COUNTRY REPORT

FIJI METEOROLOGICAL SERVICE

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BMKG Headquarter

Outline

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Abstract

- Fiji meteorological services uses a Japanese weather satellite, the 8th of the Himawari geostationary weather satellites operated by the Japan Meteorological and the GOES Satellite data and in daily weather forecast and also Tropical cyclone.Mainly internet and IBL have been used to access satellite data however more methods should be implemented especially in terms of natural disaster.We are looking at a plan in which data would be readily available for us to use.
- More training and awareness is needed on the specifications of the different cannels and how it can illustrate benefits to the economy and communities.

Satellite data

- GOES-15 - IR/VIS and WV - McIDAS format
- Himawari 8 Cloud - Channels 03,07,08,13,15 Segments 05,06,07,08,09,10 every 30 minutes interval and is directly dependent on ISP bandwidth availability via internet connectivity at 20MB
- Himawari 8 Cast - 14 Channels via data collection platform
- LRIT/EMWIN - 14 Channels via data collection platform

Future Plan

- Upgrade GOES 15 to GOES 17 - IR/VIS and WV - 16 channels with increased resolution
- Himawari 8 Cloud - Utilise all 01-16 channels with Segments 05,06,07,08,09,10 every 10 minutes interval with increased bandwidth that can sustain this
- Utilise RGB products operationally
- Application of Satellite Data to Weather Analysis and Disaster Monitoring
- Application of Satellite Data to Data Assimilation and Numerical Weather Prediction (NWP)
- Application of Satellite Data Calibration / Validation and Climate / Environmental Monitoring
- Applicaton of Satellite Data Land Surface and Ocean Parameters Derived from Satellite Observations
- Training in satellite imagery analysis for multi-spectral and high resolution spatial imagery

PROCESSING AND APPLICATIONS

- IBL Visual Weather Satellite imagery: FM-92 GRIB (various systems), PIF & XPIF (VCS), HDF5 &l MEOS HDF5 (Kongsberg; European MSG NWCSAF Nowcasting project), GeoTIFF (SeaSpace TeraScan; various systems), other third-party receivers for MeteoSat 2nd Generation (MSG), MeteoSat, NOAA, FengYun, GOES, NWCSAF, MPEF, etc.

Applications:

- display, generating and printing of surface charts, upper-air charts, weather charts, model outputs, remote-sensing imagery
- overlaying of any kind of meterological data and features
- display of all NWP products, unlimited number of models and parameters
- Mathematical Kernel for extensive model computation and evaluation
- combining different models in overlays or even computations between models
- extensible satellite and radar support (including nowcasting) with composing, coloring, reprojecting and multi-channel combining of images

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- display, generating and printing of surface charts, upper-air charts, weather charts, model outputs, remote-sensing imagery
- NWP field modification
- report correction
- objective analysis with model-initialization and numerical quality-control
- Presentation Templates allowing on-map visualization of custom bulletins
- unification of BUFR/CREX and alphanumeric reports
- extended customizable shapefile orography with unlimited precision and content
- direct access to received reports and messages
- extensive chart and table output including weather monitoring for both observations and models

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- Development our current system using enhanced features of new-generation satellites such as high spatial resolution, multi-spectral bands and product development
- Development of its current delivery mechanism's and product delivery by integrating new technology due to vast geographic locations within Fiji
- Active participation in meetings with focus on the utilization of new-generation satellite imagery
- Utilize VLAB educational system to better to educate Forecasting competences
- Himawari Cloud as Primary
- HimwariCast as Backup

Training Needs

- Tropical cyclones Multi-spectral bands: New channels derived from multi-spectral-band observations will support issuance of new and more effective warnings.
- Torrential rain Multi-spectral bands: New quantitative products will be derived from multi-spectral band observation data.
- High Spatial Resolution: High resolution images will assist in clarifying

atmospheric particulars

- Torrential rain Multi spectral bands: New signals derived from multi-spectral band observation before extremely heavy rainfall are expected to be useful.
- FMS's requirements to get desired benefits from the new generation of satellites
- Major hazard Features of new generation GEO met. Satellite

