METEOROLOGY & COAST RADIO SERVICES

MINISTRY OF METEOROLOGY, ENERGY, INFORMATION,DISASTER MANAGEMENT, ENVIRONMENT, CLIMATE CHANGE AND COMMUNICATION

KINGDOM OF TONGA

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Tonga Meteorological & Coastal Radio Services

Outline

- Products of Mesoscale WRF
- Common Alert Protocol
- Products of JAXA

Funded by UN ESCAP, Japan and BMKG

Strengthening Multi-Hazard Risk Assessment and Early Warning Systems with Applications of Space and Geographic Information Systems in Pacific Islands Countries

Objectives:

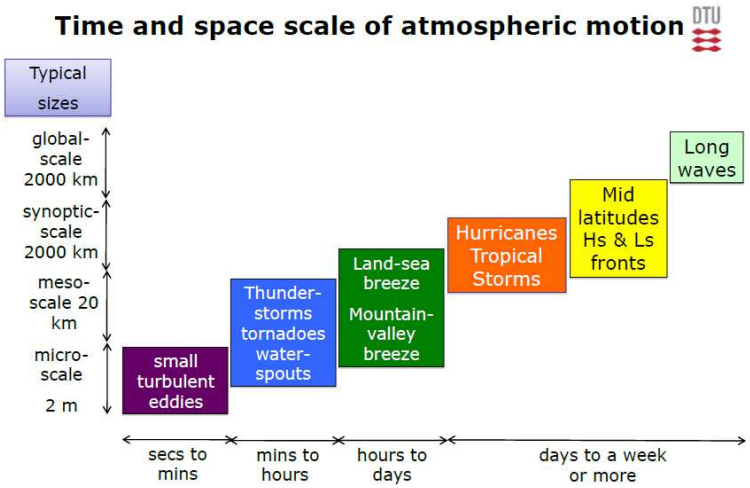
1. *To strengthen MHEWS of PICs through:*
   enhancing institutional capacity building
   developing national mid-term work plans on MHEWS using space technology and GIS
2. *to promote regional cooperation platforms for sharing geospatial data on EWS in Pacific region.*

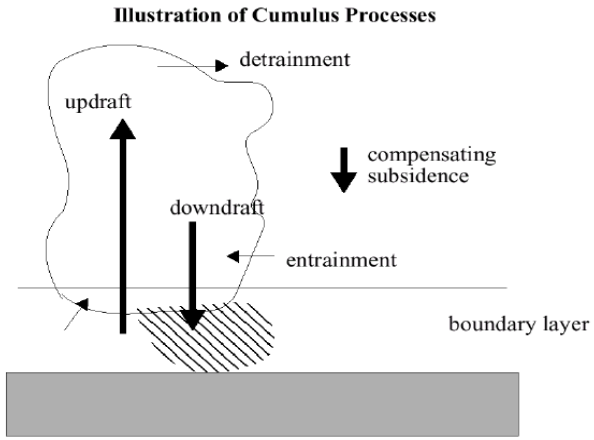
Implementation on Numerical Weather Prediction by WRF-TMS and implementation of Common Alert Protocol (CAP) in Tonga

(23 October – 4 November 2017)

