



Mauritius Meteorological Services

Overview of the MMS and EWS



Dr Prithiviraj Booneedy

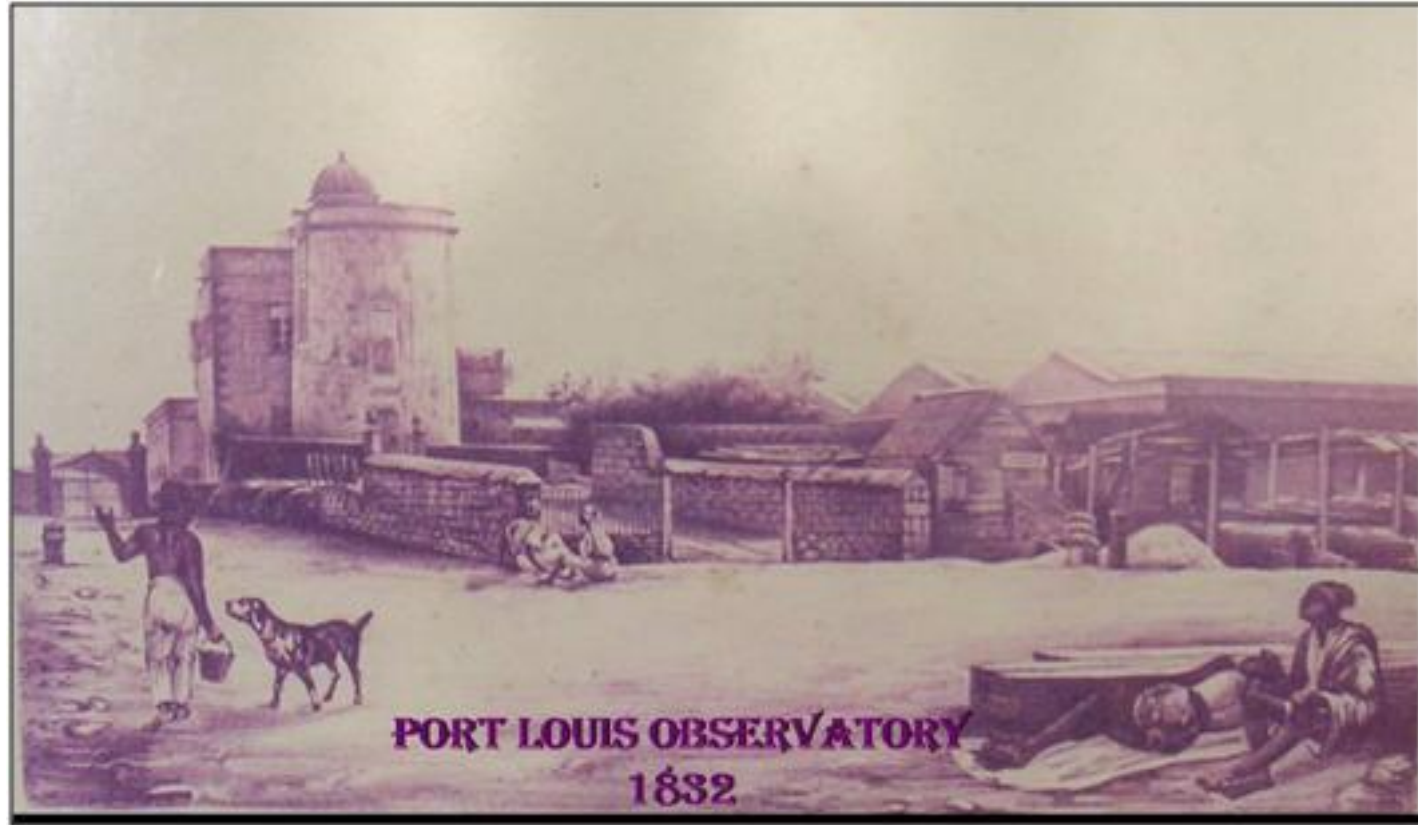
Acting Director, MMS

Outline

- History
- Current situation
- Services
- Upcoming developments

History of MMS

1733-1754: Cyclones affected Mauritius “Mémoires de L’Académie des Sciences.”



Weather observations were very helpful for **merchant ships** in 1700s and early 1900s because Mauritius served as a vital maritime crossroads for trade between Europe, Asia, Africa, and the Americas

1874- 1961: Royal Alfred Observatory



Astronomy, Meteorology, Magnetism, Clock (time-ball), Seismology

First order meteorological and magnetic station equipped with the best instrument

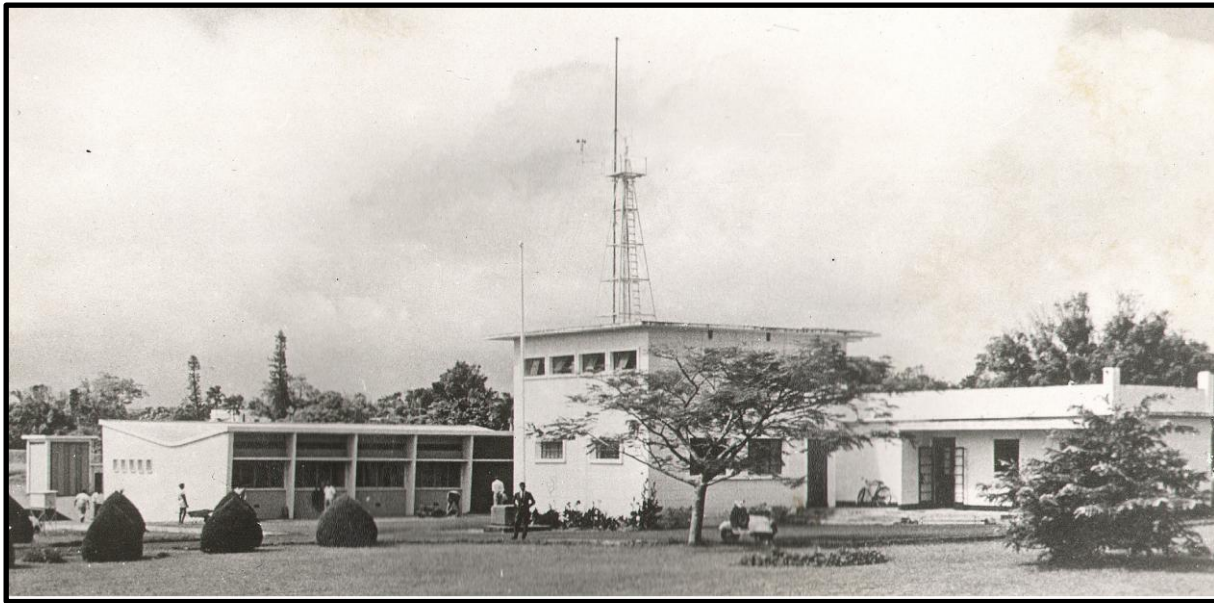


- 1923-1925: Albert Walter (1877-1972) initiated upper-air wind measurements using kites up to a height of about 4000 feet
- November 1925, pilot balloon observations could reach altitudes of up to 6,000 metres

- Systematic atmospheric measurements were established at Vacoas in the early 1920s

[anemometer (to measure wind), thermometers, barometer (to measure atmospheric pressure), rain gauge, nephoscope and sunshine recorders were installed at Vacoas]





1950s onwards, the Royal Observatory at Vacoas (Figure 2) focused exclusively on meteorology,

1959: *Meteorological Department* in 1959

1968: *Mauritius Meteorological Services* in 1968 + first satellite image reception system

1979: meteorological radar (UNDP).

300 years of Existence

MMS Stations

The HQ is located at Vacoas.