Appendix

Technical infrastructure issues to access and process/visualize satellite data

- Upgrade from GOES-15 to GOES 17. Need to utilise same antenna but requires modifications to mounting feed. FMS does not have the expertise to deploy this and need assistance in this area
- Increase in ISP bandwidth to facilitate 16 channels download very expensive in comparison to overseas costs
- Non-existence of a Satellite Division in FMS to look into extra-terrestial development, requirements and upgrades

Background

Country over- view

Geography

- Fiji consists of 332 islands in the southwest Pacific Ocean about 1,960 mi (3,152 km) from Sydney, Australia. About 110 of these islands are inhabited. The two largest are Viti Levu (4,109 sq mi; 10,642 sq km) and Vanua Levu (2,242 sq mi; 5,807 sq km).
- Most of Fiji's terrain is mountainous. The majority of these mountains are dormant or extinct volcanoes, though some were also formed from limestone and coral islets. The highest point in Fiji is Mt. Tomanivi, located on the main island of Viti Levu. It rises 1,324 meters (4,344 feet) above sea level

Population

- Fiji’s total population stands at 884,887 compared to 837,271 in the 2007 census. This is an increase of 47,616 or 5.7 per cent. The average annual population growth is 0.6 per cent, due to low birth rates and out migration.

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Climate

- Fiji's climate is warm and tropical year-round, even in the islands' "winter" months. The average temperature in Fiji is 25°C (77°F), but it can climb to above 30°C (86°F) in summer (December and January) and sink to 18°C (64°F) in winter (July and August). Many people consider the Fijian winter, which is the dry season from May to October, to be the best time to visit the islands. This is when it is drier, less humid and a bit cooler, so outside activities are more pleasant. However, this is also Fiji's peak tourist season so the prices for airfare and accommodation peak as well, especially in June and July.

Major historial hydrometeorological disasters

I. Disaster type and distribution

- **Tropical Cyclones**

Another cyclone, named Cyclone Gene, hit the Fijian city capital of Suva and surrounding areas with wind gusts up to 185 kmh (115 mph) in January 2008, causing widespread flooding and blackouts. Eight people were killed directly or indirectly by the storm.

In December 2012, Cyclone Evan unleashed winds of up to 230 kmh (145 mph) on Fiji's main island, Viti Levu, as well as the area to the west and northwest. The cyclone uprooted trees, destroyed homes and caused widespread power and water outages.

➢**Flooding** - Flooding poses a serious threat to the Fiji Islands.

In recent years, inundation of the towns of Ba and Nadi in western Viti Levu (Fig. 1) in January 1999 resulted in an estimated damage bill of F$40 million (~US$20 million) and the loss of six lives (Yeo, 2000).

Flooding of mostly rural areas in northern Vanua Levu (Fig. 1) in April 2000 is estimated to have caused financial losses of F$3 million (~US$1.5 million), a figure that obscures substantial losses incurred at the household level (Yeo, 2001).

Severe flooding associated with Tropical Cyclone Ami in January 2003 cost tens of millions of dollars and left 17 people dead near Labasa (Fig. 1) (NDMO, 2003; Terry et al., 2004). Another 10 people drowned as a result of flooding in eastern Viti Levu in April 2004 (Fiji Government Online, 2004).

(PDF) Flooding in Fiji: Findings from a 100-year Historical Series. Available from: https://www.researchgate.net/publication/233142298_Flooding_in_Fiji_Findings_from_a_100-year_Historical_Series [accessed Sep 25 2018].

➢Drought

The 1997-98 drought in Fiji caused a F$104 million loss in revenue in the sugarcane industry alone. The Western sides of Viti Levu and Vanua Levu and the Yasawas were the worst hit regions, where 90% of the population received food and water rations. In September 1998 the Fiji Cabinet declared a natural disaster for the prolonged drought.

➢Earthquake and tsunami

One of the most destructive Fijian tsunamis hit Suva on September 14, 1953. It occurred right after a 6.7 earthquake. It caused major damage and destruction to the wharf and infrastructure and caused three deaths in Suva, as well as twelve who had reportedly drowned in Koro and Kadavu. It was determined that the source of the tsunami was the result of a 60 million cubic meter submarine landslide at the head of the Suva Canyon.

