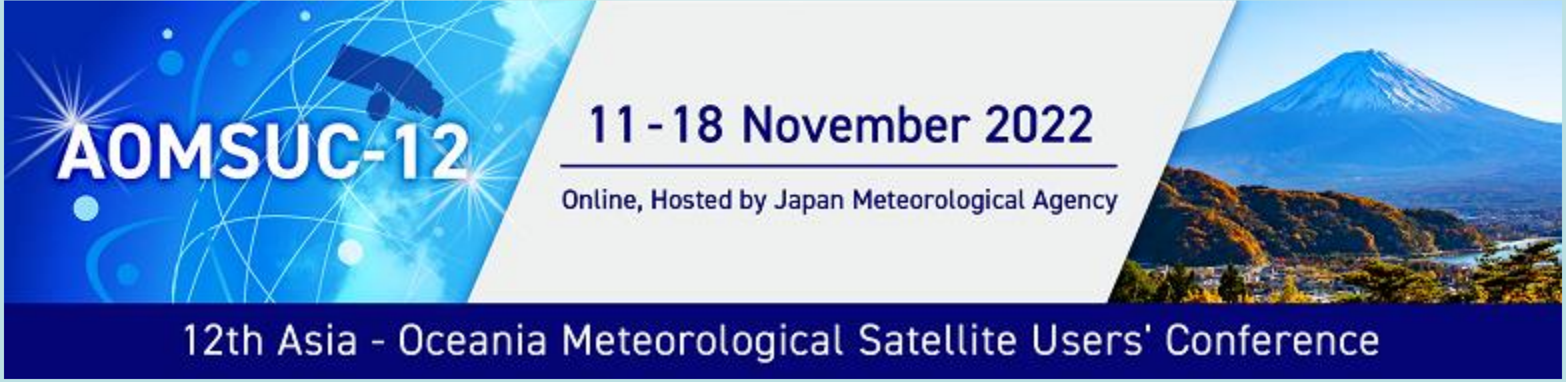


AOMSUC-12 Training Course

James F.W. Purdom, PhD

Chair, AOMSUC International Conference Steering Committee

Thank you to all involved in putting this two-day training course together. It required a lot of hard work and is truly appreciated.

Congratulations to JMA on the conintinued provision of meteorological satellite data and products across Asia/Oceania; of particular note is the Himawari-8 geostationary satellite

Today, meteorological satellites provide essential data for NMHSs in Asia/Oceania and across the globe. Their data are used for a variety of applications ranging from nowcasting to climate, land to oceans, and ecology to observing the sun.

This did not happen by accident. It required 4 necessary ingredients.

This did not happen by accident. It required 4 necessary ingredients.

Over 60 years of:

Leadership

Vision

Understanding

Utilization

Those four attributes have been embodied within satellite community from the very beginning; from the top administrative level to across the spectrum of workers within those organizations and their User Community

Here we will focus on two of those necessary ingredients.

Understanding
Utilization

This training course focuses on understanding and utilization of the wonderful information that you have available to you from the meteorological satellites that provide data over Asia/Oceania.