Weather Research Forecast Model WRF

Introduction Mesoscale Numerical Weather Prediction



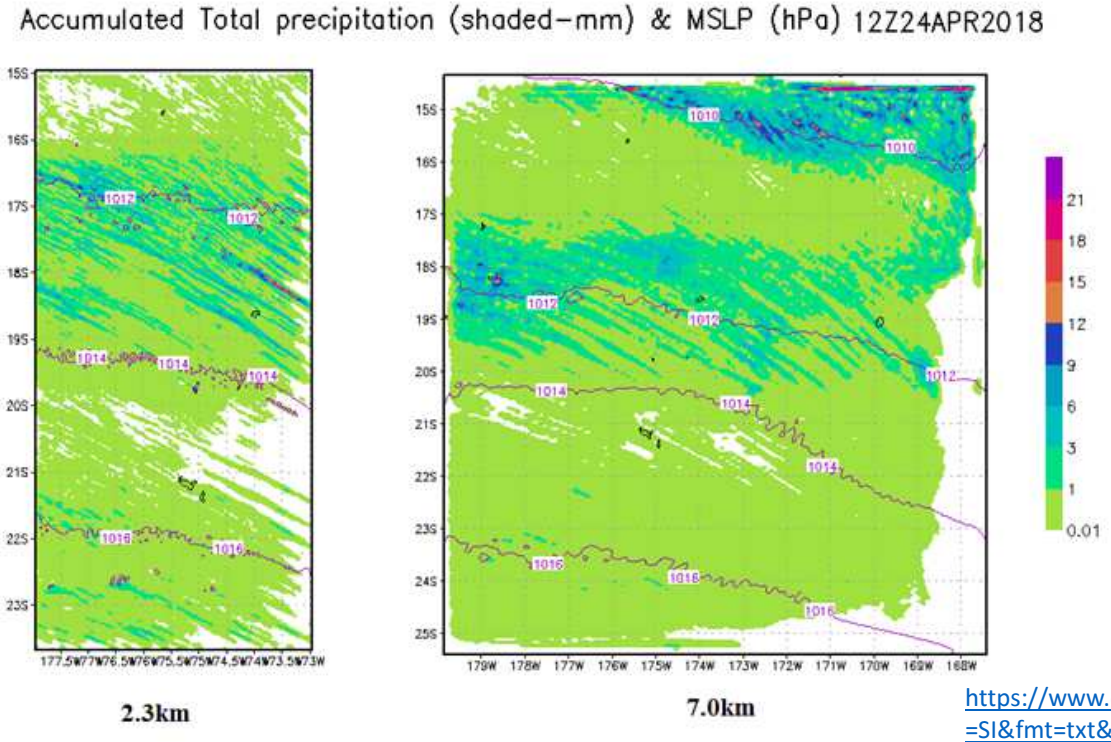


WRF is a state-of-the-art atmospheric modeling system designed for both meteorological research and numerical weather prediction. It offers a host of options for atmospheric processes and can run on a variety of computing platforms.

Specifics Model Setup based on Atmosphere Science Reason

Cumulus Parameterization	Tiedke
Platenetary Boundary Layer	YSU
Microphysics	WRF single moment (WSM3)
Longwave Radiation	RRTMG
Shorwave Radiation	RRTMG
Surface Layer	TEMF
Land Surface	layer thermal diffusion

Rainfall Accumulation Forecast



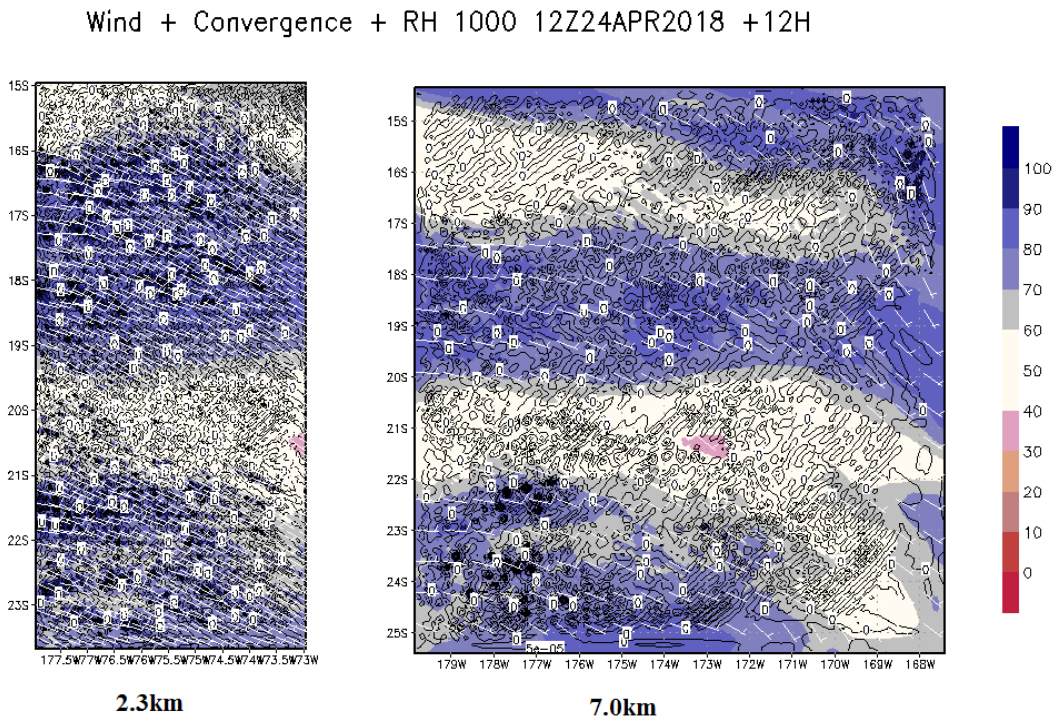
Stations	WMO ID	Rainfall (ml)	Forecasted Rainfall 2.3km (ml)	Forecasted Rainfall 7.0 km (ml)
Niuafo'ou	91772	1.4	1>	1>
Niuatoputapu	91776	0.4	1>	1>
Vava'u	91779	2.9	3>	3>
Ha'apai	91784	2.8	3>	3>
Fua'amotu	91792	NIL	1>	1>

Stations	WMO ID	Mean Sea Level Pressure (hPa)	Forecasted Mean Sea Level Pressure 2.3km (hPa)	Forecasted Mean Sea Level Pressure 7.0 km (hPa)
Niuafo'ou	91772	////	1012>	1012>
Niuatoputapu	91776	1010.2	1012>	1012>
Vava'u	91779	1012.5	1012-1014	1012-1014
Ha'apai	91784	1013.2	1014-1016	1012-1014
Fua'amotu	91792	1014.8	1014-1016	1014-1016

http://met.gov.to/index_files/staff/twips/Discussion_Page/wrf/

https://www.ogimet.com/display_synopsc2.php?lang=en&estado=Spa&tipo=ALL&ord=REV&nil=SI&fmt=txt&ano=2018&mes=04&day=24&hora=00&anof=2018&mesf=04&dayf=24&horaf=12&send=send