Life and economic loss

	Economic Loss	Life loss
Tropical cyclone Gene	FJ$51 million	8 people
Tropical cyclone Evan	FJ$ 73.4 million	2 people
Tropical Cyclone Winston	FJ$1.42 billion	44 people

Major national economic sectors relying on NMHSs

-General public and Agriculture sector
-Transportations
- Commercial sector

Short Description of NMHS Activities

The National Meteorological and Hydrological Services own and operate most of the infrastructure that is needed for providing the weather, climate, water and related environmental services for the protection of life and property, economic planning and development, and for the sustainable exploitation and management of natural resources.

Most of the NMHSs develop and distribute forecasts, warnings and alerts for safety of life and property and to support efforts to reduce the impacts of weather, climate, water and related environmental natural hazards.

The NMHSs make important contributions to international systems established by the Members of WMO to coordinate the collection of observations based on common standards of accuracy and reliability, to process these observations and data into weather forecasts and advisories, and to exchange information and products among all NMHSs in real time. The success in the operation of this established international system depends on the contribution of individual countries

Current Observational System Overview

Instruments Used at Fiji Meteorological Service

Stevenson Screen

Stevenson screen is an enclosure to shield meteorological instruments against precipitation and direct heat radiation from outside sources, allowing air to circulate freely around. It holds instruments like thermometers, hygrometers, and thermographs.

Earth Thermometers

This thermometer is used to measure temperature readings at various depths below the surface. Standards depths are 5cm, 10cm, 20cm, 30 cm and 50cm.

Grass Minimum Thermometer

The grass minimum thermometer is used to record the lowest temperature when exposed just above a grass surface. Black shield is fitted over the outer sheath to prevent spirit in the tube vaporizing.

Rain Gauge

Rain gauge is a type of instrument used to gather and measure the amount of liquid precipitation over a set period of time. This standard manual rainguage has a funnel, diameter of 5 inches.

Tilting Siphon Rainguage

The tilting siphon recording rainuage has been the standard type of recording rainguages used by Fiji Meteorological service in the climate network to determine the duration and intensity of rainfall.

Evaporation Meter

Measures evaporation from free standing water, and in millimeters. Water is either added or removed from the pan through the use of a measuring can till the tip of the fixed point coincides with the surface of the water in the pan

Barometer

A barometer is a meteorological instrument used to measure atmospheric pressure. It can measure the pressure exerted by the atmosphere by using water, air, or mercury.

Sunshine Recorder

This instrument records duration of sunshine by a trace scorched on a special card by the burning action of the suns rays focused on the card by a glass sphere. The cards fit into grooves in the metal bowl of the sunshine recorder.

Weather Balloon

A weather balloon filled with hydrogen gas is released every day at 11am and 11pm. It carries a radiosonde which sends back information on atmospheric pressure, temperature, and humidity.

Barograph

A barograph is a recording aneroid barometer. It produces a paper or foil chart called a barogram that records the barometric pressure over time.

Anemometer and wind vane

Anemometer measures the wind speed.

Wind vane measures the wind direction.

Radiosonde

The standard method of obtaining values of temperature,pressure and humidity at different levels in the atmosphere is by the use of a balloon carrying a small radio transmitter known as a radiosonde.

Automatic Weather Station

The Automatic Weather Station is a self contained, data logging system for measuring atmospheric pressure, wind speed, wind direction, air temperature, relative humidity and amount of rainfall.

Radar

In Meteorology, radars serve a dual role:

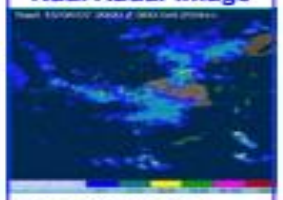
1. Weather watch.
2. Wind find.

Wind Find

In this mode the radar is used in to track an aluminum target tethered beneath a balloon as it ascends through the atmosphere.