APPLICATIONS

Some Basics in brief

- Satellites and their orbits
- What we sense
- What we are observing

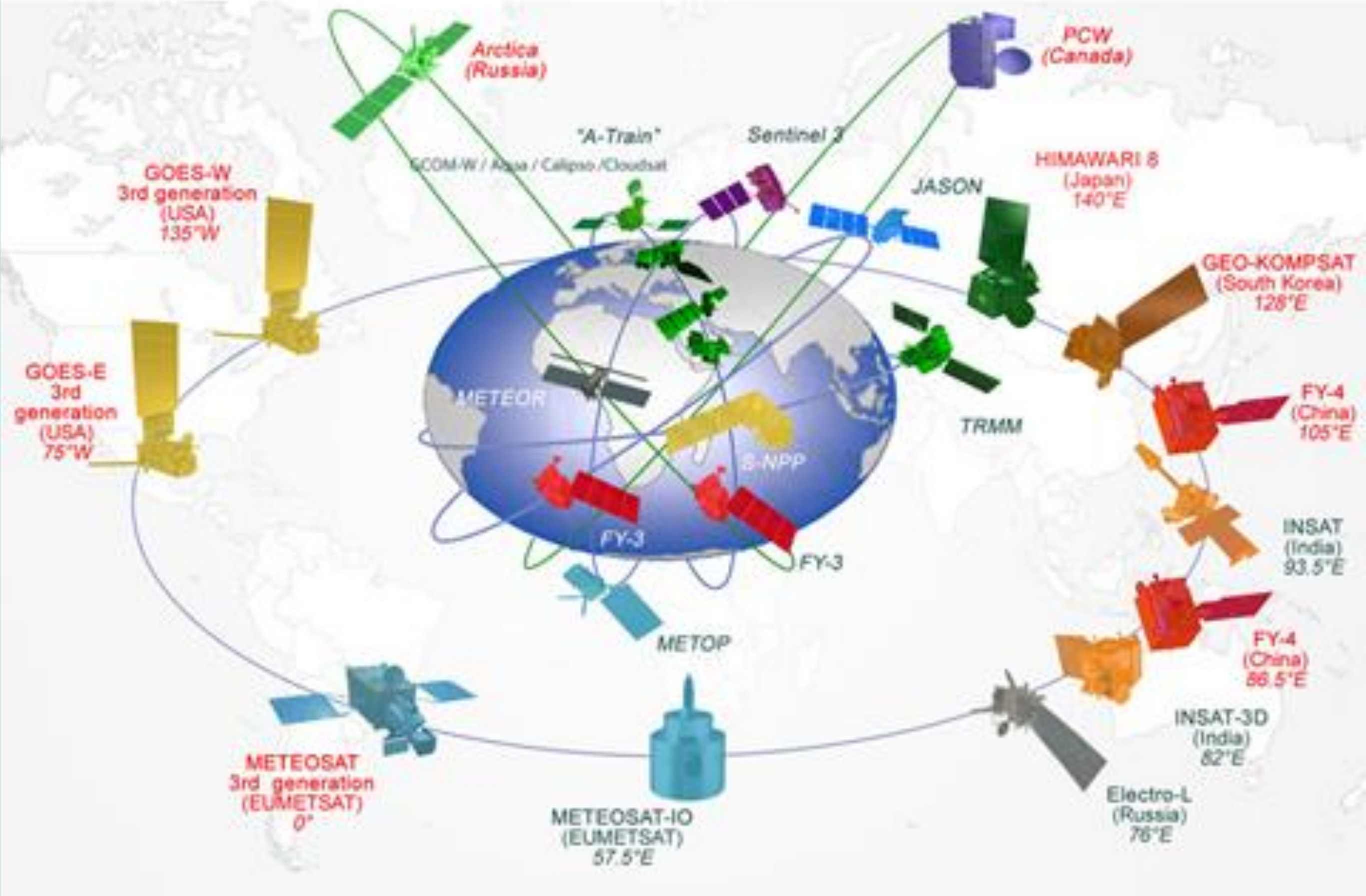
Orbits

- The mainstay orbits for meteorological and environmental applications
  - **Sun synchronous Polar orbits**
  - **Geostationary orbits**
- Other orbits and specialized applications
  - **Pro-grade orbits**
  - **Constellations and formation flying**

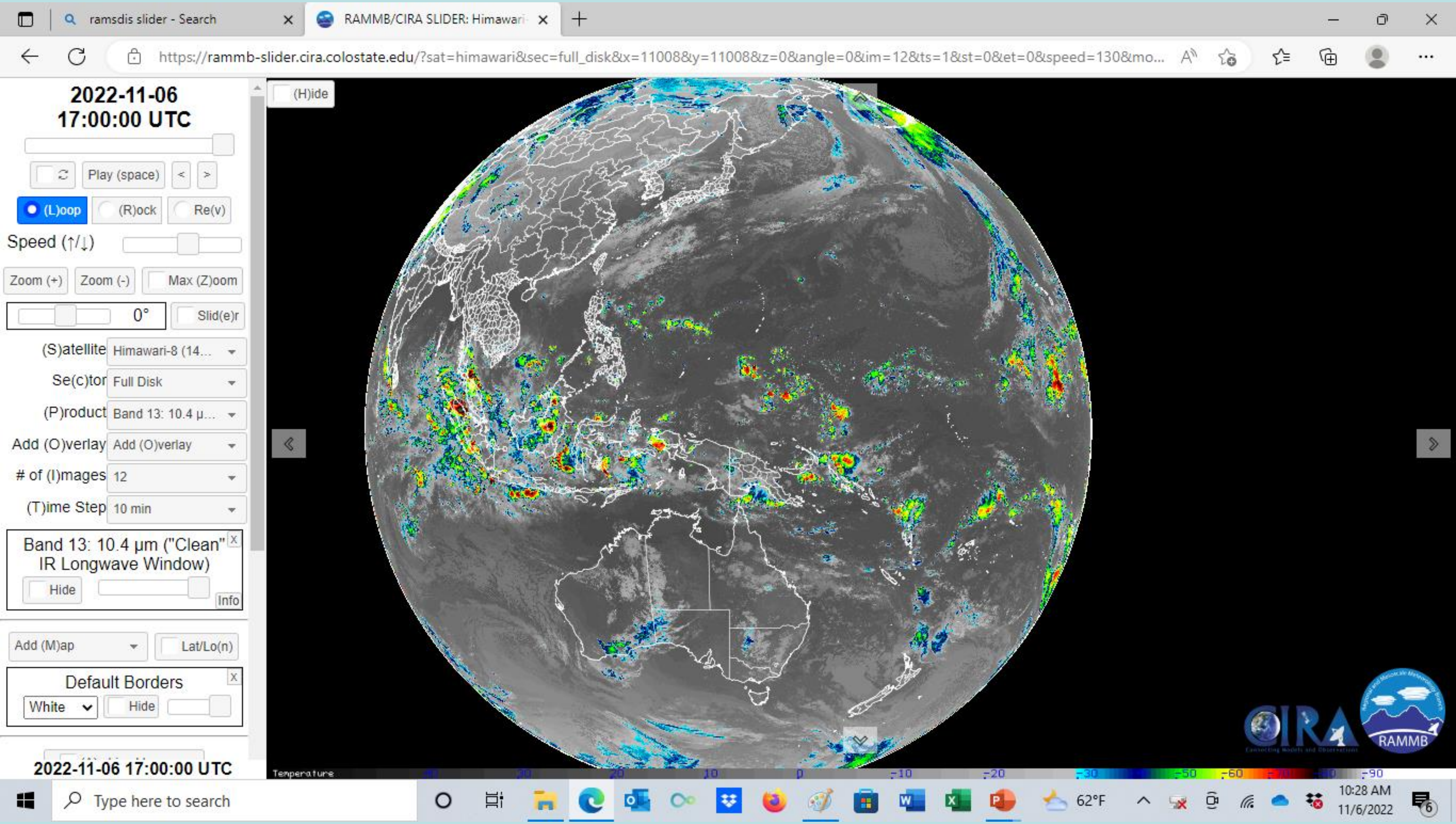
A Brief Reminder: Comparison of geostationary (Geo) and low earth orbiting (Leo) satellite capabilities