Doppler Radar at Trou aux Cerfs



Agalega



Rodrigues (Pte Canon & Plaine Corail)



St Brandon

Objects of MMS (As per MMS Act 2019)

The Mauritius Meteorological Services shall be the official authority responsible for

- (a) monitoring the evolution of weather and climate, including extreme weather, throughout Mauritius;
- (b) monitoring the progress of tsunami waves caused mainly by seismic activity;
- (c) providing weather forecasts, advisories and warnings for the welfare and safety of the general public;
- (d) providing climate services for the sustainable socio-economic development of Mauritius;
- (e) fulfilling the international obligations of Mauritius under the conventions of the World Meteorological Organization;
- (f) fulfilling the international obligations of Mauritius under the Convention on International Civil Aviation on Meteorological Service for International Air Navigation; and
- (g) fulfilling such other weather or climate-related regional and international obligations as may be necessary



Mauritius Meteorological Services

MMS is ISO Certified since 29 December 2008

Annex 2

MAURITIUS STANDARDS BUREAU
NATIONAL QUALITY SYSTEM CERTIFICATION SCHEME



Annex to Certificate Number **RF 087**

This annex defines the scope of the Certificate of Registration awarded to:

**Mauritius Meteorological Services
Aeronautical Meteorological Station
SSR International Airport
Plaisance
Republic of Mauritius**

Scope of Registration:
NACE Rev. 2: 74.90 - Provision of information and products related to weather and climate

Date **29 December 2008**
Moka, Mauritius


Director
Mauritius Standards Bureau

MAURITIUS STANDARDS BUREAU
NATIONAL QUALITY SYSTEM CERTIFICATION SCHEME



Certificate of Registration

Certificate Number **RF 087**

This is to certify that

Mauritius Meteorological Services
has a quality system to manufacture goods, operate processes or provide services detailed in the annex to this certificate and in accordance with

MS ISO 9001:2000

This certificate remains valid until

14 November 2010

and is subject to the terms and conditions contained in this certificate.

Signed for and on behalf of the Standards Council

Date **29 December 2008**
Moka, Mauritius


Director
Mauritius Standards Bureau

Annex 1

MAURITIUS STANDARDS BUREAU
NATIONAL QUALITY SYSTEM CERTIFICATION SCHEME



Annex to Certificate Number **RF 087**

This annex defines the scope of the Certificate of Registration awarded to:

**Mauritius Meteorological Services
St Paul Road
Vacoas
Republic of Mauritius**

Scope of Registration:
NACE Rev. 2: 74.90 - Provision of information and products related to weather and climate
- Issuance of warnings for related natural hazards

Date **29 December 2008**
Moka, Mauritius


Director
Mauritius Standards Bureau

Applied/Climate Services

- Interlinked Services
 - Hydrometeorology: rainfall → water security
 - Climatology: temp, cyclones → Health + Energy
 - Agrometeorology: Sunshine, RH → Food Security
 - Marine: Sea level, SST → Blue Economy
- Publication: Public Weather Service – reports, sensitisation

Weather, water, ocean and climate Services

Aeronautical Services



Maritime Services



Hydro Meteorology



Agro Meteorology



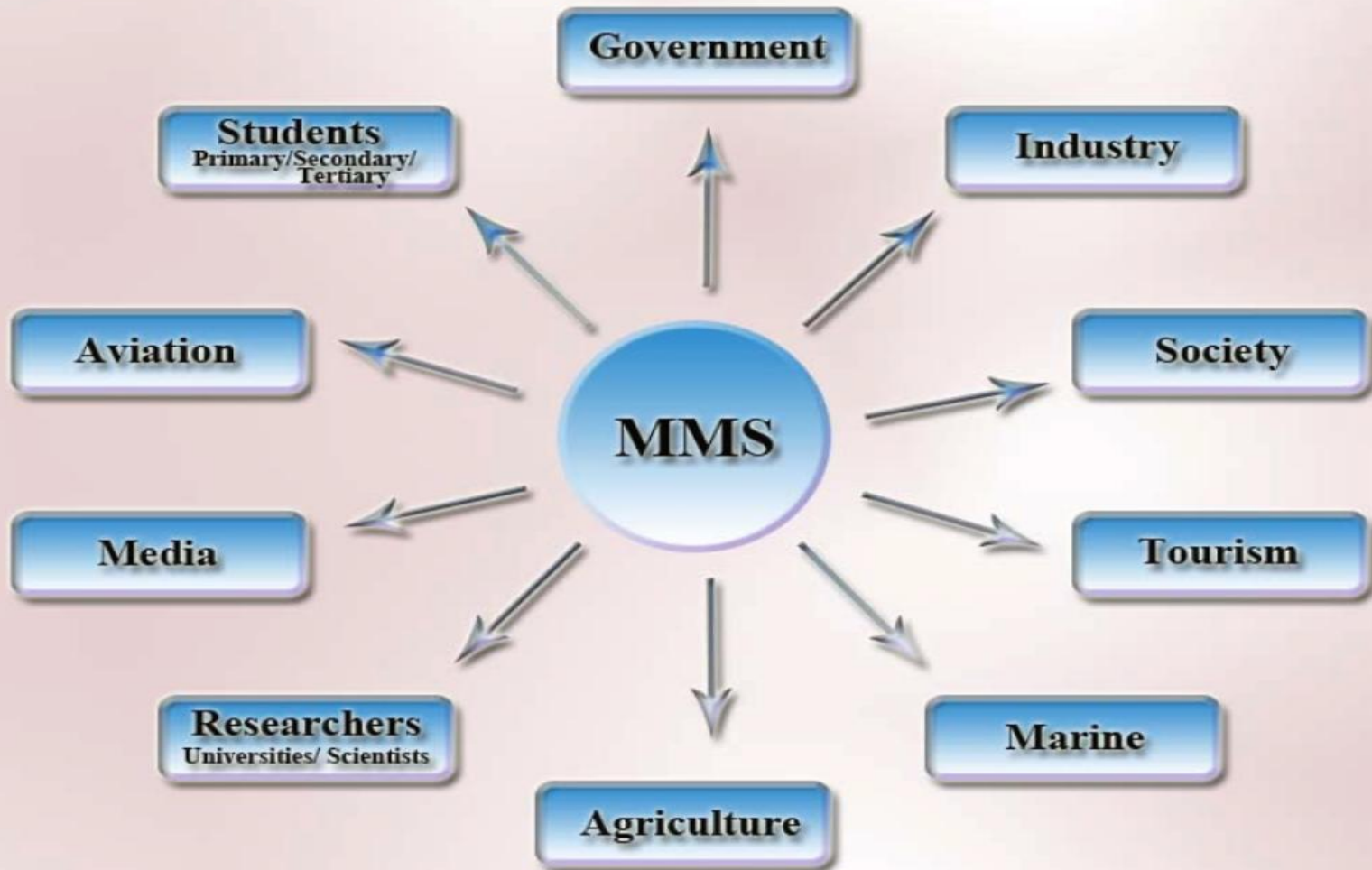
Upper Air Sounding



Climatology



Our Customers



Climate Change

Weather and Climate extremes: New Norms

- No surprise headlines: extremes continue from mountaintops to ocean depths
 - Main driver: Global warming – due to human-induced GHG emissions → climate change (high confidence -IPCC);
 - Global T > 1.5°C, above pre-industrial era
 - Extremes → rainfall and temperature regimes + SLR : , heatwaves, wildfires; disrupted marine ecosystems
 - Severe drought, cyclones, violent flash floods, catastrophic glacier & rock collapse (Nepal)
 - New tipping points being observed earlier
- World Economic Forum 2026: environmental risks (ext Wx, biodiversity loss & critical Earth System change) still account for 50% of the 10 global threats over 10 yr horizon
- SEB/CBA: “*Early Warning are low-hanging fruits of climate change adaptation*”, \$1 invested in surface-based observations & Early Warning Systems realises at least \$10-20 in socioeconomic returns