Surface Wind Forecast (Mesoscale WRF)



http://met.gov.to/index_files/staff/twips/Discussion_Page/wrf/

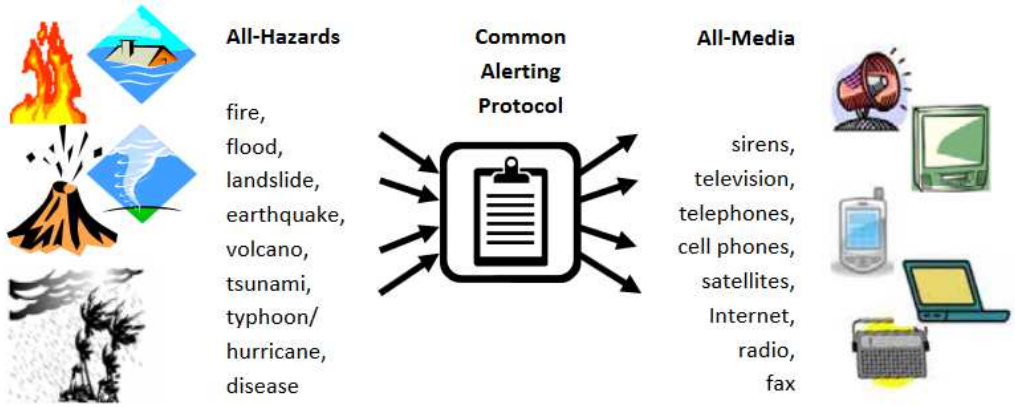
Stations	WMO ID	Observation		2.3km Forecast		7.0km Forecast	
		Windspeed (knot)	Wind direction	Windspeed (knot)	Wind direction	Windspeed (knot)	Wind direction
Niuafo'ou	91772	6	SE	5	SE	5	SE
Niuatoputapu	91776	CALM	CALM	5	SE	5	SE
Vava'u	91779	7	SE	5 to 10	SE	5 to 10	SE
Ha'apai	91784	11	SE	5 to 10	SE	5 to 10	SE
Fua'amotu	91792	4	SE	5	SE	5	SE

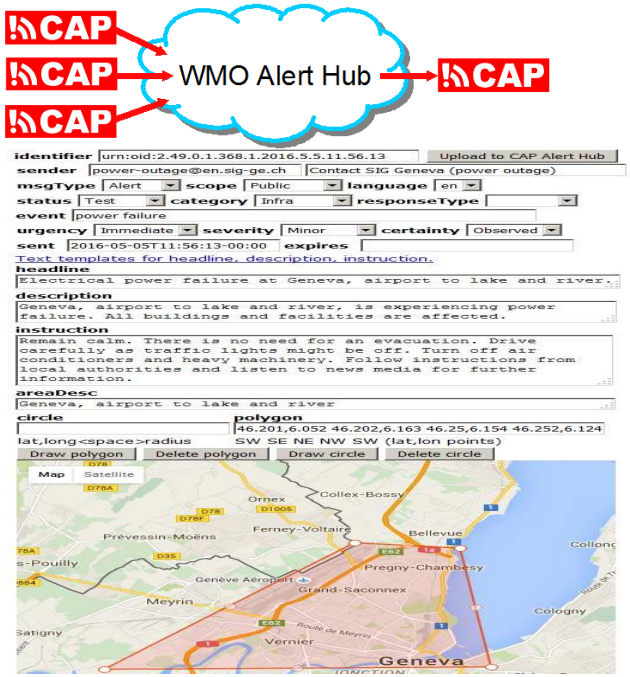
Stations	WMO ID	Rainfall (ml)	Forecasted Relative Humidity 2.3km (%)	Forecasted Relative Humidity 7.0 km (%)
Niuafo'ou	91772	1.4	50-70	50-70
Niuatoputapu	91776	0.4	50-70	50-70
Vava'u	91779	2.9	90-100	90-100
Ha'apai	91784	2.8	90-100	90-100
Fua'amotu	91792	NIL	50>	50>

https://www.ogimet.com/display_synopsc2.php?lang=en&estado=Spa&tipo=ALL&ord=REV&nil=SI&fmt=txt&ano=2018&mes=04&day=24&hora=00&anof=2018&mesf=04&dayf=24&horaf=12&send=send