Geo	Leo
observes process itself (motion and targets of opportunity)	observes effects of process
repeat coverage in minutes ($\Delta t \leq 15$ minutes)	repeat coverage twice daily ($\Delta t = 12$ hours)
near full earth disk	global coverage
best viewing of tropics & mid-latitudes	best viewing of poles
same viewing angle	varying viewing angle
differing solar illumination	same solar illumination
multispectral imager	multispectral imager (generally higher resolution)
IR only sounder (8 km resolution)	IR and microwave sounder (1, 17, 50 km resolution)
filter radiometer	filter radiometer, interferometer, and grating spectrometer
diffraction more than leo	diffraction less than geo

Vision for WIGOS 2020



The space agencies are meeting the challenge of providing a vibrant polar and geostationary satellite constellation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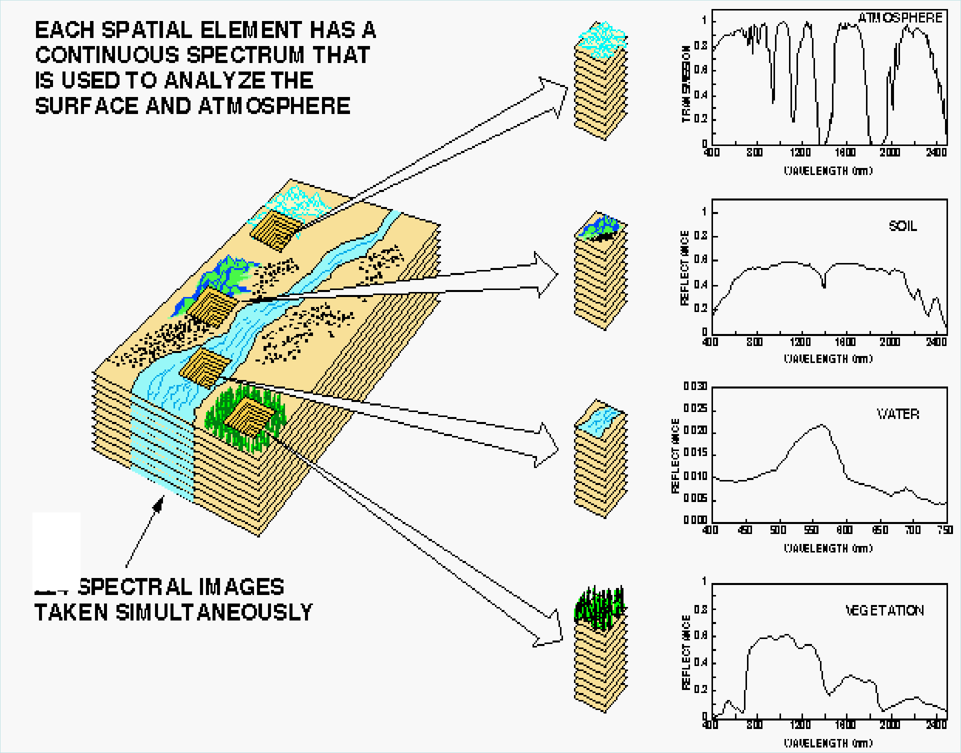
Some Basics in brief

- Satellites and their orbits
- What we sense
- What we are observing

In satellite remote sensing, four basic parameters need to be addressed: all deal with resolution. The current generation satellites are a giant step forward in all four.

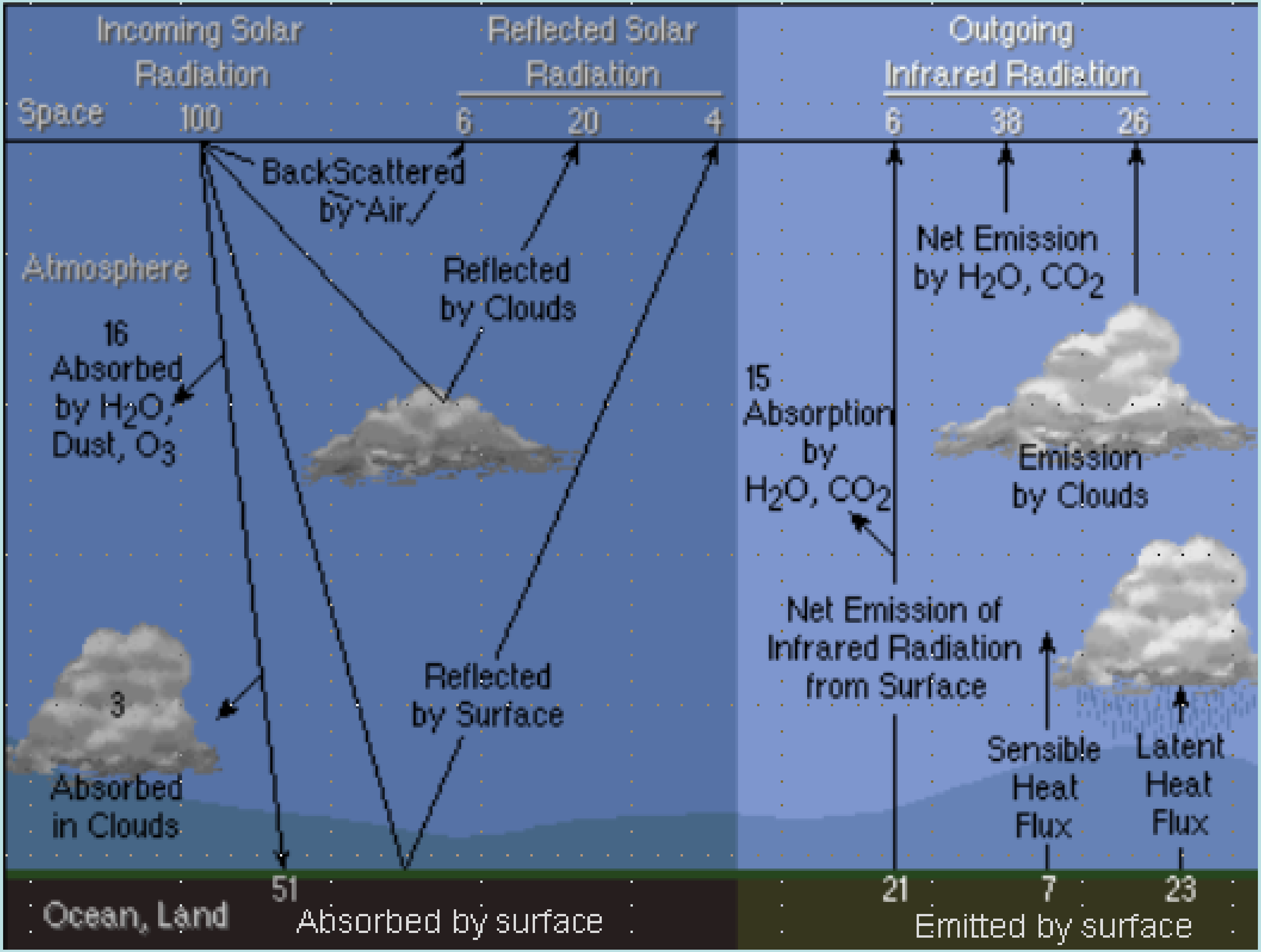
- **temporal (how often)**
- **spatial (what size)**
- **spectral (what wavelengths and their width)**
- **radiometric (signal-to-noise)**



