SIGN | ALERT STATUS | DESCRIPTION | ACTION REQUIRED |
|-----------|------|-------------------|--|--|
| 1 | | Information | Likelihood of Moderate Rainfall <100 mm | Effects of rainfall will vary from place to place according to local conditions. Act according to the relevant official instructions |
| 2 | | Alert | Likelihood of Heavy Rainfall 100- 150 mm | Effects of rainfall will vary from place to place according to local conditions. Act according to the relevant official instructions |
| 3 | | Warning | Likelihood of Very Heavy Rainfall > 150 mm | Effects of rainfall will vary from place to place according to local conditions. Act according to the relevant official instructions |
| 4 | | Threat is over | Threat of heavy rainfall is over however light to moderate rainfall can be experienced ³ | Effects of rainfall will vary from place to place according to local conditions. Act according to the relevant official instructions |



It is estimated over 434 mm (17 inches)

STATISTICAL SUMMARY OF DISPLACEMENT SITUATION Gampaha IOM SRELANKA 30 MAY 2017 DATA SOURCE DISASTER MANAGEMENT CENTRE, GOVERNMENT OF SRI LANKA Nuwara Eliya Badulla 545,283 80,409 UVA **Total Affected** Total Individuals Individuals in Safe Sites Colembo No. of Damaged Houses by District CARADACIAN 768 Batticaloa Kalutara 361 Fully Damaged Houses Colombo Safe Site 5,869 Galle Moneragala Partially Domaged Houses Gampaha Hambantota No. of Individuals in Safe Shes by Disblot Kalutara Kandy Caturda 8.39% Galle 1,78% Kegalle. Matale mila 14.529 Matara SOUTHERN Hambantota Mullaitivu Nuwara Eliya Kalutara 7.8% Kasalia 81106 Rathnapura Trincomalee Island 13,749 Batheapara \$2,45% - Namera Kitya 0.42% Vavuniya Data Source: Disater Management Centre, Sri Lanka, 30 May 2017 09:00am Tito map is for illustration purposes only. Names and boundaries on this map do not imply official endersement or acceptance by IOM. Note: DS Division names are deplayed only for those with more than 500 individuals in safe sites International Organization for Migration + Sri Lanka No. 62 Ananda Coomateswamy Mawatha (Green Path), Colorabo 03, Sri Lanka fat +94 11 5325 500 | Fax +96 11 5325 302 Affected individuals Individuals Evacuated to In DS Divisions Safe Sites in DS Divisions For more information, please send your email to iomoniombogitom int DM+OP

SRILANKA FLOOD 2017

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CENTRAL

NWP model rainfall Forecast for 25th May 2017 by WRFDA(5km) and ECMWF (Based on 1200UTC on 24th May 2017)



Predicted Maximum rainfall for 25th 80-100 mm



Forecast (ECMWF)



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Observed rainfall on 25th 553.5 mm

Early Warning System of Sri Lanka Strong Winds

Department of Meteorology (DOM) is responsible for issue ocean state forecast and warning to the sea areas surround by Sri Lanka



DOM provides the ocean state information to all the sea faring communities like the fishermen, SL Navy, SL Coast Guard, merchant and passenger shipping agencies, research organizations and also other coastal communities.

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Sea waves due to strong winds vulnerable to fishermen fishing near coast and coastal communities due to coastal erosion





Average Wind Hazard

Maximum Wind Hazard

82*0'0"

40

Wind Speed (Knots)

Legend

25 - 35

35 - 45

45 - 55

Techniques

55 - 68

Maximum winds for each

arid cells has been

calculated for the period of

1958 - 2009. Grid cell size:

0.09*0.09 Degree and data

interpolated by Kriging

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Early Warning System of Sri Lanka Strong Winds

Responsible areas for Marine Weather Forecast

| Arabian Sea | | Bay of Ben | pat n | Gulf of |
|-------------|-------------------|------------|-------|----------|
| 00 | 05 Laccadive S | 10 | 15 | hailand |
| 20 | 25 | 30 | 35 | Malaysia |
| 40 | 45 | 50 | 55 | Car. |
| 60 | 65 | 70 | 75 | |
| | 80 | 85 | | |
| | | | | |



Early Warning System of Sri Lanka Strong Winds

| Land | | Wind speed | Wave Height | Alert Status | Color | |
|--|--------------------|------------|---|-----------------|--------------------|-------|
| Wind speed | Alert Status | Color | Average Wind is > 30kmph Gusting > 60kmph | > 2m | Alert/ Advisory | Amber |
| Average Wind is >30kmph Gusting > 60kmph | Alert/ Advisory | Amber | Average Wind is > 70kmph Gusting > 100kmph | > 4 m | Warning | Red |
| Average Wind is > 50kmph Gusting > 70kmph | Warning | Red | Squall line Wind Speed > 70kmph | | Alert/ Advisory | Amber |

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Criteria use in DOM, Sri Lanka for Strong Winds

Thank You!

Early Warning System of Sri Lanka Tsunami



National Tsunami Warning Center located at the Department of Meteorology

A Technical Committee consisting of members from relevant government institutions under the Chair of DG/Meteorology coordinating the activities.

Tsunami/Earthquake Advisories are received from RTSP, (INDONESIA, India and Australia)

Earthquake warnings are received within 15 minutes of occurrence

However it takes several minutes (some time up to 1hrs) to receive sea level information as no own tide gauge stations

Early Warning System of Sri Lanka Tsunami

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Principle Guideline

Under normal circumstances tsunami travel time from Indonesian seismic zone to Sri Lanka is approx. 1.5 hours

The first bulletin to be released from the EWC within 30 minutes of the occurrence of the earthquake.

Bulletins to be issued for all earthquakes occurring in the concerned area with magnitude above 6.5 in the Richter scale.

The first bulletin to include a statement to the effect that the information in the bulletin is based solely on seismic data.

The second bulletin with detailed information should be issued.

Early Warning System of Sri Lanka Tsunami

Warning Criteria for tsunami Magnitude of the Potential for Tsunami Bulletin Colour Earthquake No Tsunami threat < 6.5 Information white Tsunami possible within 100km of the Information 6.5<M<7.5 white epicenter Potential for destructive Tsunami Watch 7.0<M<7.5 Amber within 100km of the epicenter But Sri-Lanka is not in the area. Potential for destructive Tsunami Warning Ređ within 100km of the epicenter But Sri Lanka is in the area Potential for destructive regional White 7.6<M<7.8 Information Tsunami. But Sri Lanka is not in the area Potential for destructive regional Warning Ređ Tsunami, But Sri Lanka is in the area. Warning Potential for destructive ocean wide Ređ 7.8<M Tsunami, But Sri Lanka is in the area Mega tsunami is expected wave height Verv Sever Brown >3m Tsunami warning

Principle Guideline

| SL No | SIGN | ALERT STATUS | DESCRIPTION | ACTION REQUIRED |
|----------|------|-------------------|---|--|
| 1 | Cat | Information | Major earthquake occurred | Information only, stay vigilant, listen to authorities and media updates |
| 2 | Ccut | Watch | Tsunami may be generated. | Be vigilant and get ready for possible evacuation. Act according to the local authorities |
| 3 | Cent | Warning | Tsunami has been generated, Sri Lanka coast will be affected | Evacuate to safe areas. Act according to the local authorities |
| 4 | Cut | Threat is over | Tsunami threat is over " | Act according to the local authorities. |

Early Warning System of Sri Lanka Tsunami



Tide gauge data



Warning Dissemination needs improvement !