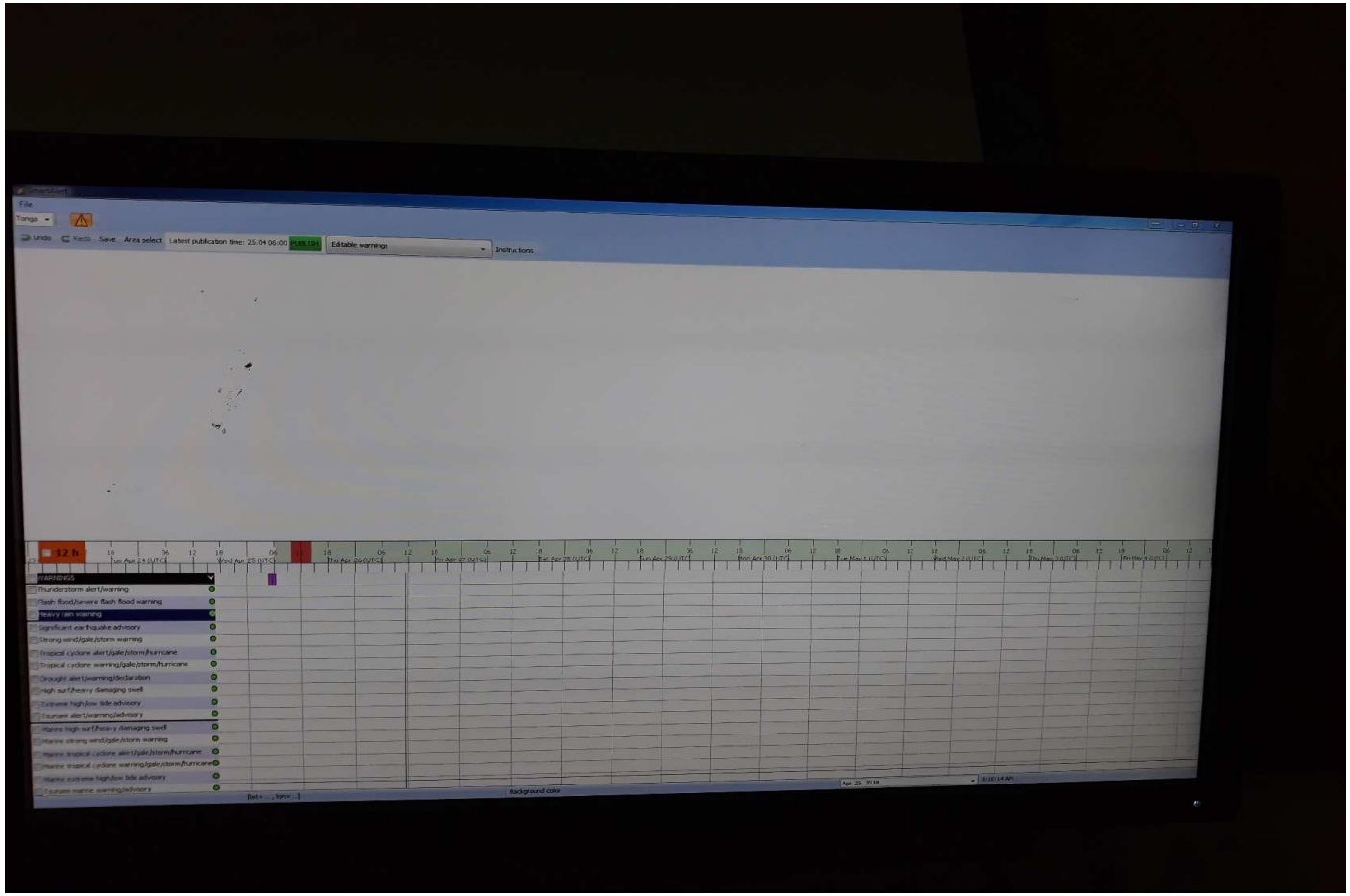
Common Alert Protocol (CAP)

- CAP is an international standard format for emergency alerting and public warning. It is designed for "all-hazards", related to weather events, earthquakes, tsunami, volcanoes, public health, power outages, and many other emergencies