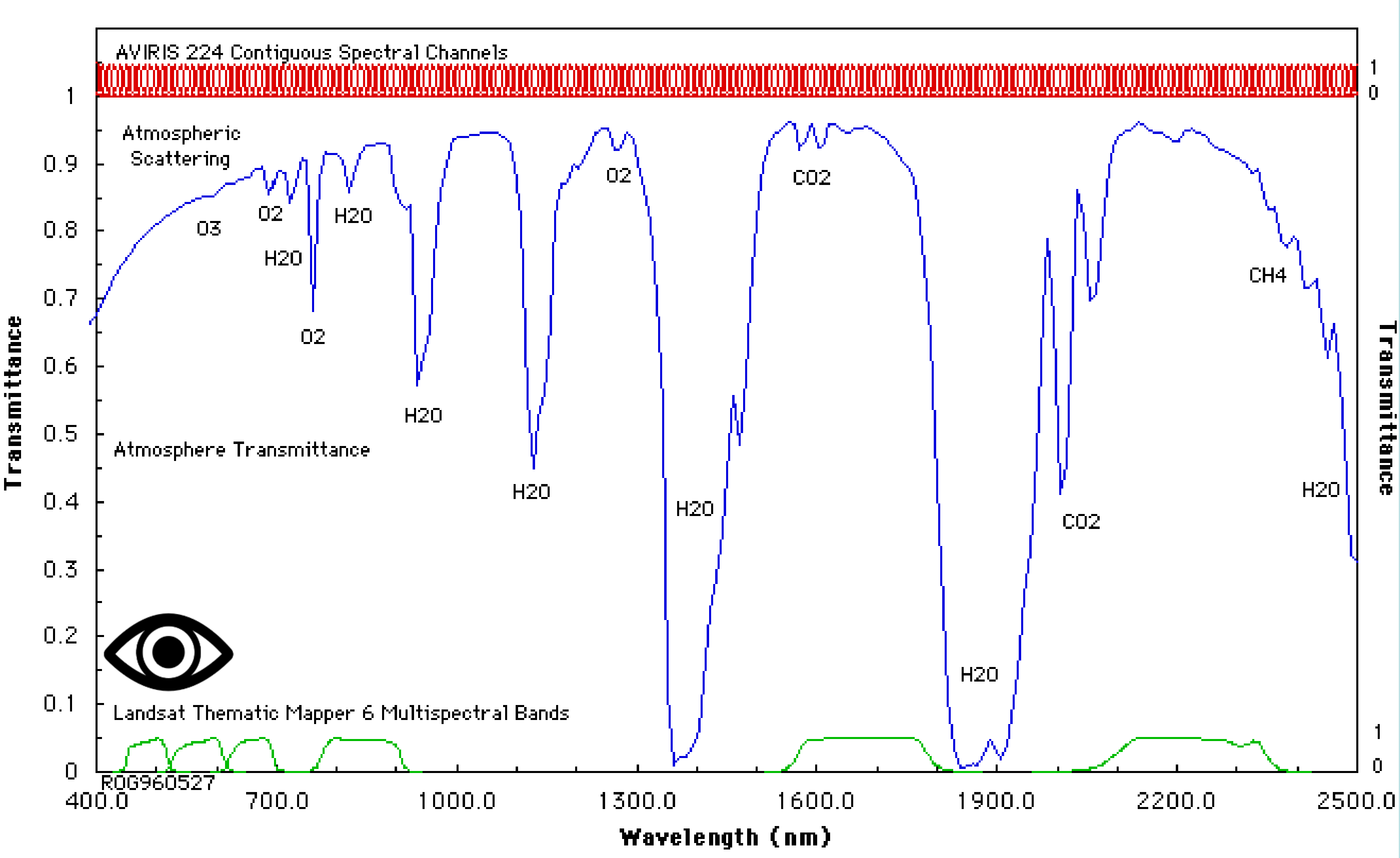
The spatial and temporal domains of the phenomena being observed drive the satellite systems' spectral needs as a function of space, time, and signal to noise.

