DOCUMENT
**GSM-AUS-CPL.024**

DOCUMENT TITLE

# METEOROLOGY FOR AUSTRALIA

# CHAPTER 25 – RADIATION AND SATELLITE IMAGES

Version 3.0
November 2014

CONTENTS ........................................................................ PAGE

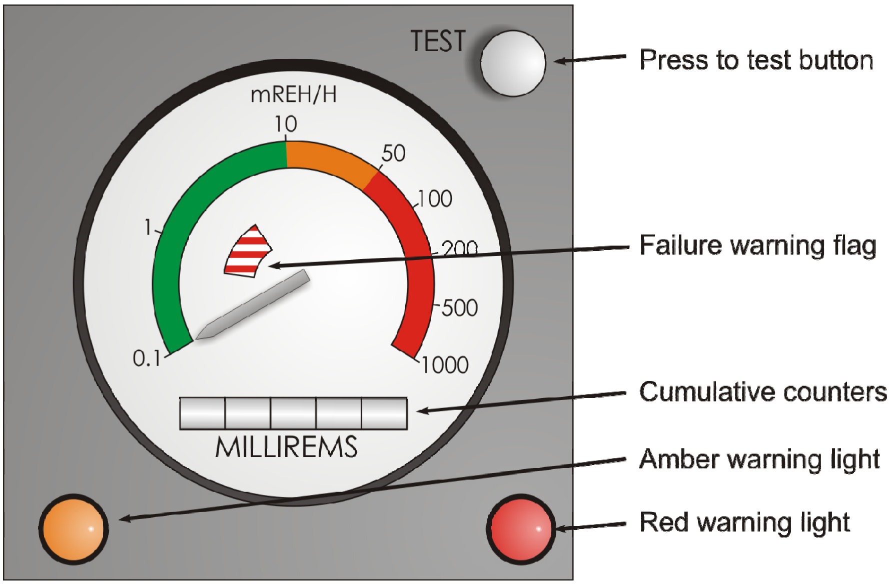
# RADIATION AND SATELLITE IMAGERY

## RADIATION

The International Commission on Radiological Protection (ICRP) makes recommendations on the limits of radiation that human beings should experience.

It is mandatory to carry equipment to detect cosmic radiation in aircraft, when flying at an altitude of more than 49,000 ft. The equipment should be calibrated in millirems per hour and capable of indicating action and alert levels of radiation dose rate.

Checking the radiation experienced on every Concorde flight was done by means of a radiation meter. A detector, sensitive to both ionising and neutron radiation, is mounted in the external skin of the upper forward part of the fuselage and detects both galactic and solar radiation.




**A Radiation Meter**

The effect of ultra – violet radiation passing through the depleted ozone layer does not have any effect on the weather a pilot is going to experience on a particular flight, however, the slow global warming and the link to exposure to u-v rays and skin cancer has been established.

Radioactivity does not directly affect the weather on a particular flight. Generally, radioactivity which concerned Concorde operations in the lower stratosphere and extended range operations involving very lengthy flights around the height of the tropopause may be from two natural causes of cosmic radiation; as galactic radiation (which arrives from sources outside the solar system) and solar radiation.

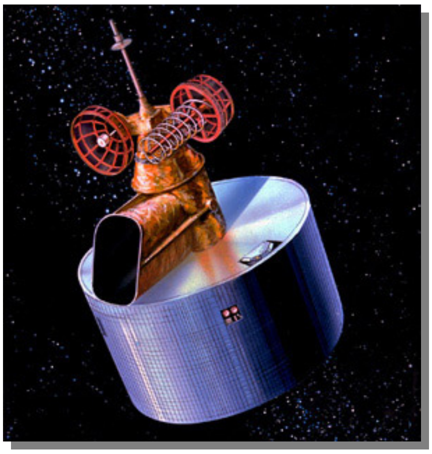
The earth's magnetic field tends to intensify cosmic radiation in high latitudes near the earth's magnetic poles. Solar radiation is associated with sunspot activity (solar flares) which is intermittent

## SATELLITE IMAGERY

### SATELLITES

There are 2 basic types of satellite in common use for meteorology:

- Polar orbiting satellites (USA and Russia) which orbit the earth at altitudes of approximately 850km. An individual satellite will provide cloud pictures for the entire globe twice per day.
- Geostationary satellites which from their much higher vantage points some 36,000km. over the equator, can observe continuously about one-third of the globe.