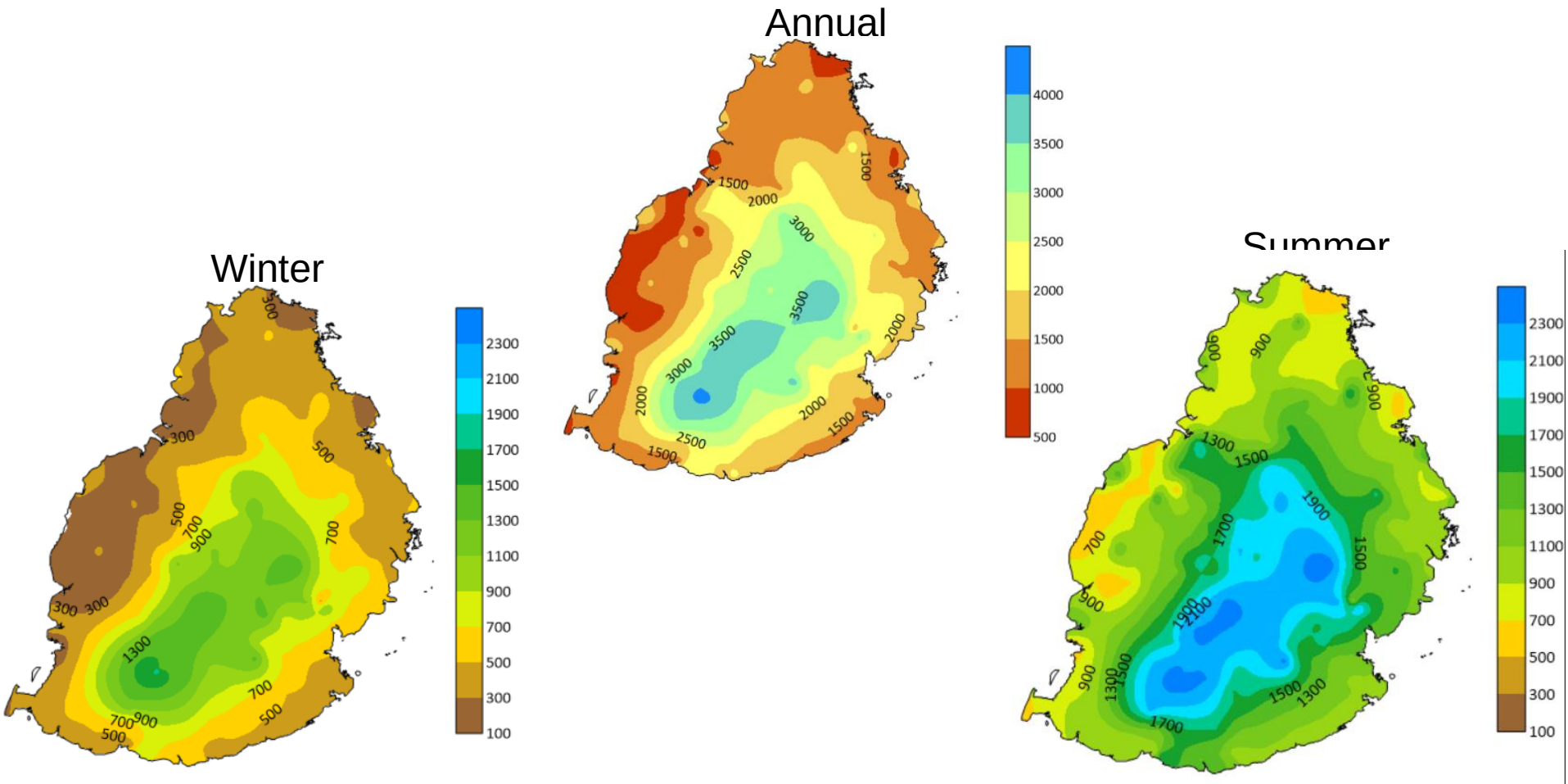
Climate change a wicked problem

- CC – affects all walks of life, societies, economies & ecosystems
 - Environmental systems- T+ → droughts, cyclones, floods // Forest loss → carbon sink, ocean acidification and SLR // declining biodiversity
 - Social systems – Water and Food insecurity // Health risks // Vulnerability cause displacement
 - Economic systems – Unstable supply chain //

CLIMATE OF MAURITIUS

- Mauritius enjoys a mild tropical maritime climate throughout the year.
- Long term Mean Temperature (1991-2020)
 - Annual mean: 23.7 Deg C
 - Two seasons: Warm moist summer (Nov to April) / Mean Temperature: 25.6 deg C
 - Cool dry winter from (May to Oct) / Mean Temperature: 21.8 deg C
- Long term mean rainfall (1991-2020) over the island
 - Annual rainfall : 2018 mm.
 - Mean summer (Nov-April) rainfall: 1355 mm, which is 67% of the annual amount.
 - Mean winter (May-Oct) rainfall : 663 mm.
 - The wettest months are January, February and March. The driest month is October.
- The Island receives 6.5 to above 8 hours of bright sunshine daily.

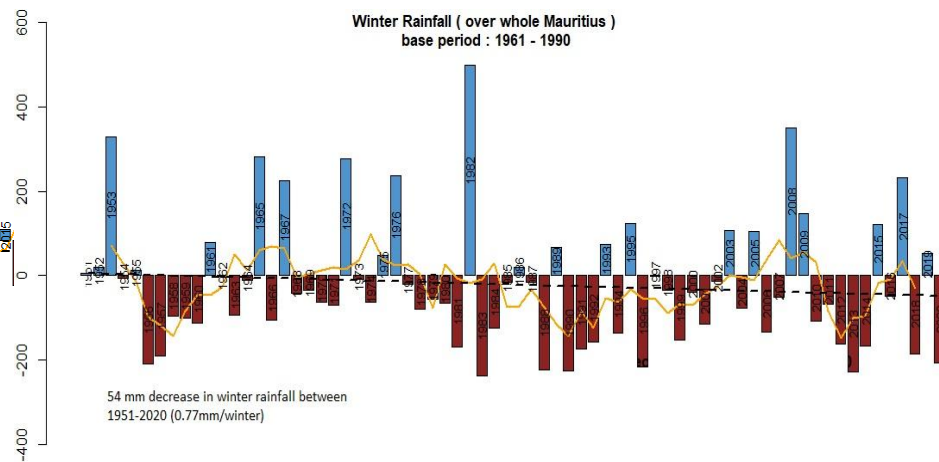
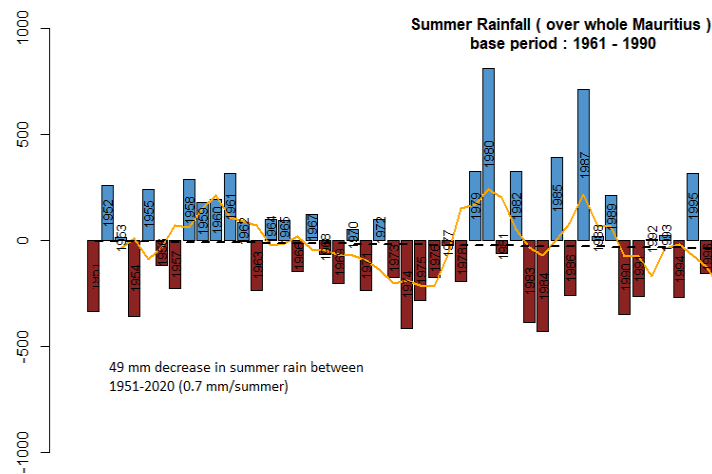
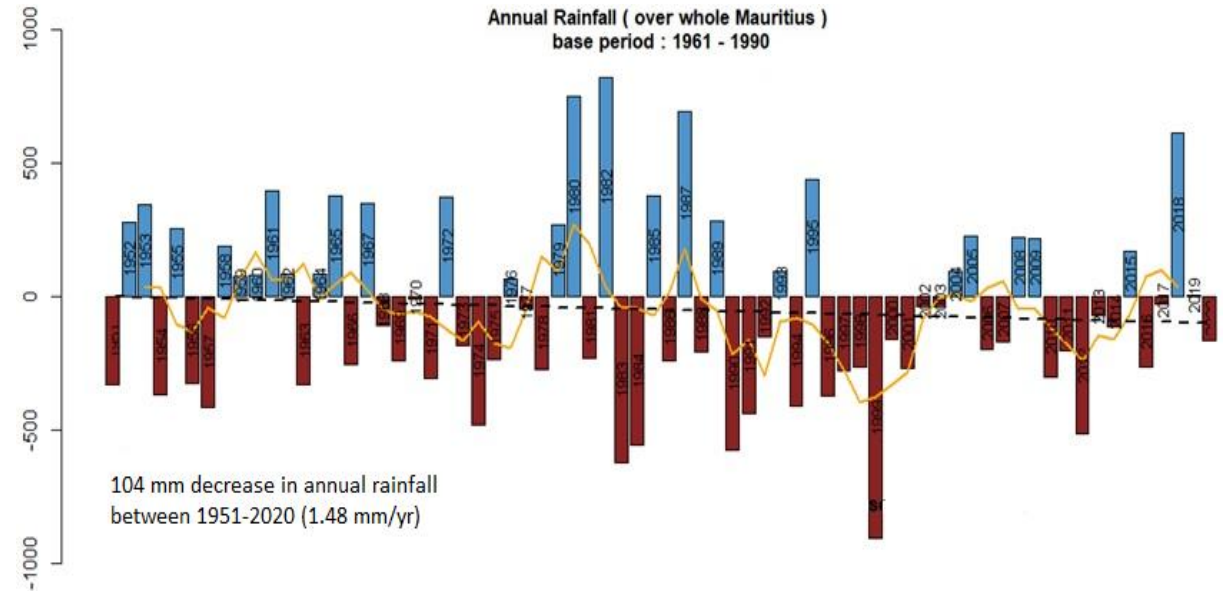
Climatological Rainfall Distribution



Rainfall Trends

A slight decrease in annual rainfall (1.48mm/year) is observed.