Each spatial element has a continuous spectrum (vis and IR) that may be used to analyze the surface and atmosphere

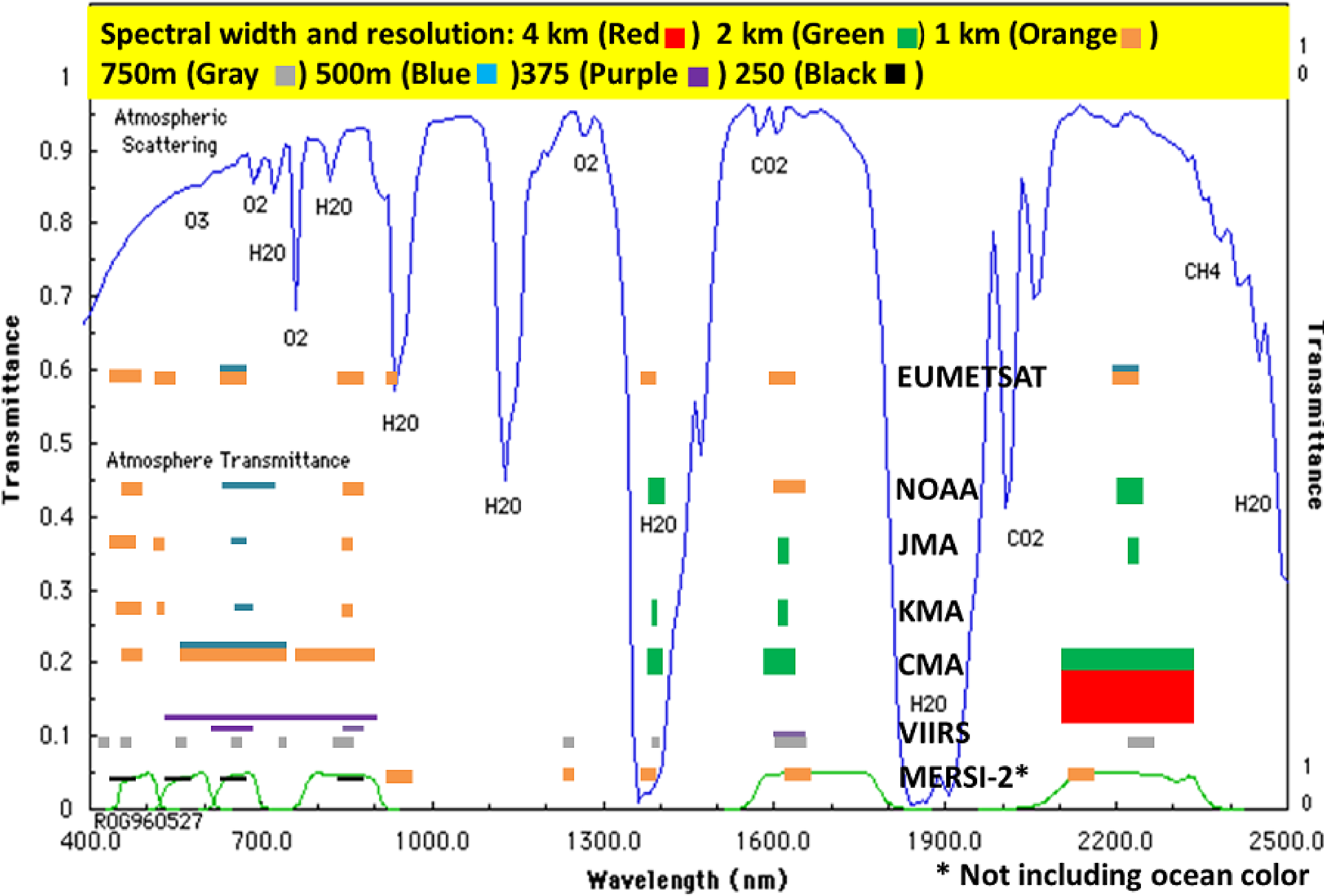
Surface and atmospheric properties effect what we view with a satellite sensor (solar left, emitted IR right)