At designated time intervals, the balloons location in space are recorded and then simple trigonometric calculations are made to determine the average wind through that level of atmosphere

Nadi Radar Image



Weather Watch

The power returning to the radar is processed and displayed to indicate target " reflectivity". Thus, a weather radar system estimates the efficiency with which targets in the atmosphere return the energy transmitted by radar. The intensity of returned echoes, hence precipitation, is displayed on the Rapic system as areas of different colors.

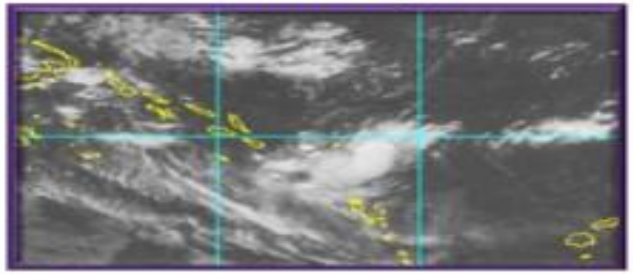
Weather Satellite

Satellite Receiver

Satellite

A weather satellite is a type of satellite that is primarily used to monitor the weather and climate of the Earth. Satellites can be either polar orbiting, seeing the same swath of the Earth every 12 hours, or geostationary, hovering over the same spot on Earth by orbiting over the equator while moving at the speed of the Earth's rotation.

Satellite Image



Striving to meet your daily weather information needs monitoring the climate around you...

Weather Services
- Public Weather Forecast Info
- Marine Weather Forecast
- Aviation Weather Forecast
- Tropical Cyclone Warning
- Other Severe Weather Warning
- Weather for Search and Rescue

Climate Services
- Climate Data and Info
- Seasonal Rainfall Forecast
- Advise on Climate Change and Variability (El Nino & La Nina)
- Drought Prediction & Monitoring
- Information on Sea Level Change

THE DIRECTOR, FIJI METEOROLOGICAL SERVICE
Private Mail Bag NAP0351, Nadi Airport
Phone: 6724888
Fax: 6720190(TCWC) 6720430(HQ)
Recorded Weather Bulletins: 6736080 (Public) 6736081 (Marine)

FIJI METEOROLOGICAL SERVICE

The Fiji Meteorological Service (FMS) functions as a Department under the Government of Fiji and has the responsibility to provide essential weather, climate and, hydrological service to the country. It also serves on a regional scale providing weather forecasting and tropical cyclone warning services to many other countries and a vast area of the tropical South-West Pacific.

Weather Stations around Fiji

Fiji Meteorological Service has Synoptic, Climatological, Rainfall and Automatic Weather Stations (AWS) which provide weather observations.

1. Synoptic station reports are compiled every three hours in an international numerical code by staff of the Fiji Meteorological Service. The weather stations are vastly networked, and are distributed over the main islands of the Fiji group as well as other remote islands.

2. Climatological Stations provide more detailed information on elements like temperatures (air/soil), humidity, rainfall, radiation, sunshine hour and wind. The stations are run by staff of the Fiji Meteorological Service and others are staff of other government departments, or other organizations.

3. The Automatic Weather Station (AWS) is defined as a station which automatically transmits or records observations obtained by measuring instruments. The data derived from AWS includes the date, time of observation, station indicators, wind speed, direction, temperature, relative humidity, MSL pressure and rainfall data.

4. Rainfall Stations provide rainfall data that are measured every day at 9.00am. These stations are manned by workers of either corporate organizations, or other government de-

Access, Processing and Application of Satellite Data and Products

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

-Himawari 8 satellite with 16 bands

-Goes satellite

-Radar

-Ascat/wind profiler

-Authomatic weather sattions

-Observations

-NWP models

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

-AIFs systems, IBL system and internet

Current satellite data applications and Key application areas

-Mainly used in weather forecasting and aviation forecasting

-Tropical cyclone forecasting

-Disaster mitigation planning and recovery

More training on the use of satellite data. How the différent channels work and how it can be implimented in Daily and cyclone forecasting.