An equal decrease during Summer and Winter (0.7mm/season).



Rainfall Projections- Mean Rainfall

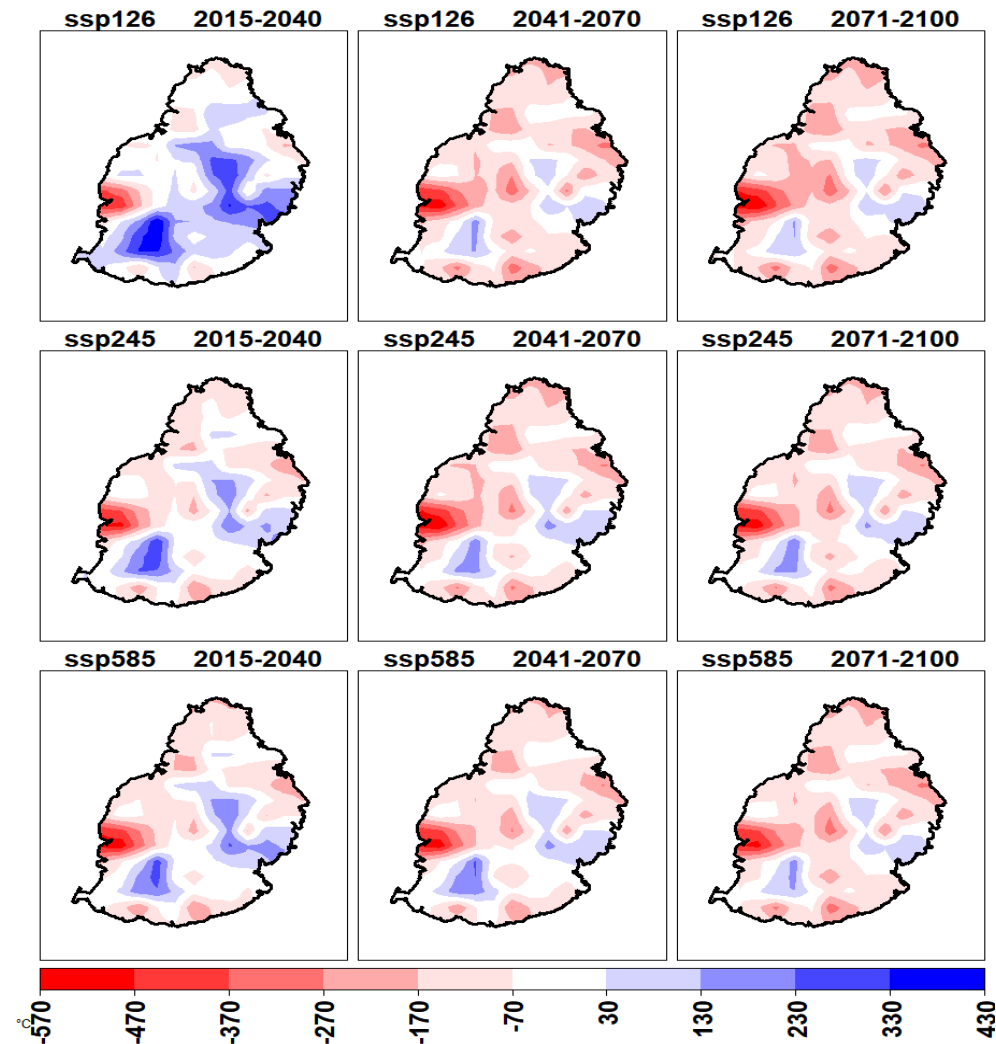
IPCC AR6 climate scenario:

SSP1-2.6: sustainability (low emission)

SSP2-4.5: intermediate (emission peak by mid-century)

SSP5-8.5: fossil-fuelled development (high emission)

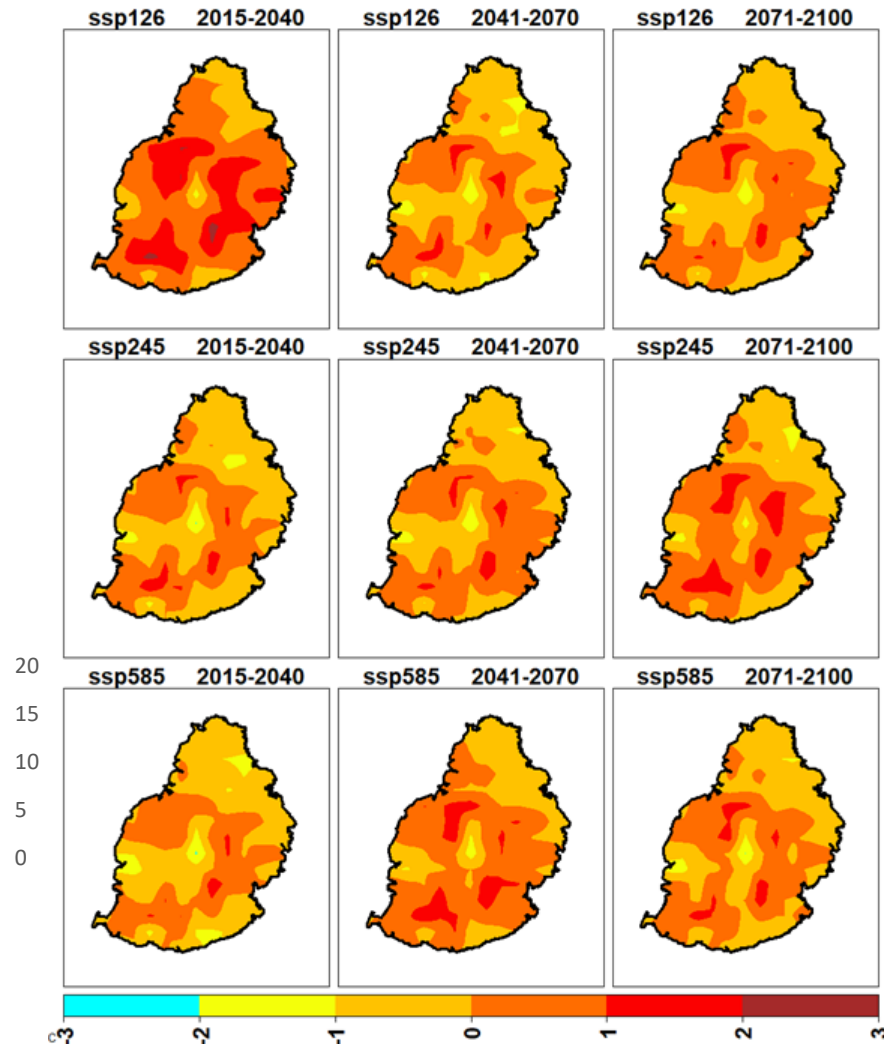
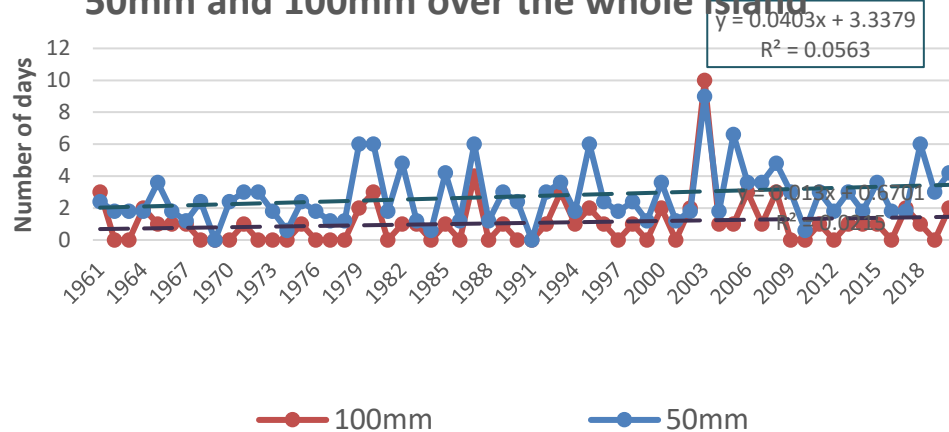
Mean annual rainfall anomaly distribution (wrt 1961-1990) over Mauritius under the three emission scenarios (SSP 126, 245 and 585) for 2015-2040, 2041-2070 and 2071-2100