The visible to near infrared portion of the spectrum



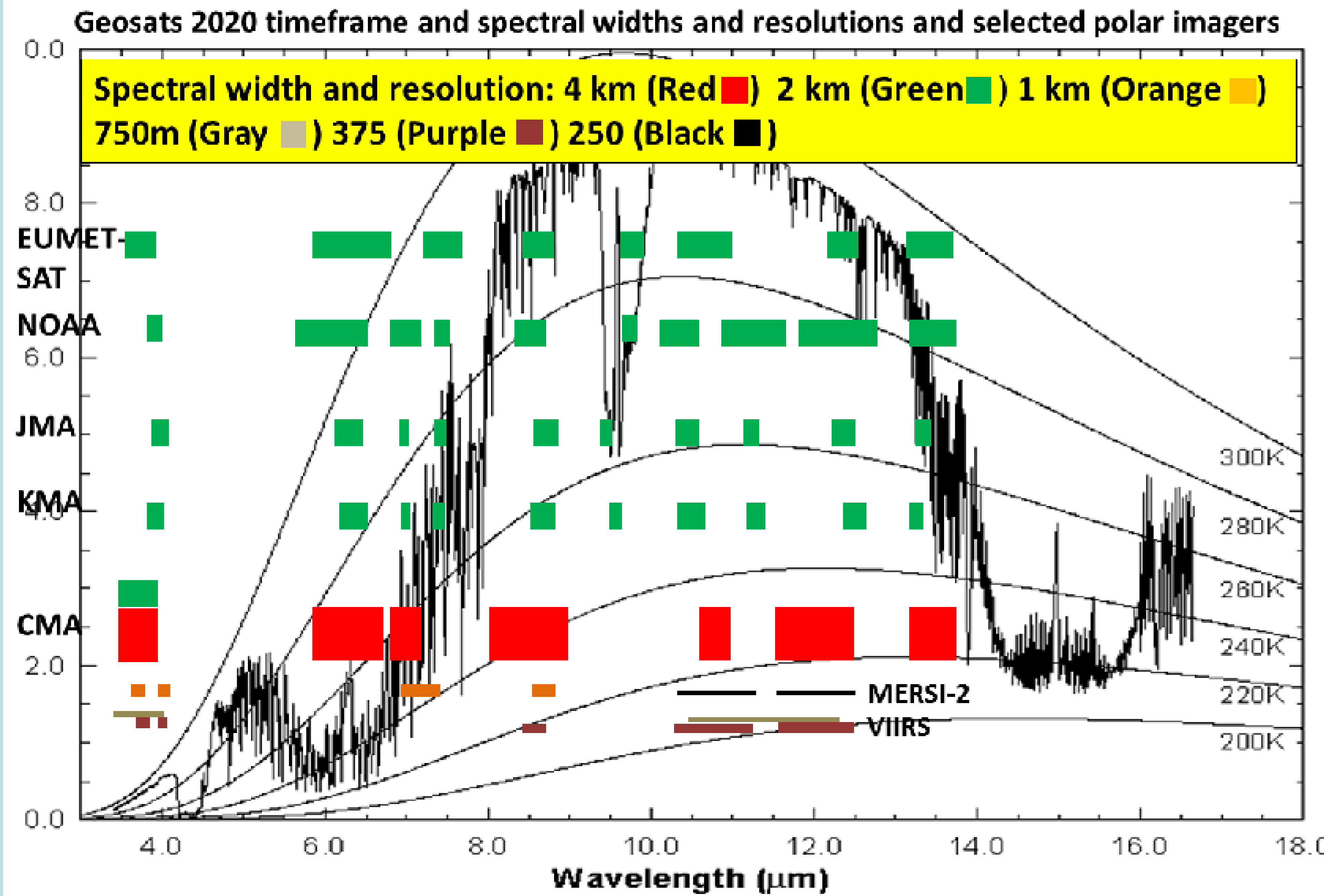
Geosats 2020 timeframe and spectral widths and resolutions and selected polar imagers