Smart Alert


File
Tonga
Undo
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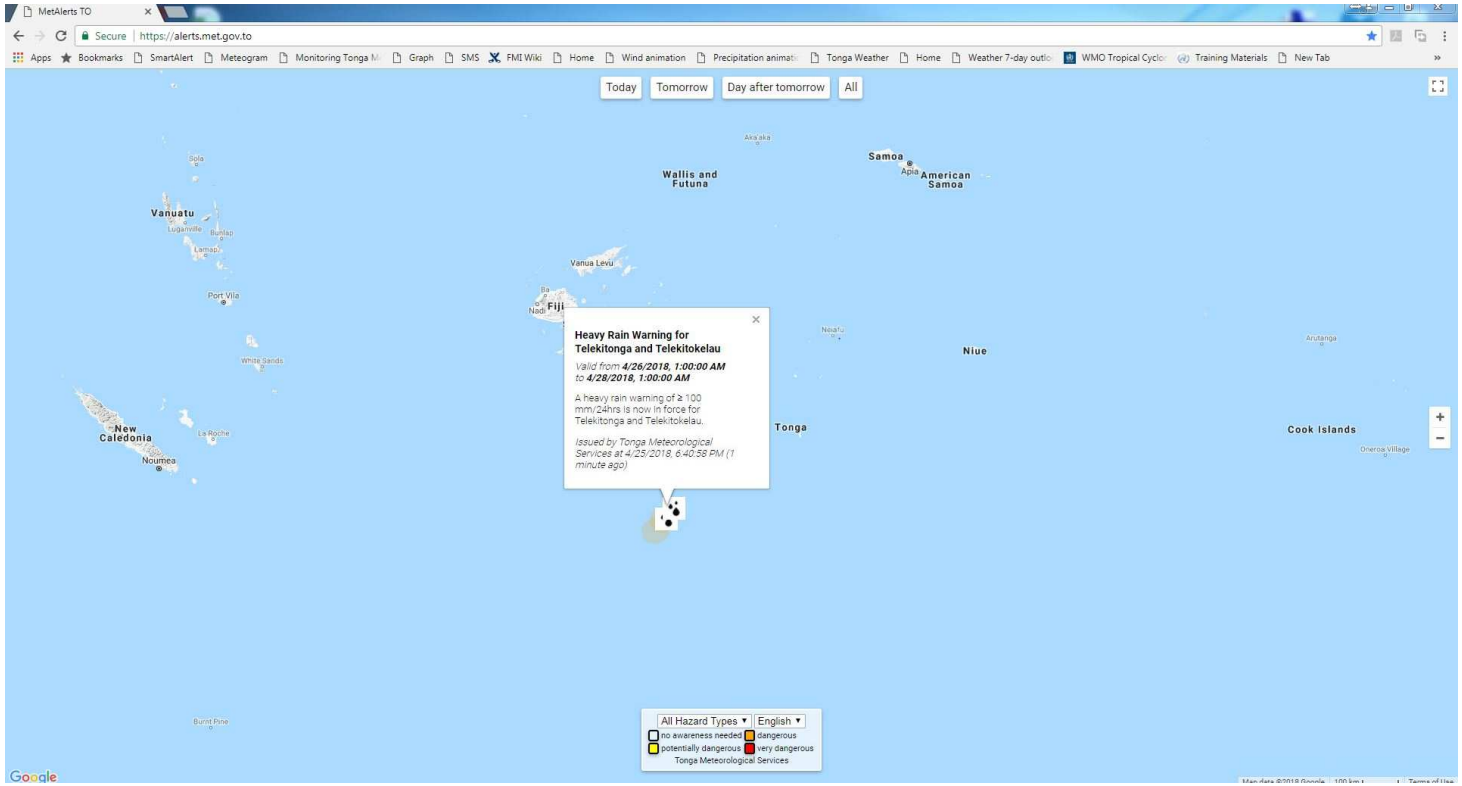
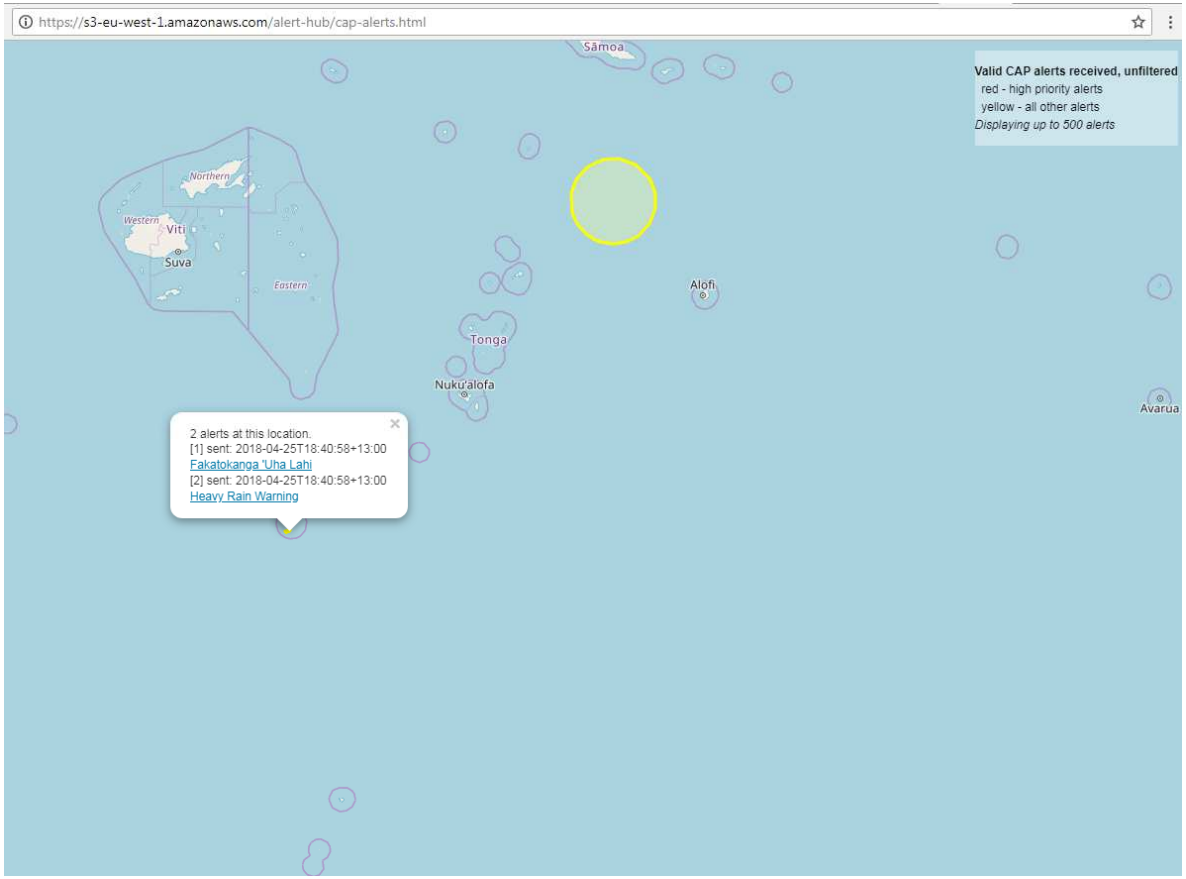
Save
Area select
Latest publication time: 25.04 06:00
Editable warnings
Instructions
12 h
WARNINGS
Thunderstorm alert/warning
Flash flood/severe flash flood warning
Heavy rain warning
Significant earthquake advisory
Strong wind/gale/storm warning
Tropical cyclone alert/gale/storm/hurricane
Tropical cyclone warning/gale/storm/hurricane
Drought alert/warning/declaration
High surf/heavy damaging swell
Extreme high/low tide advisory
Tsunami alert/warning/advisory
Marine high surf/heavy damaging swell
Marine strong wind/gale/storm warning
Marine tropical cyclone alert/gale/storm/hurricane
Marine tropical cyclone warning/gale/storm/hurricane
Marine extreme high/low tide advisory
Tsunami marine warning/advisory
Background color
Apr 25, 2018