### GEOSTATIONARY METEOROLOGICAL SATELLITES

Some typical features are:

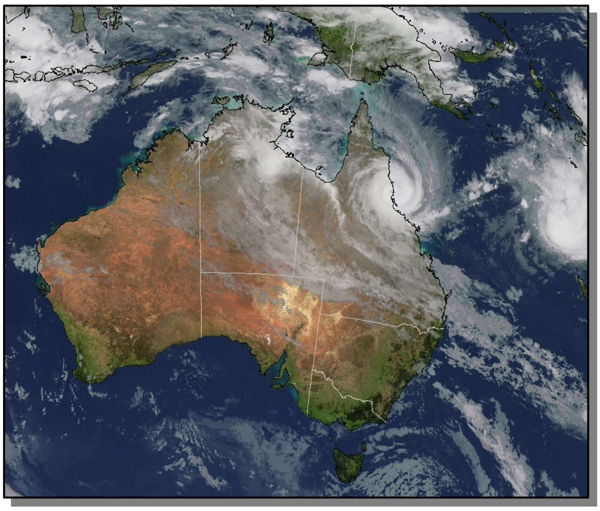
- Altitude – around 35 800 km
- Orbital period – 23 hours 56 minutes (i.e. that of the earth)
- Inclination of orbit – zero, i.e. coincident with the earth's equatorial plane
- Spatial resolution – around 1.25 km in the visible channel and 5.0 km in the infrared channel at the equator but decreasing pole wards

### POLAR – ORBITING METEOROLOGICAL SATELLITES

Some typical features are:

- Altitude – 850 km
- Orbital period – around 100 minutes
- Inclination of orbit – generally around 81 degrees to the equator, so that their coverage is synchronised with the movement of the sun over the earth's surface and they pass over a given point on the earth's surface at the same time each day.
- Spatial resolution – typically 1.1 km for visible images and 5 km for IR.

Weather satellites are able to take two different types of cloud pictures (imagery)



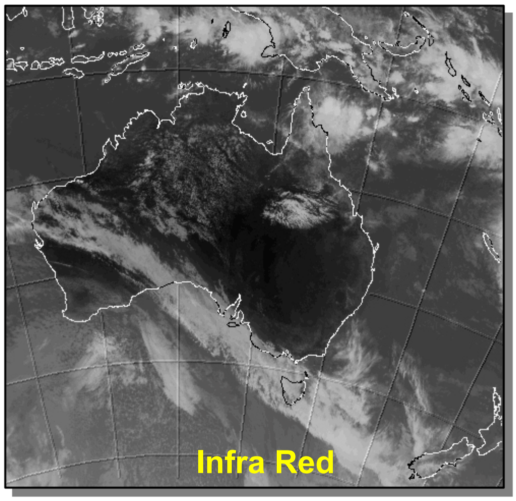
## VISIBLE (VIS)

Which are greyscale photographs of the earth and its cloud, as a camera see the scene.

A shortcoming of visible images is they are not available at night.

Composite and colour-enhanced images are commonly portrayed by the Bureau of Meteorology

## INFRA-RED (IR)




The satellite detects infra red radiation from the underlying surface and essentially measures their temperatures. Very warm surfaces appear black on the pictures and very cold surfaces, such as the top of high cloud, appear white. There is a spectrum of grey shades in between.

## USES OF THE IMAGERY

Satellite pictures tend to be weighted towards IR pictures because the cloud formations and features can be observed by day as well as by night.

High clouds are cold and their whitish hues on the IR pictures stand in sharp contrast to the darker tones of the warmer earth's surface. Masses of high cirrus clouds are easily identifiable, as are Cbs and the clouds associated with cold fronts, tropical cyclones and major storms in middle and high latitudes.

Areas of low cloud are usually better defined on the VIS pictures, particularly if the cloud layer is not thick, for example Sc and St. In this case there would not be a big difference between the temperatures of the earth's surface and the top of the cloud and there would only be a small contrast on the IR pictures.