Rainfall Projections- Days RR>xx mm

- Distribution of extreme rainfall (>50mm, >100mm) projected for different time horizon and different emission scenarios.
- These could be key inputs flood management

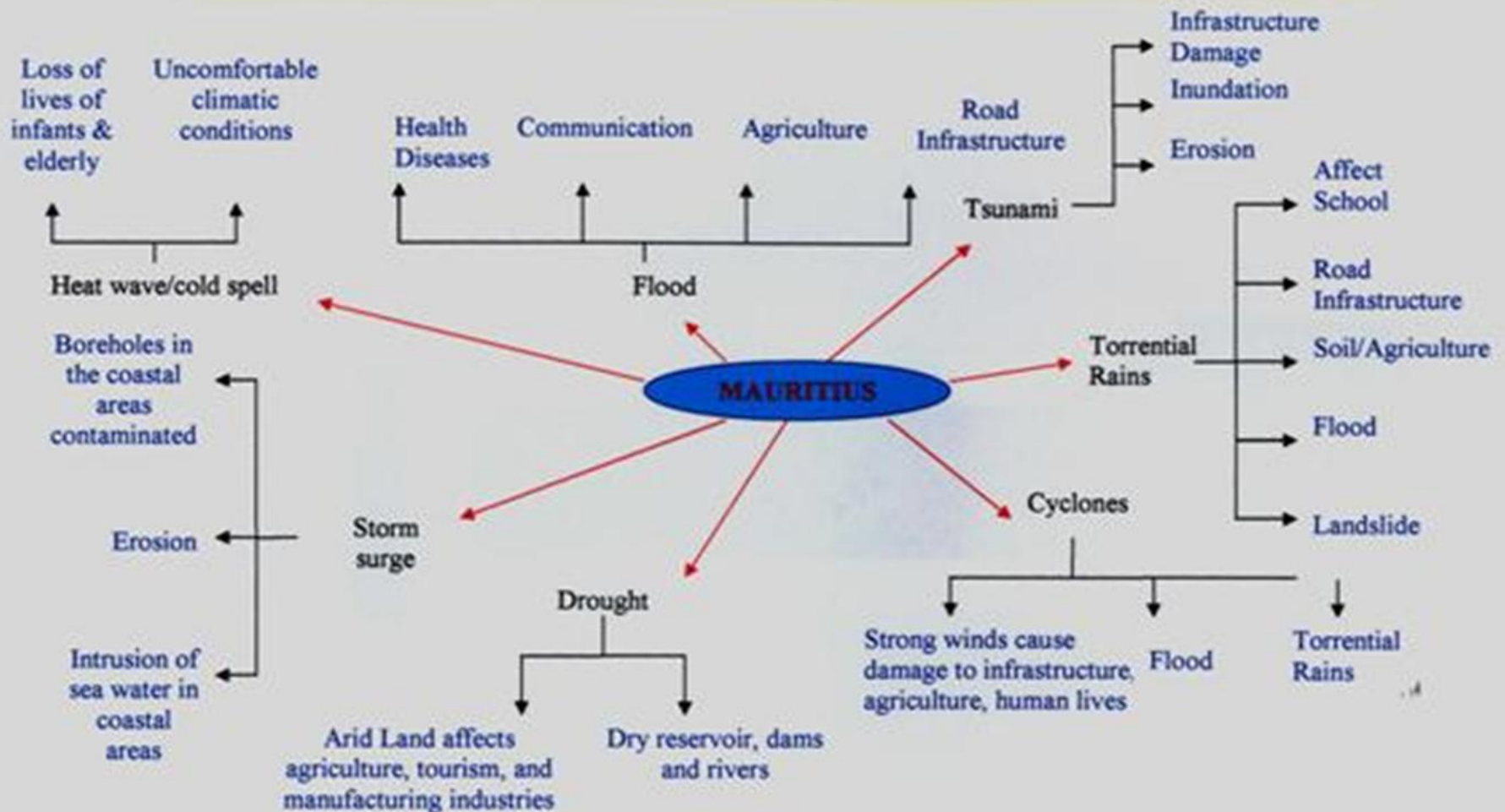
Rainfall Trend: Mean number of days with 50mm and 100mm over the whole island



Infra/ Operations

- Public Weather Service
- Observations: ground, air, ocean
 - Radar
 - Telecommunications: AWS, tide gauges, wave riders, Communications, IT
 - Upper Air /Wind: Radiosonde
 - Instruments: manned stations, calibrations
 - Seismometer/Earthquakes/Tsunami
- Regular Services → Marine, Aviation, General Public
- Early Warnings

Hydrometeorological Hazards



Early Warning of these events allow decision makers to take appropriate steps towards mitigation

Few Instruments

Automatic Weather Stations (30 Mru, 4 Rod)



Lightning Detectors (HQ, Plaisance)



Tide gauge (Port Louis, Blue Bay, Rodrigues, and Agalega).



Wave Rider Buoy (Blue Bay)