Satellite-based products

- Himawari cloud and Himawari cast data.
- Volcanic ashe
- Water vapor data
- Sea surface temperatures
- Ozone and atmosphere

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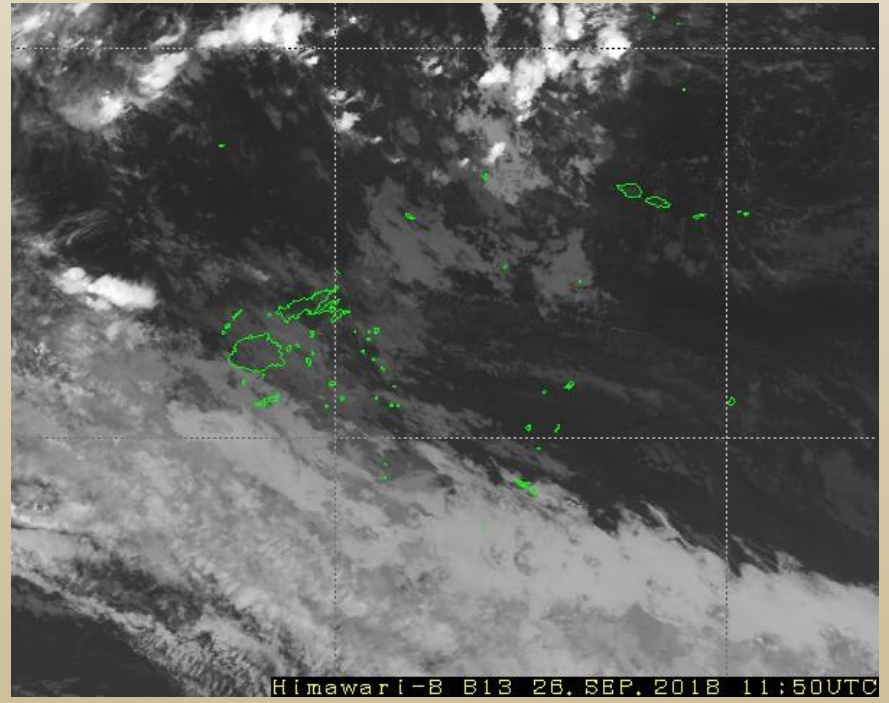
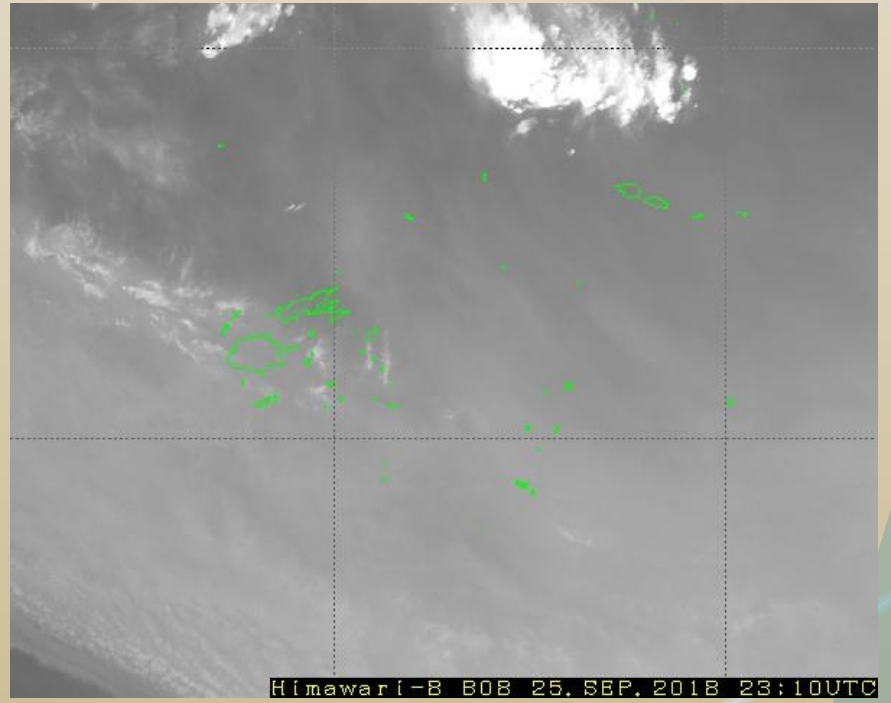
Satellite data to address regional changes