Tonga Met New Website



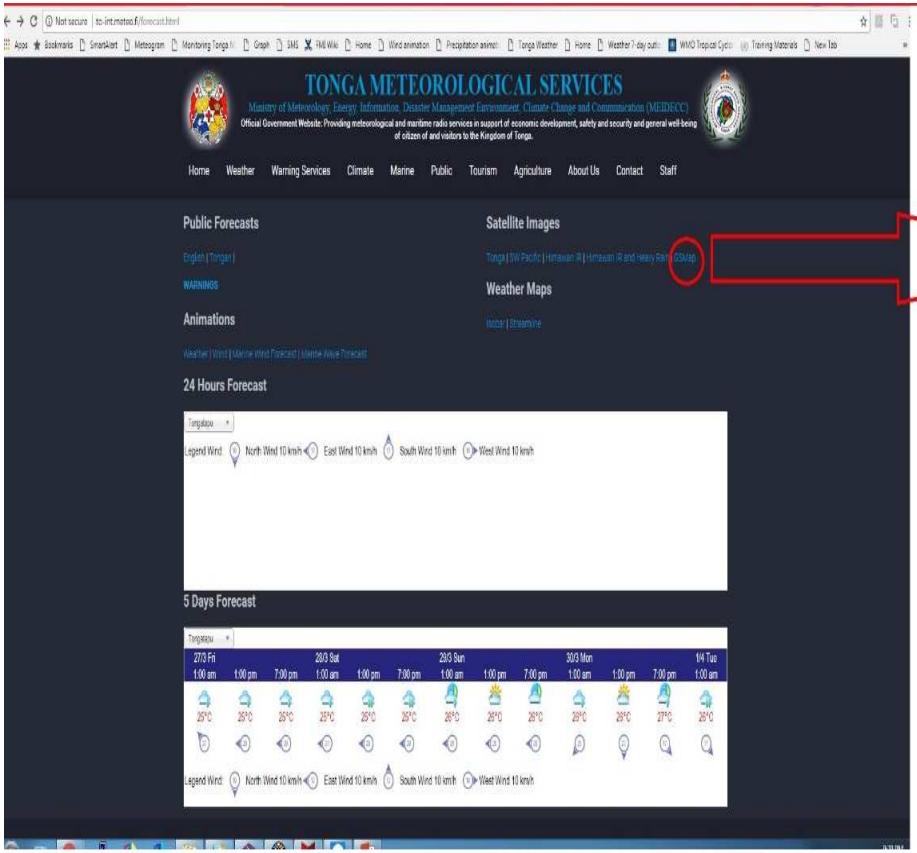
Link:
www.alerts.met.gov.to

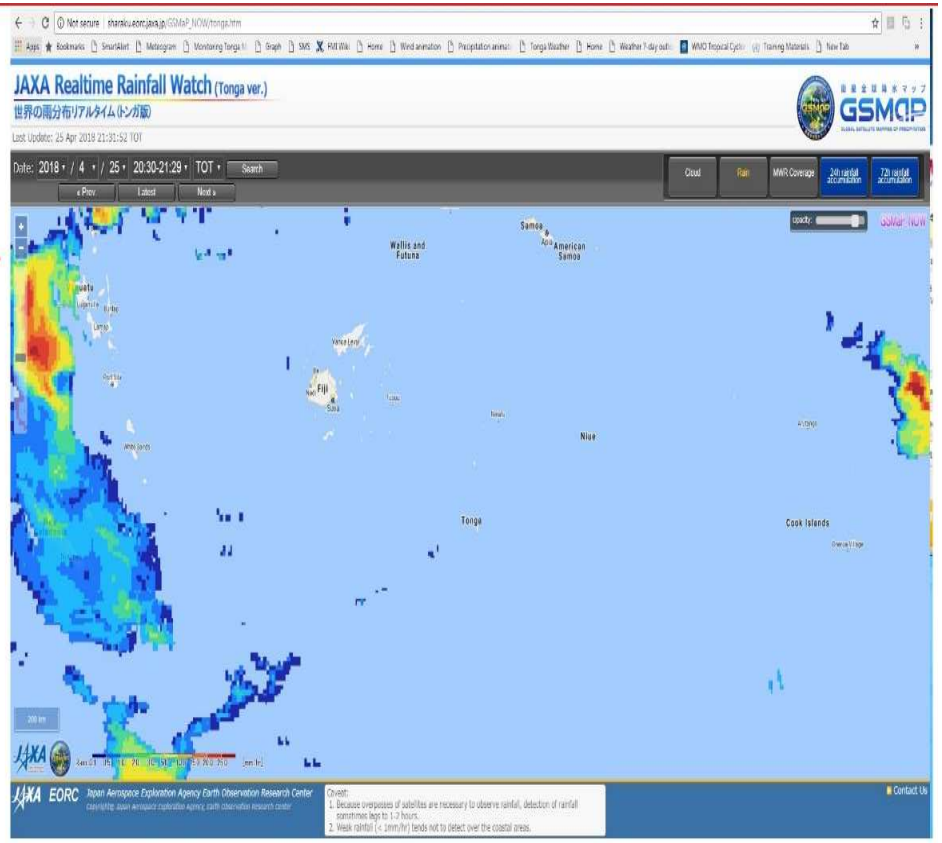