Doppler Radar at TAC



Seismometer at Vacoas

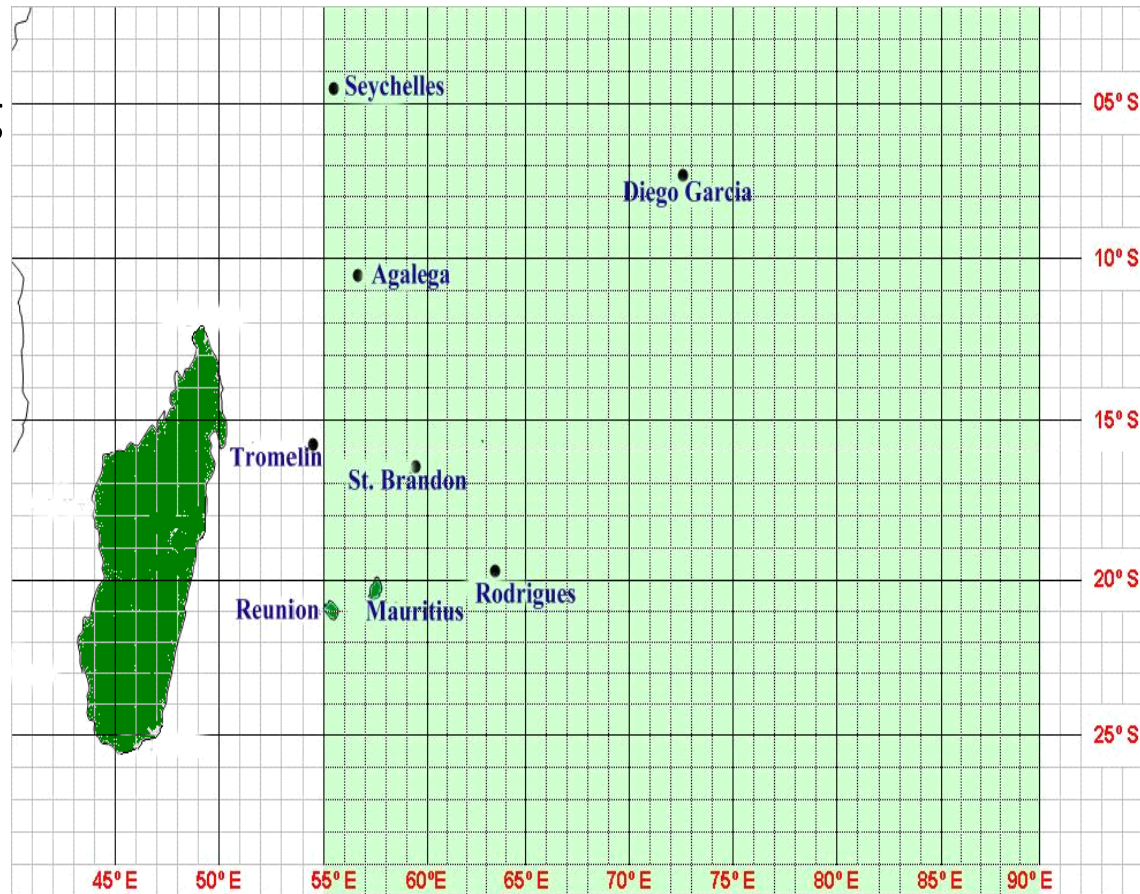


Naming of tropical storms in the SWIO Basin

Mauritius is responsible for naming storms forming in the region lying between longitude 55 E and 90 E.

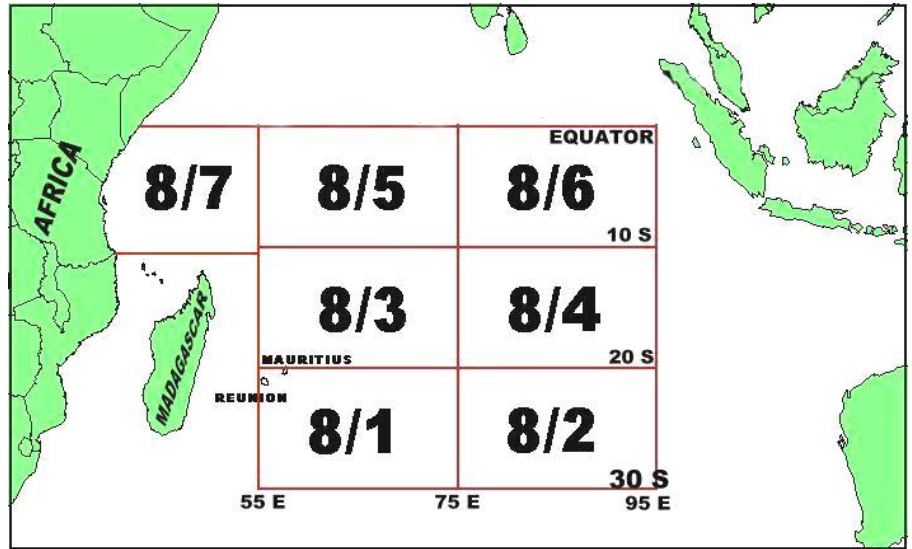
Madagascar is responsible for the region west of longitude 55 E

The Australian Bureau of Meteorology for the region east of 90 E.

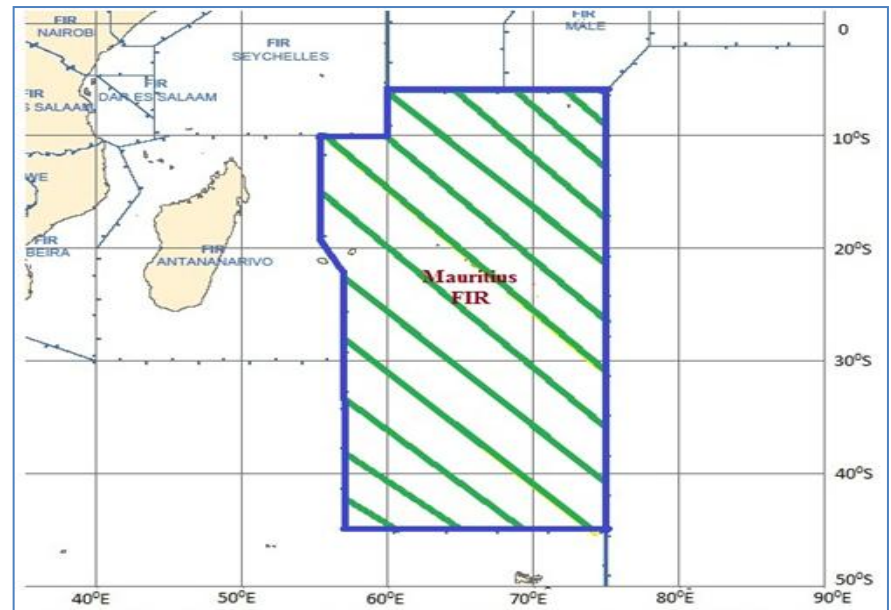


Marine and Aviation Services

- The MMS has the responsibility to issue weather and sea forecast for the high seas in Met Area VIII (S). Weather and sea forecasts are issued for the region bounded by the Equator and latitude 30° S and from longitude 55° E to 95° E under the framework of Global Maritime Distress Safety System (GMDSS) at 0115 UTC and 1315 UTC.
- Bulletins are transmitted by satellite via INMARSAT, by the RSMC La Réunion, through the earth station at Aussaguel (France).
- TAFs, SIGMETs and other meteorological information are provided to aircrafts operating in the Mauritius FIR.
- FIR extends from 55 E to 75 E and from 5.5S to 40S.



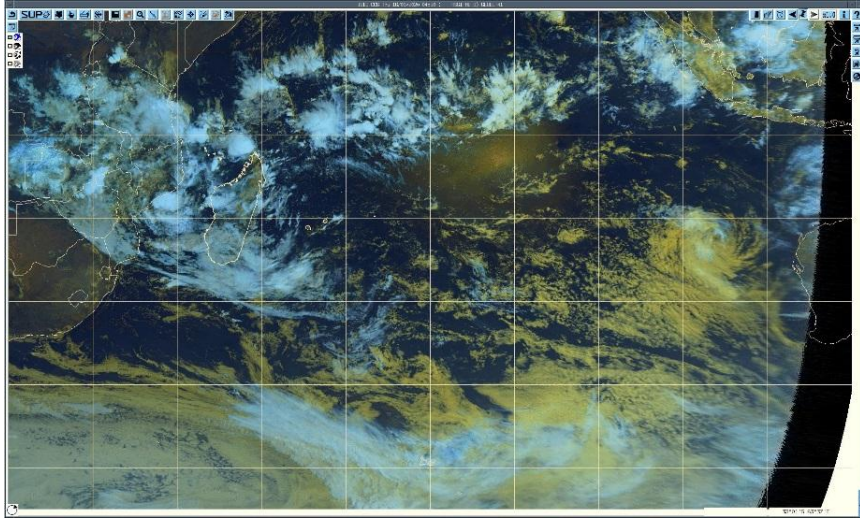
Met Area VIII (S)