Many uses can be made from these images. For example:

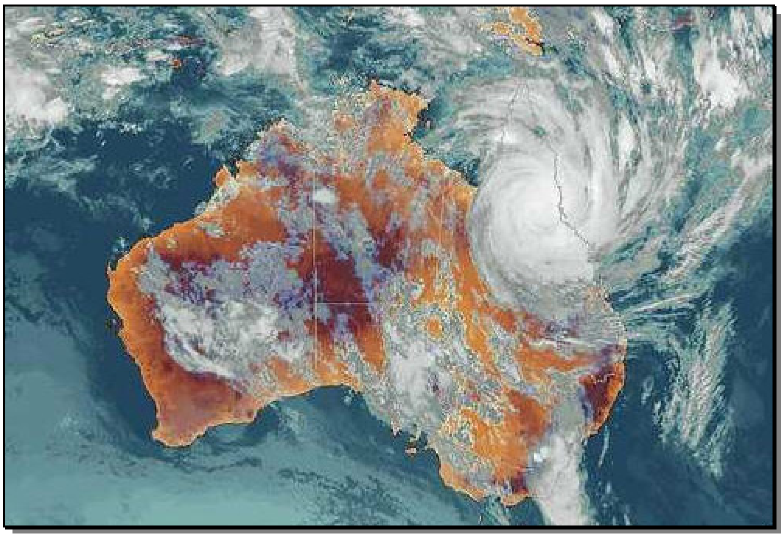
- The location and type of fronts. These phenomena are associated with clouds, which can be easily seen. The speed and direction of movement can then be measured using a sequence of images.
- The types of air masses. The cloud type and quantity can be detected giving an indication of the type of air mass in a particular region. For example, in the North Atlantic a field of convective cloud would show up as "bright" spots indicating a Polar Maritime air mass.

- The presence of a high-pressure system. An absence of cloud may indicate the presence of a high-pressure area.
- The position of the ITCZ. The position of the ITCZ and Tropical storms can be clearly identified, and their movement monitored.
- Thunderstorms, dust, smoke, volcanic ash; as well as clouds associated with turbulence.

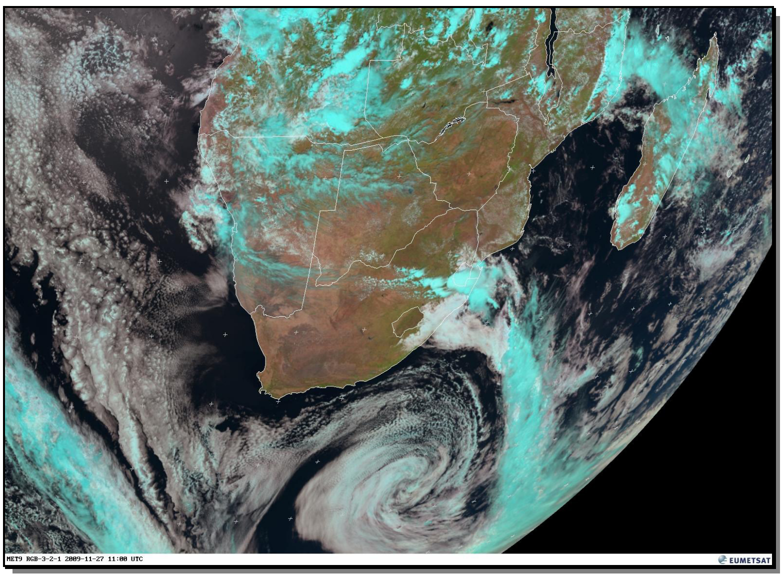
Most of these weather features can be seen in the examples which follow.

## EXAMPLES OF IMAGERY

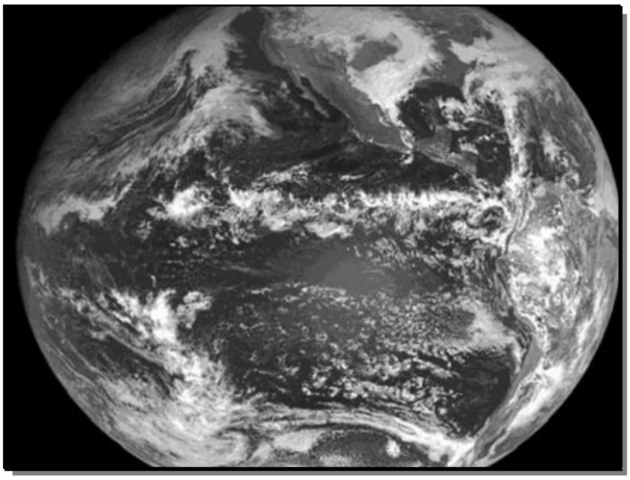
Below is a composite enhanced image taken at 17:30 UTC on 2 February 2011. It shows tropical cyclone Yasi crossing the Queensland coast.