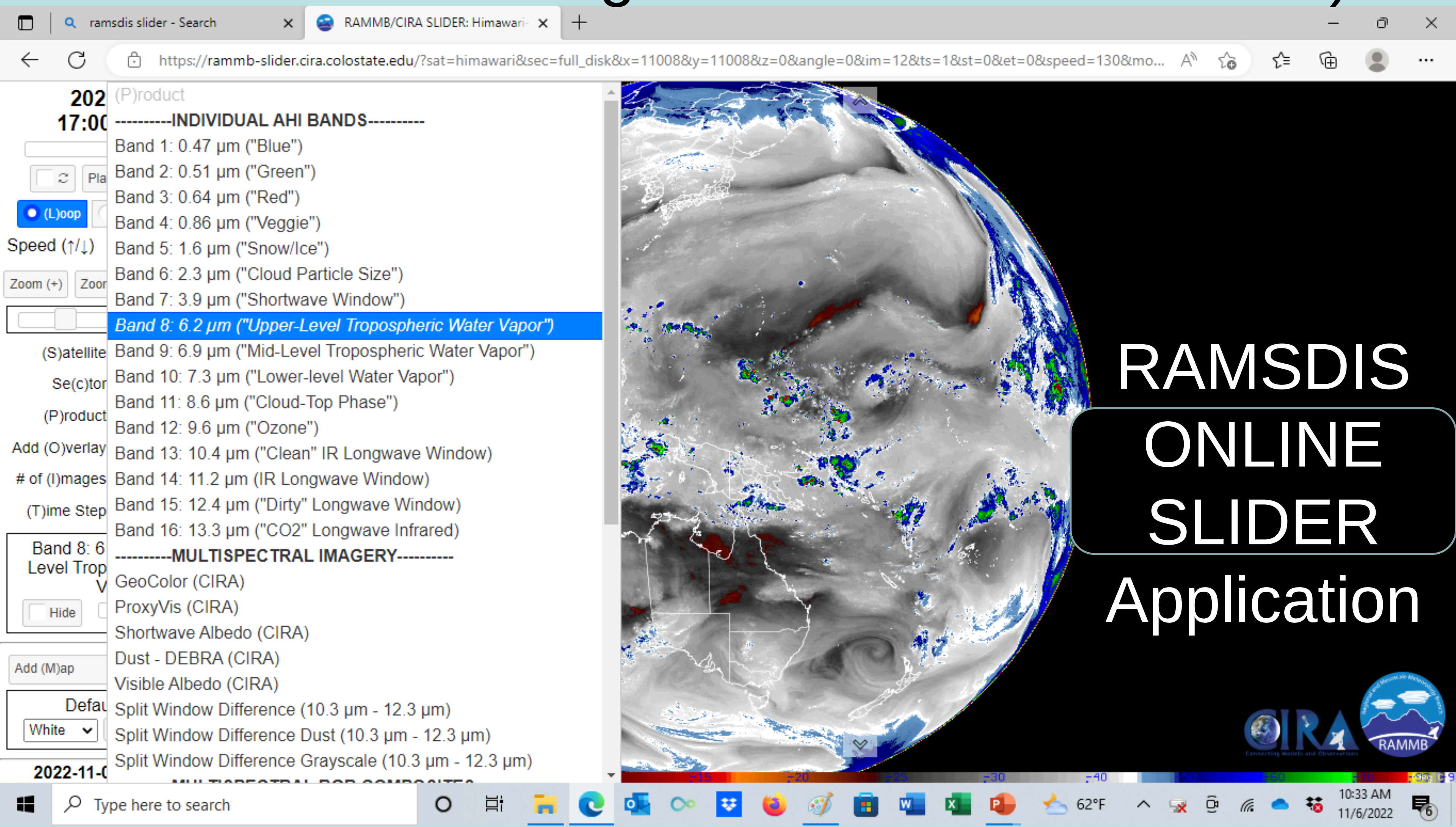
* Not including ocean color

Infrared

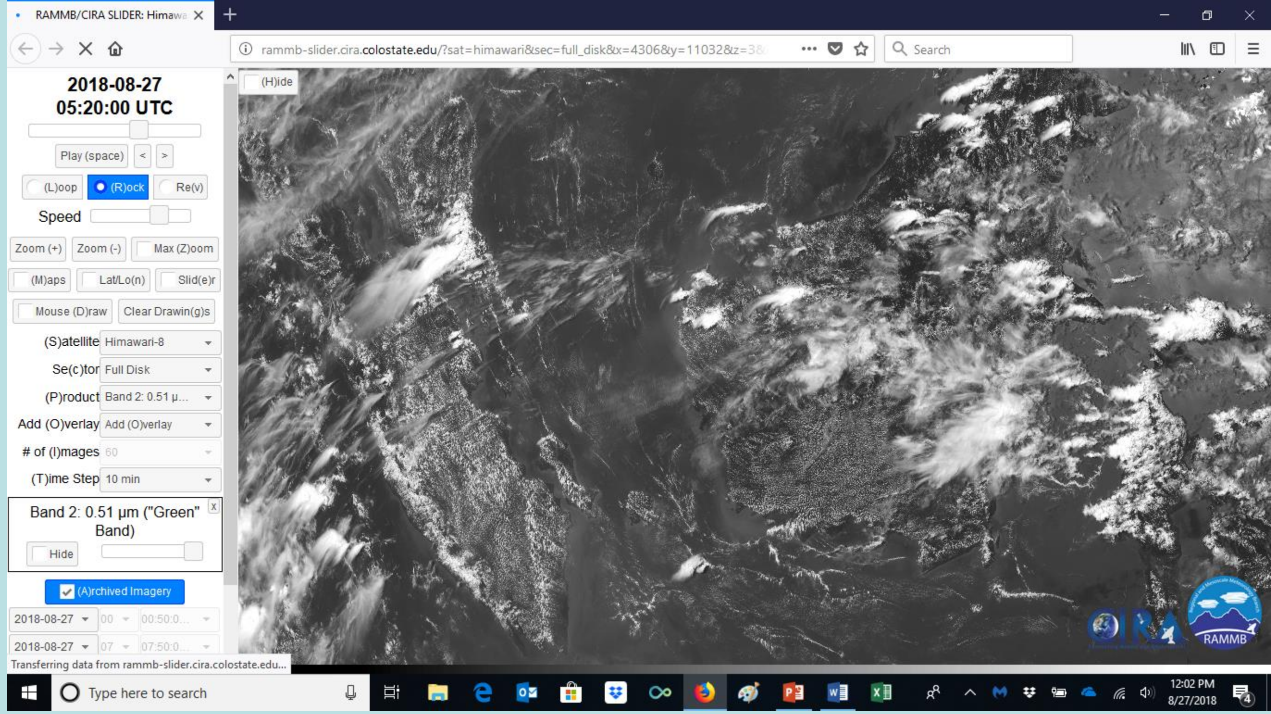
High resolution atmospheric absorption spectrum and comparative blackbody curves.