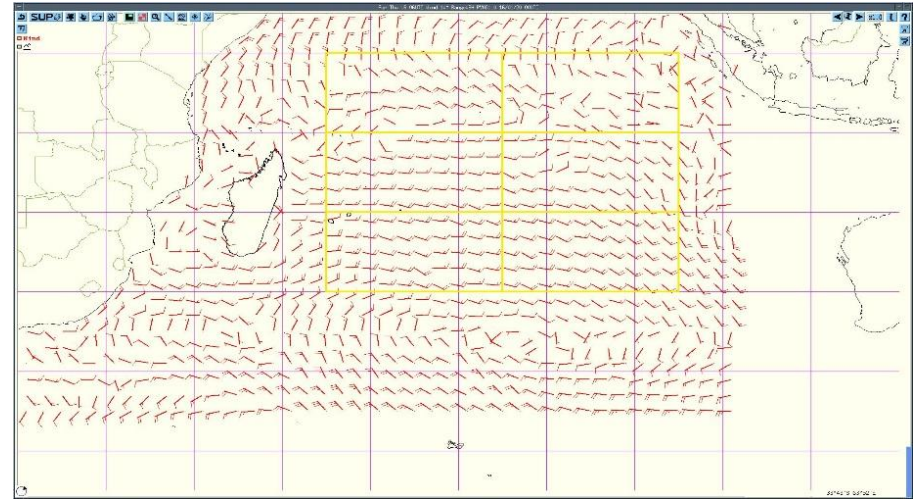
Mauritius FIR

Tools

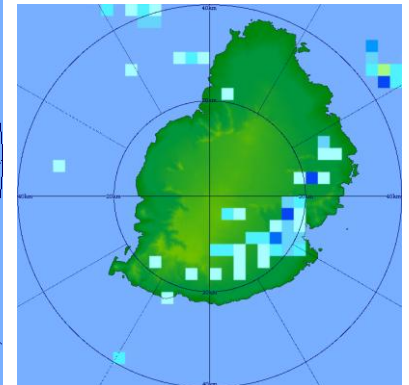
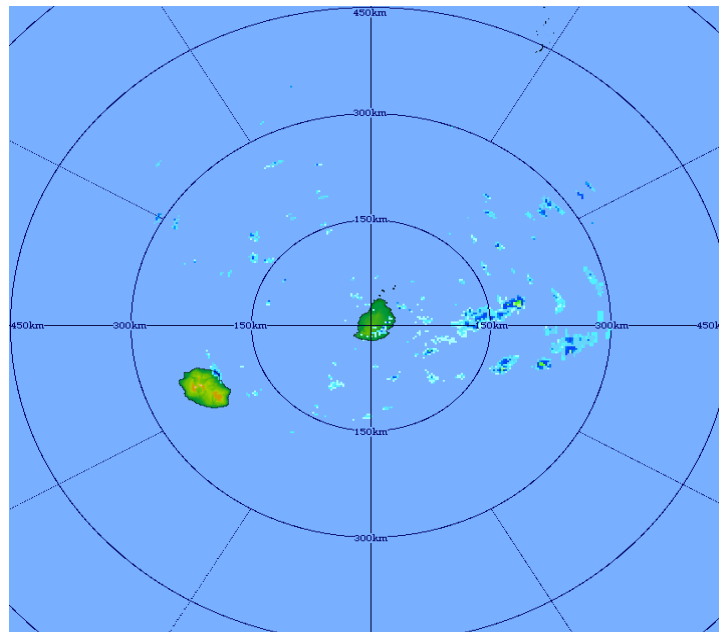
Satellite Image MSG/ MTG



NWP Models- ECMWF/Meteo France

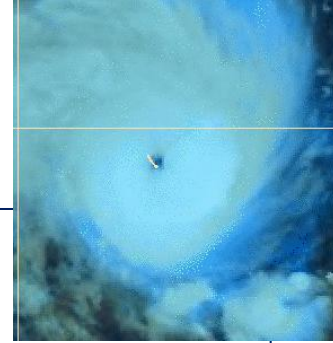


Doppler Weather Radar TAC



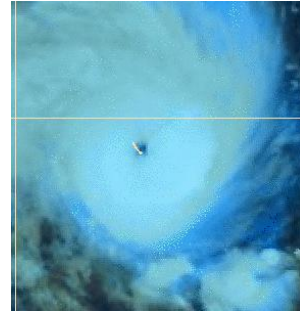
Current EWS

Cyclone Warning System



- CLASS I:** Issued not less than 36 hrs nor more than 48 hrs before the occurrence of gusts of 120 km/h;
- CLASS II:** issued so as to allow, as far as practicable, 12 hrs of daylight before the occurrence of gusts of 120 km/h;
- CLASS III:** issued so as to allow, as far as practicable, 6 hrs of daylight before the occurrence of gusts of 120 km/h;
- CLASS IV:** issued when gusts of 120 km/h have been recorded and are expected to continue;
- SAFETY BULLETIN:** Issued to:
 - Lift either a Class III or Class IV Warning;
 - Inform on persisting severe weather conditions and associated risks;
- TERMINATION:** Issued after consultation with, and following advice from, the National Crisis Committee to the effect that outdoor risks have considerably decreased.

Cyclone Warning System



- A warning system based on wind and time factors;
- Amount of daylight hours is a key element of **Class II** and **Class III**;
- Class III is a critical level of warning because of several socio-economic implications;
- Prior to cyclone season 2022-2023, the cyclone warning system consisted of a 4-tier warning;
- Prevalence of residual hazards and environment risk after passage of storm/cyclone constitutes major threat to both lives and property;
- Addition of another tier, known as the “**Safety Bulletin**”, added as from cyclone season 2022-2023;
- The **Safety Bulletin** is issued either after a Class III or Class IV warning;
- Safety Bulletin** is not issued after a Class I or Class II warning;
- The **Termination Bulletin** is issued in consultation with the National Crisis Committee.

Heavy Rain Warning System



Warning (3-tier warning system)

Heavy Rain Watch: issued whenever conditions becomes conducive for occurrence of heavy rain and 12 to 24 hours before the occurrence of heavy rainfall;

Heavy Rain Warning: issued not less than 30 minutes, nor more than 6 hours, before the occurrence of heavy rain;

Torrential Rain Warning: Observations indicating that accumulated rainfall has reached 100 mm in a given region or is likely to reach 100 mm in a given region in the ensuing hour, and the rain is expected to continue;

- A heavy rain watch is not necessarily followed by a heavy rain warning;
- A heavy rain warning is not necessarily followed by a torrential rain warning;
- There is a Termination Bulletin for **Heavy** and **Torrential Rain Warning**
- After Termination of a heavy/torrential rain warning a Watch may remain activated;
- Normal socio-economic activities during a **Heavy rain Watch**.

Storm Surge Warning

- Storm surge is the abnormal rise in seawater level during a storm. It is
 - the height of the water above the normal predicted astronomical tide.
 - caused primarily by a storm's winds pushing water onshore.
 - Storm tide is the total observed seawater level during a storm, resulting from the combination of storm surge and the astronomical tide.
-
- Storm surge warning is issued when a storm/cyclone is evolving close to the Mascarenes islands/St Brandon/ Agalega;
 - Usually embedded in the cyclone warnings.



Heavy Swell Warning

- Swells are high energy wind-waves originating from a distant region.
- This is storm tide arising from a distant storm/cyclone or waves generated over a distant region by strong winds .
- These waves break at the reefs and also invade the lagoons and inundate low lying coastal areas.



A **heavy swell warning** is issued, as far as practicable, about 12 hours in advance before swell waves of 4.0 metres or above are likely to affect the sea state in the vicinity of the Island of Mauritius, Rodrigues, Agaléga or St Brandon

Strong Wind Warning

Strong winds associated with:

- An approaching storm or retreating storm or a weakened storm;
- Strong anticyclones
- Severe convection

Flying objects, cross winds and uprooted trees are the main hazards.



A **strong wind warning** is issued, as far as practicable, about 12 hours in advance before wind speed of not less than 40 km/h, with gusts of 90 km/h, is likely to affect the island of Mauritius, Rodrigues, Agalega or St Brandon