Visible satellite imagery

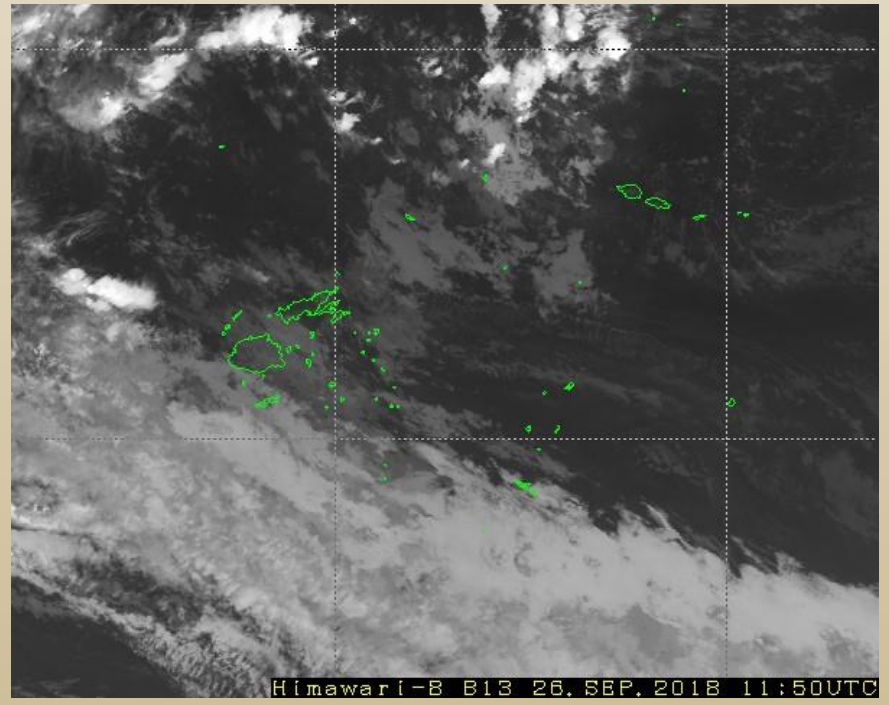


Water vapor imagery

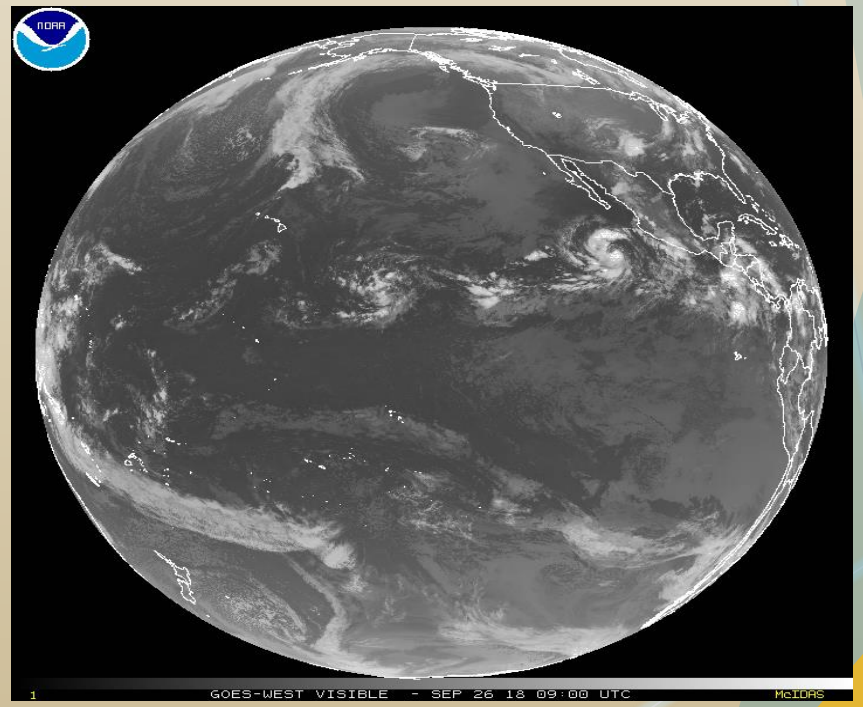


Different satellite data is used for daily weather forecasting and Severe weather forecasting