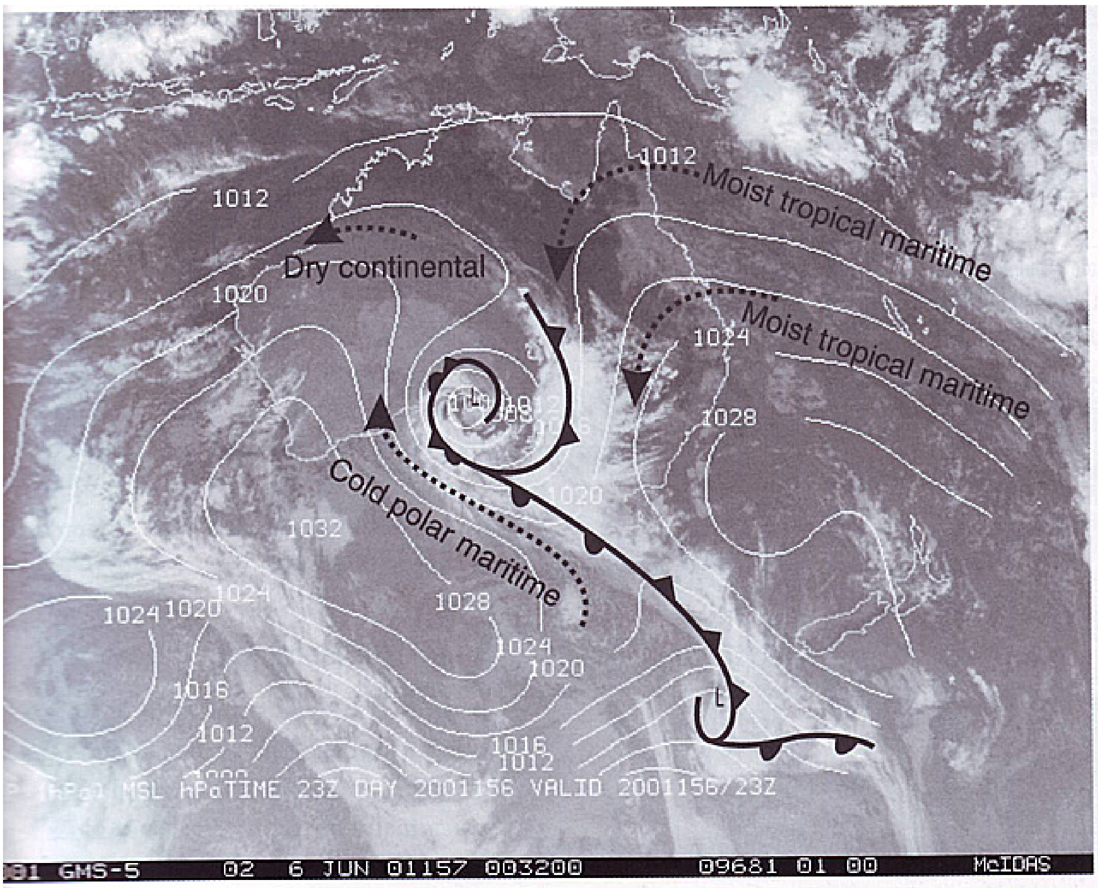
The Zehr enhanced image below shows a cold front that just passed Southern Africa, taken at 11:00 UTC 27\11\2009. Note the clockwise depression south of South Africa. Another cold front is on its way, south west of South Africa.



The image below shows the position of the ITCZ, note the “line” of clouds located near the equator.



An occlusion is shown below, note the comma like occlusion, and the large bands of cloud over South Australia.




Australian Bureau of Meteorology