WMO Alert Hub



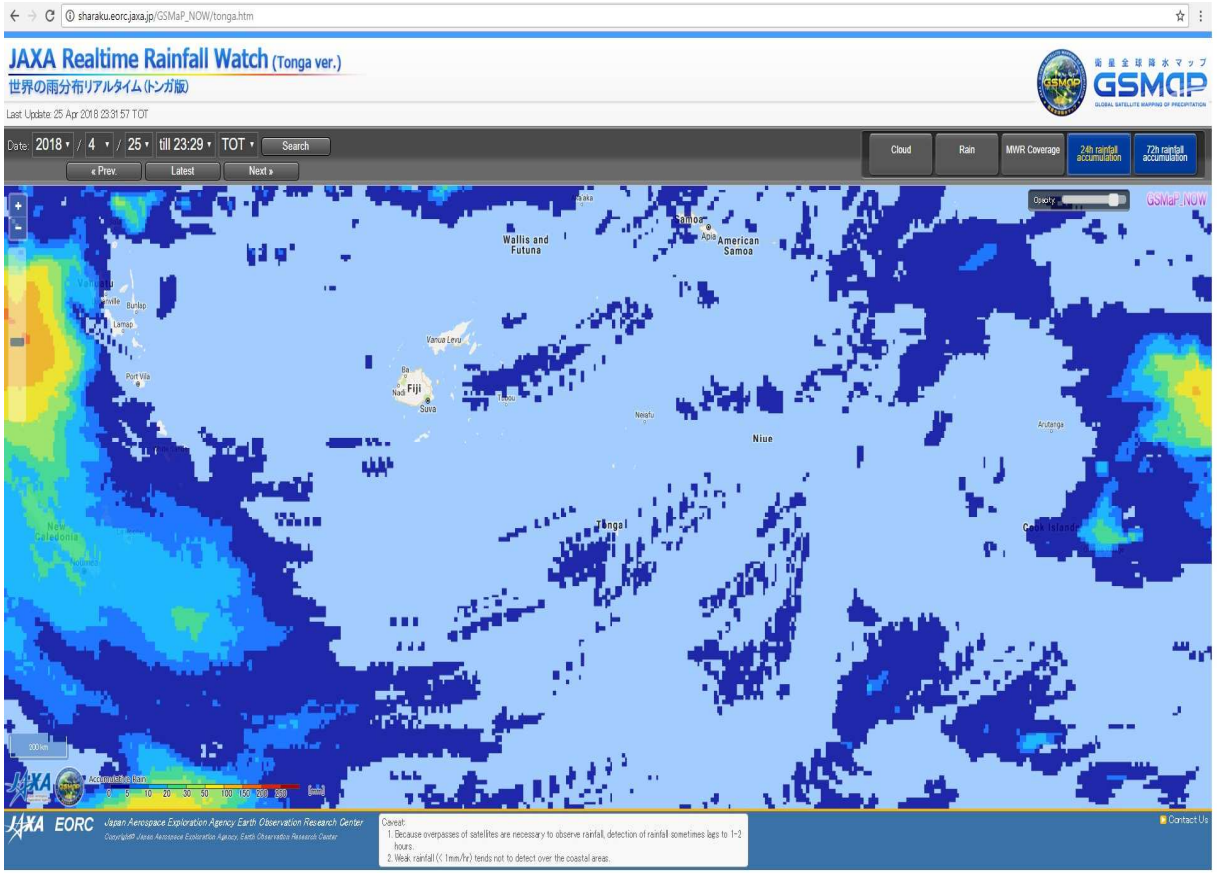
Link:
https://s3-eu-west-1.amazonaws.com/alert-hub/cap-alerts.html