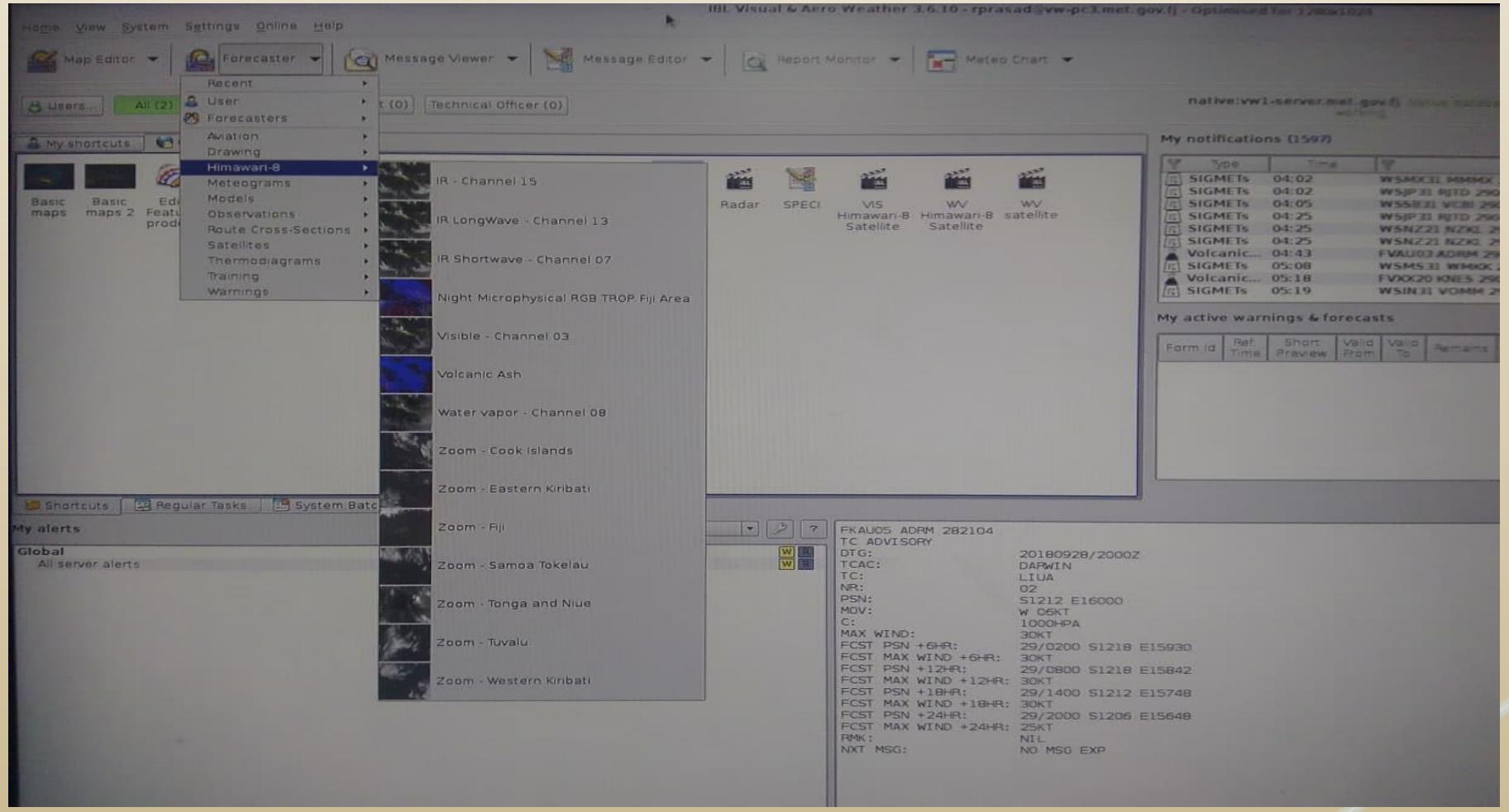
IR satellite data



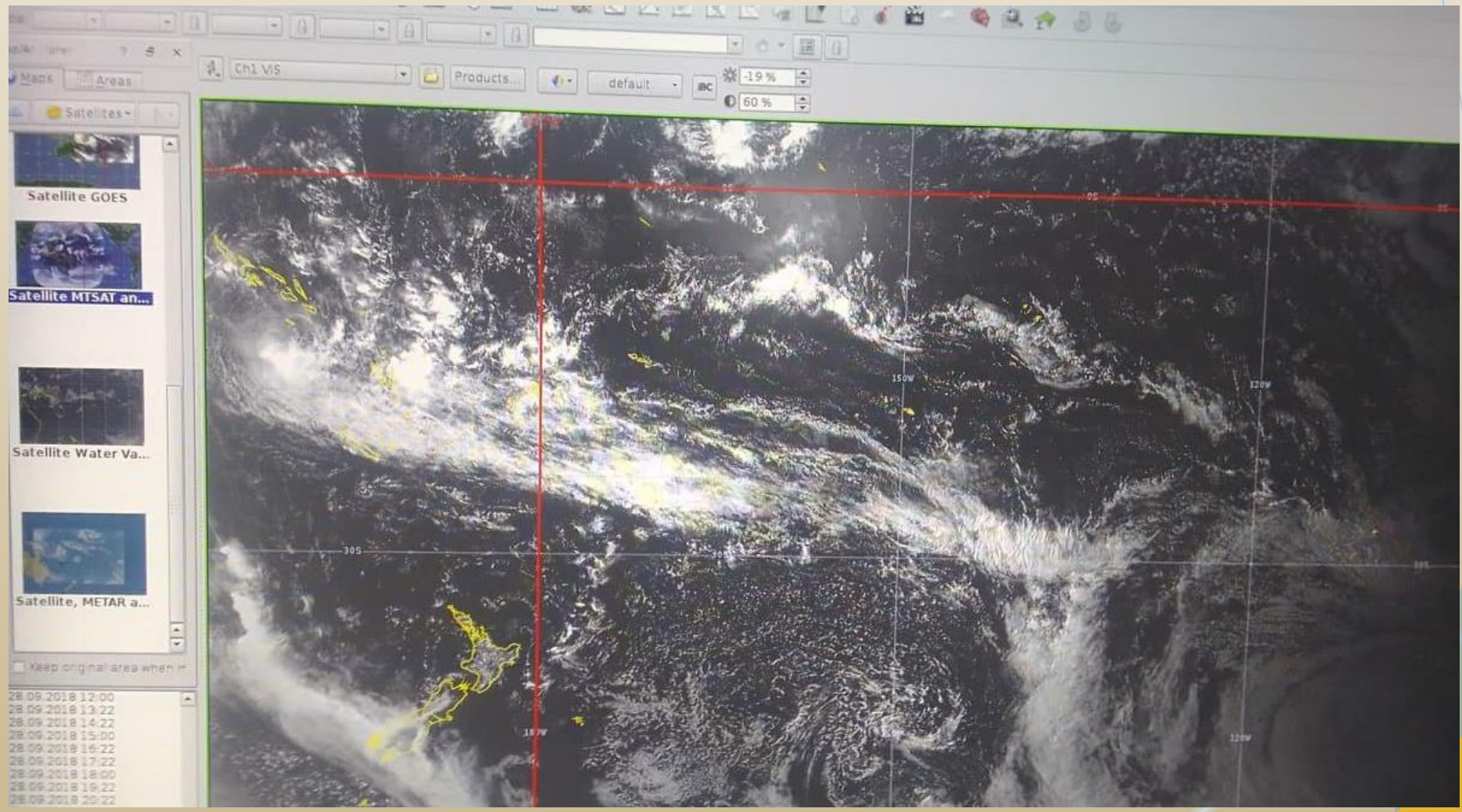
GOES Data



The IBL SYSTEM USED AT FMS



Display of GOES DATA ON IBL



DISPLAY OF HMAWARI DATA ON IBL