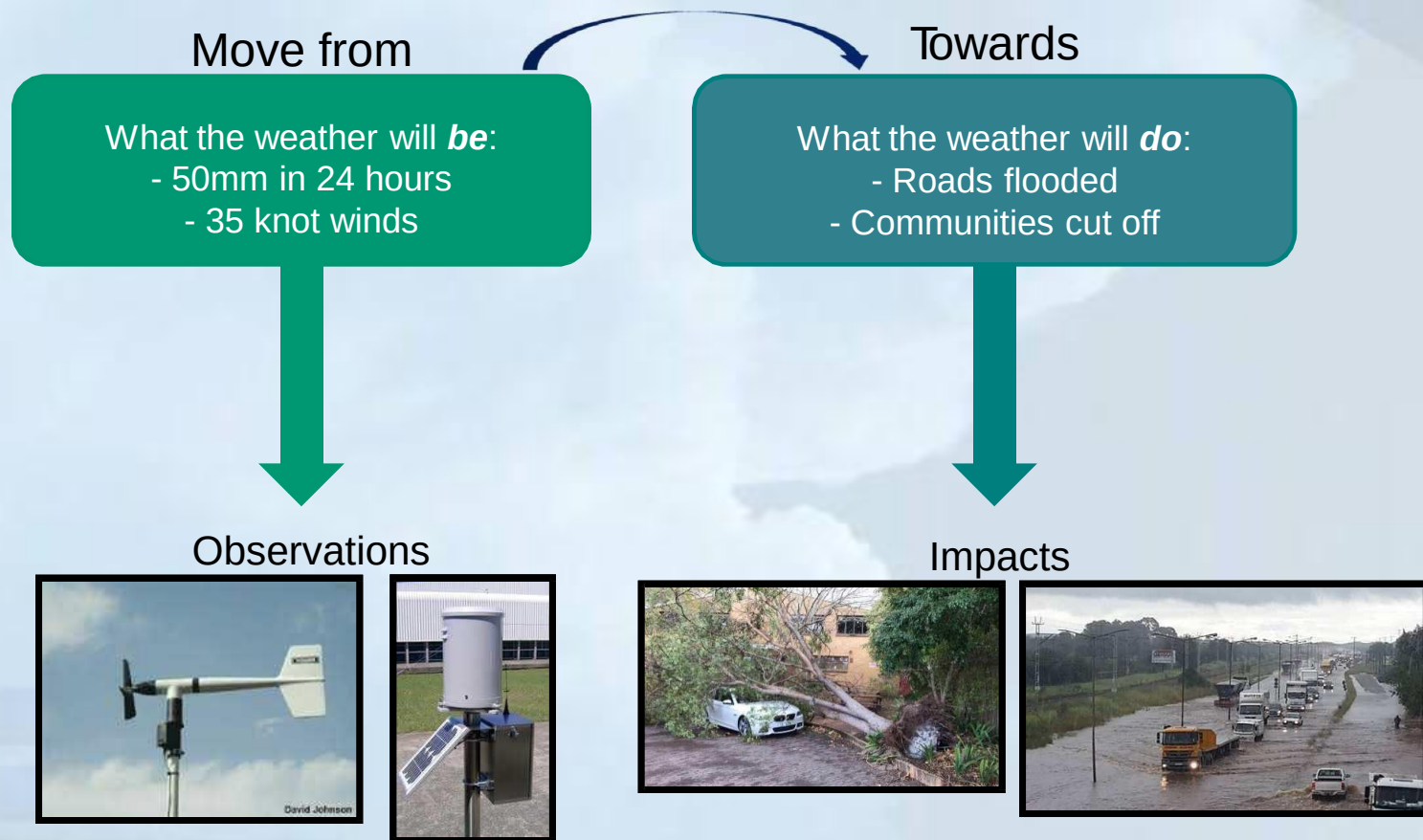
Tsunami Warning System



- **Tsunami watch:** Tsunami Service Providers; TSPs (Australia, India, Indonesia) confirm occurrence of potentially destructive Indian Ocean-wide tsunami (magnitude ≥ 7.0), the MMS issues Tsunami Watch bulletin
- **Tsunami warning:** This bulletin confirms that a destructive tsunami will affect Mauritius/Rodrigues within the next 5-7 hrs
- **Termination:** No threat of destructive tsunami wave or wave action has ceased. Issued when observations from tide gauges, Police and the Fisheries posts confirm that significant waves are no longer being observed.

Impact Based Forecasting

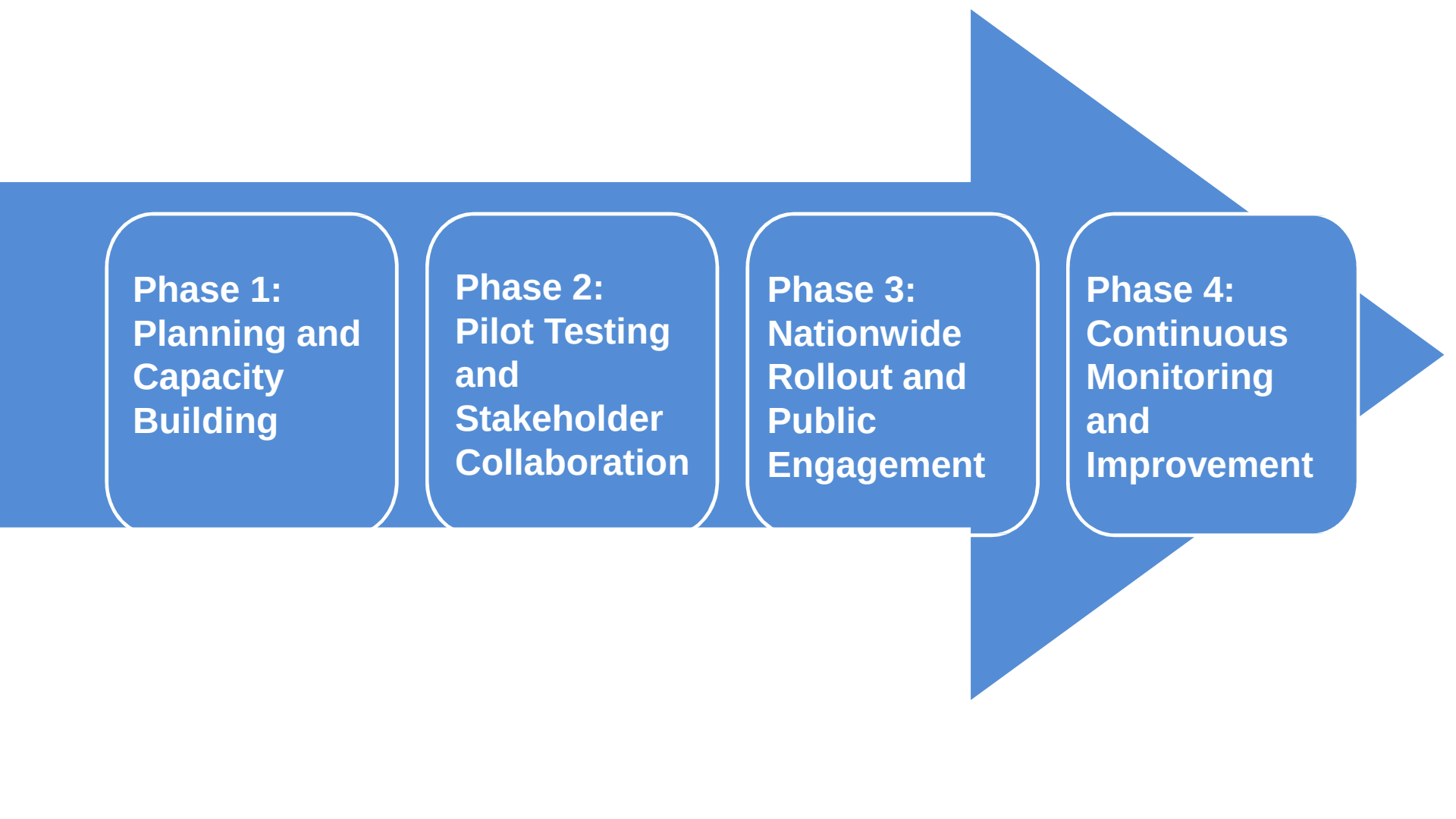
Impact-Based Forecasting – WISER (UK Gov)



Proposed Risk Matrix for Mauritius

Risk Matrix						Risk Level / Response
Likelihood	High 80%					
	Medium 60%					High / Take Action
	Low 30%					Medium / Be prepared
	Very Low < 10%					Low / Be Aware
			Minimal	Minor	Significant	Severe
		Impact				

Roadmap for developing an IBF system for Mauritius



**Phase 1:
Planning and
Capacity
Building**

**Phase 2:
Pilot Testing
and
Stakeholder
Collaboration**

**Phase 3:
Nationwide
Rollout and
Public
Engagement**

**Phase 4:
Continuous
Monitoring
and
Improvement**

PROJECTS

- CREWS - Implemented by WMO
 - Strategic Plan -
 - guidelines of WMO, the EW4All expectations and the Government Programme “**Bridge to the Future**”
 - result-oriented and implementation-driven; a living document that guides decisions, investment, partnership and institutional performance
- EWS-F SWIO and SWIO FFGS – US funded
- HYDROMET Project – IOC
- SOFF -



Mauritius Meteorological Services

**Thank you
for your kind attention**

[Website: https://metservice.intnet.mu/](https://metservice.intnet.mu/)