JAXA Website





JAXA Real-time Rainfall Watch

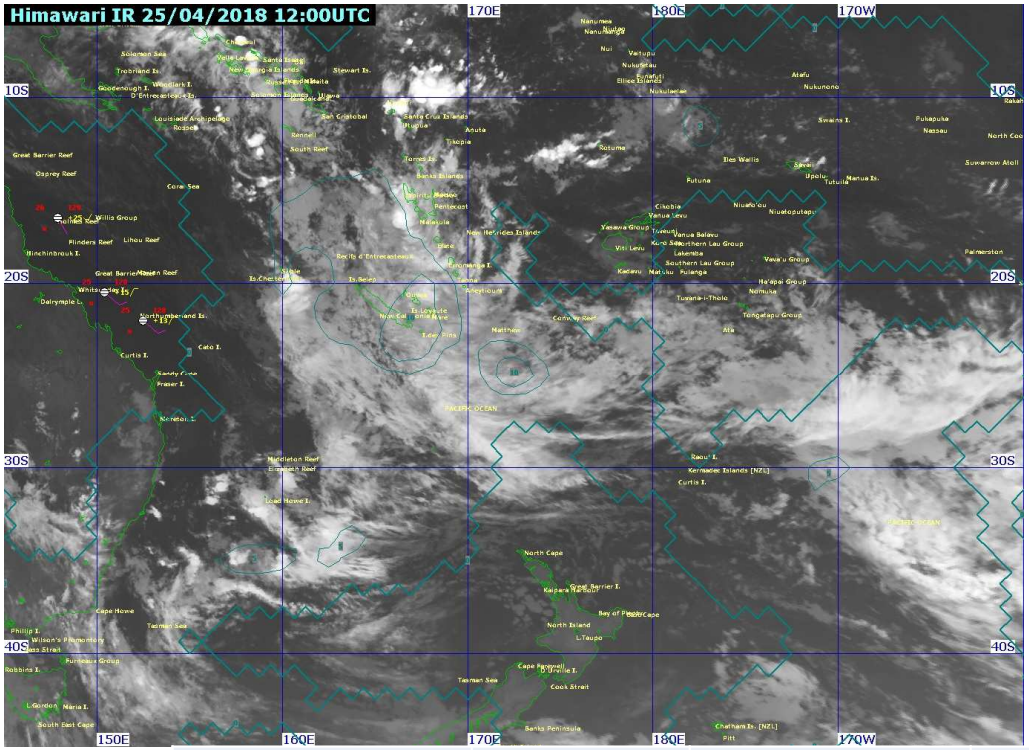


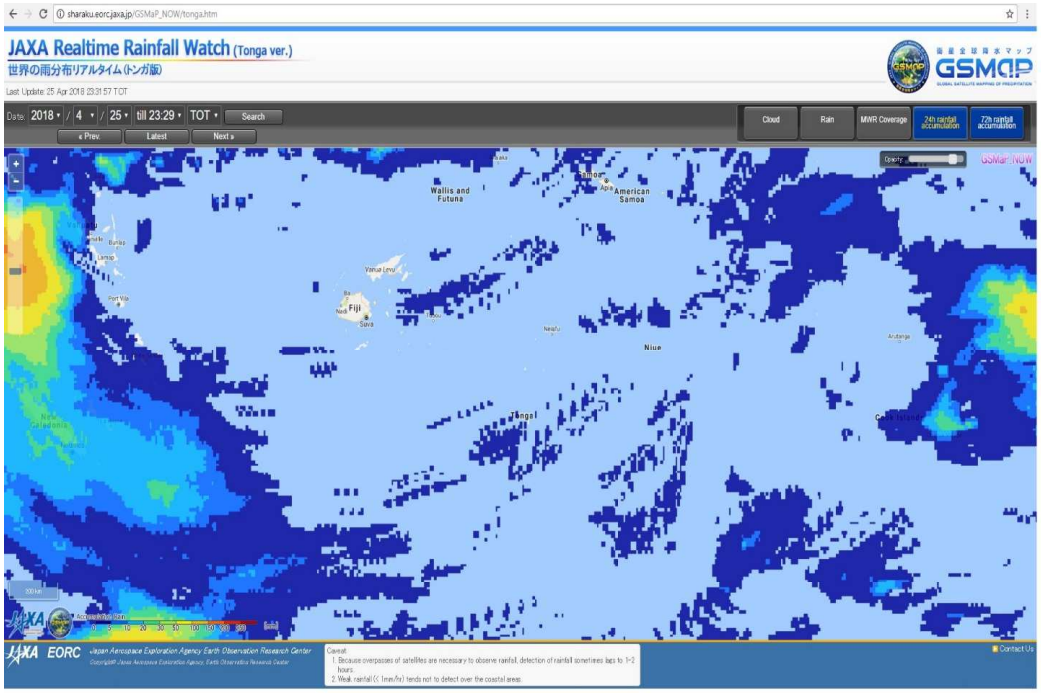
Japan Aerospace Exploration Agency (JAXA)

Usefulness of Jaxa Real-time Rainfall.

- Monitoring near real-time rainfall
- Research/case studies
- Ground proof the models
- Now-Cast at Real-time.
- Identify area of Precipitation.
- Able to determine area of heavy and low rainfall.

Nowcast: prediction of the present and very near future and recent past





Stations	WMO ID	Observation Rainfall (ml)	GSM approximation Rainfall (ml)	JAXA Rainfall (ml)
Niuafo'ou	91772	NIL	NIL	NIL
Niuatoputapu	91776	NIL	NIL	NIL
Vava'u	91779	NIL	NIL	NIL
Ha'apai	91784	NIL	NIL	NIL
Fua'amotu	91792	NIL	NIL	NIL
Ouloup Ile Ouvea (New Caledonia)	91579	27	10	20-30

Conclusion & Future Plan

- Areas needed for improvement in the WRF Output
  - Expand the area as model fields are not clear
  - Add rainfall accumulation and surface wind to the new display website
  - Continue on research on the model setup that appropriate for Tonga weather
  - Use of ECMWF (9km) data to initialize WRF and downscale into 3km and 1km
  - Use GIS to display WRF model output
  - Need to develop capacity of local IT staffs to maintain the WRF
- Needs for CAP
  - CAP need to expand to other communication tools eg. Mobile, email, face book, social media, telephones, siren etc…
- Needs for JAXA
  - JAXA needs improve spatial and temporal resolution
  - Needs model fields overlay on JAXA precipitation
- Need to build capacity on Tsunami operation
  - -Need a separate computer that can run SEISCOMP 3 and connect to other countries seismic stations (USGS, GFZ, etc) through internet and process earthquake event to compare with other organization analysis
  - Train Staffs how to operate SEICOMP 3 and interpret earthquake data events