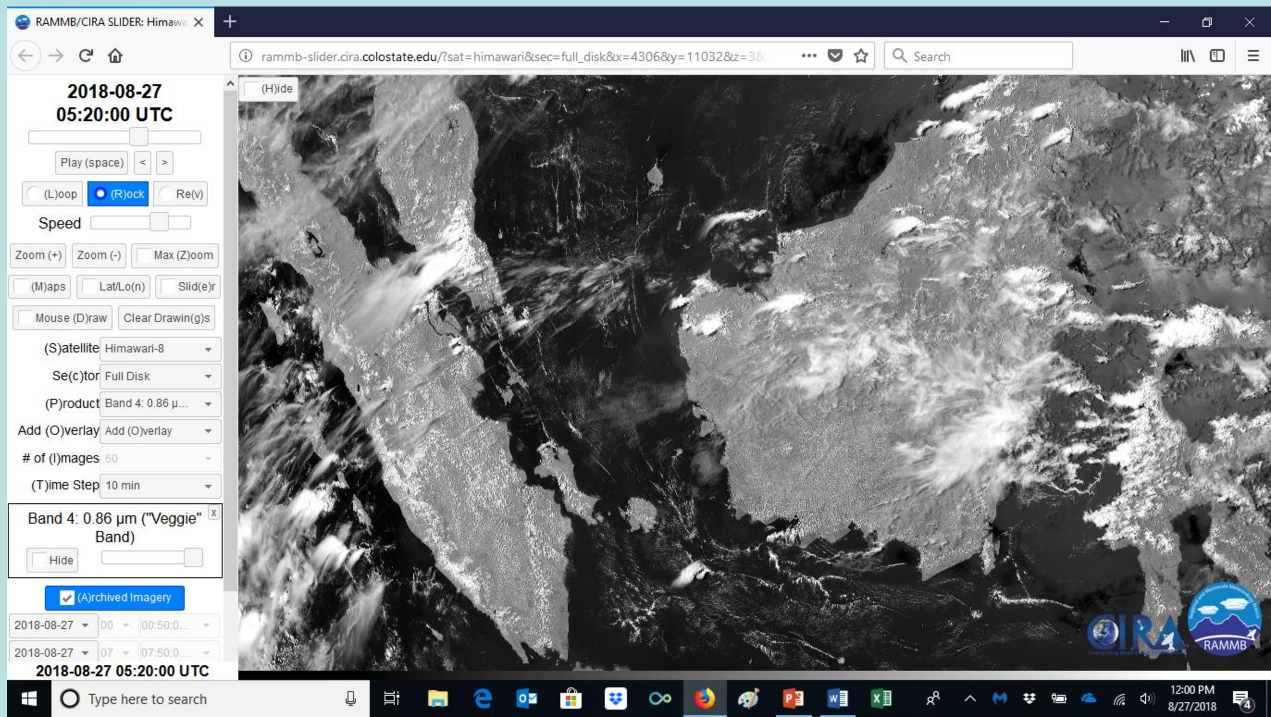


Himawari-8 full disc 6.2 micron channel taken 11/06/2022 (with side bar showing 16 channels available including a comment on their use)



H-8 images to illustrate difference between the same scene at 0.51 (top) 0.86 (bottom)

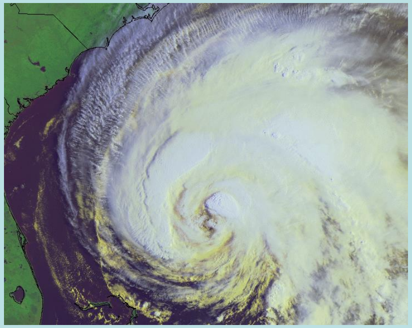




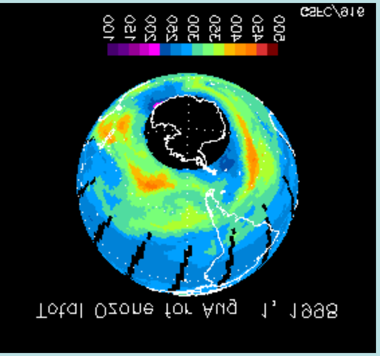
Some Basics in brief

- Satellites and their orbits
- What we sense
- What we are observing

Meteorological

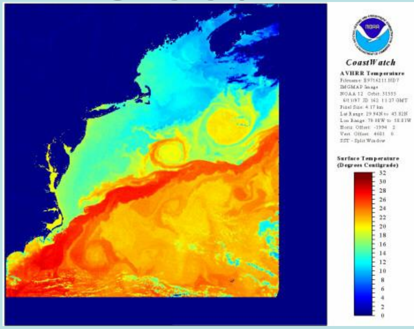


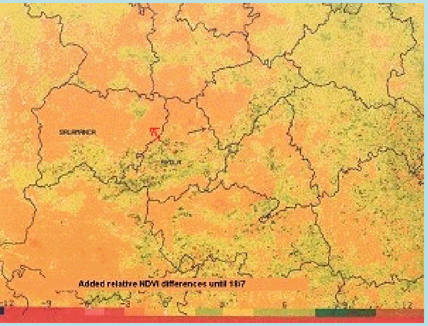
Climate



The spatial and temporal domains of the phenomena being investigated drive the satellite's observing requirements as a function of space, time, spectra, and signal to noise: and here the trade off begins.

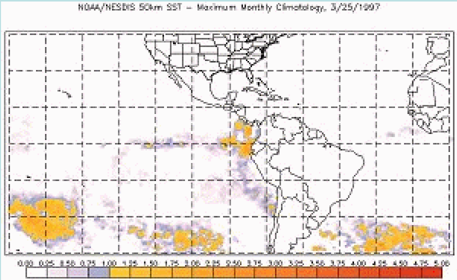
Ocean



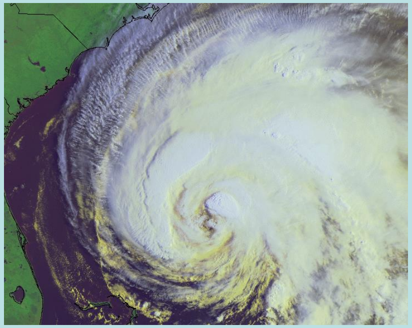


Land

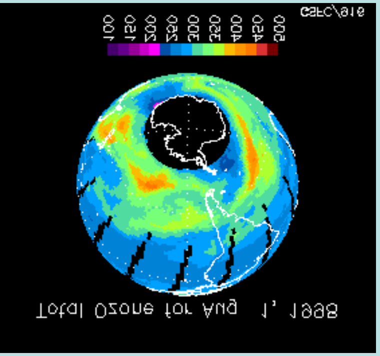
Ecological



Meteorological

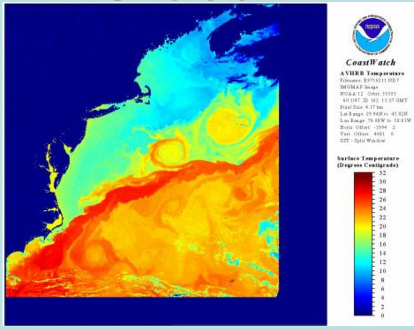


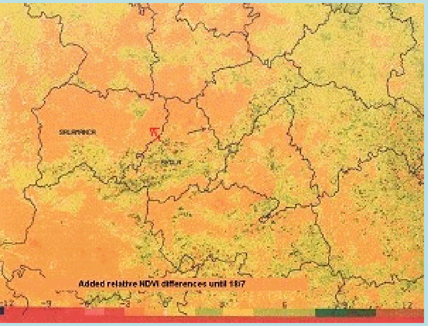
Climate



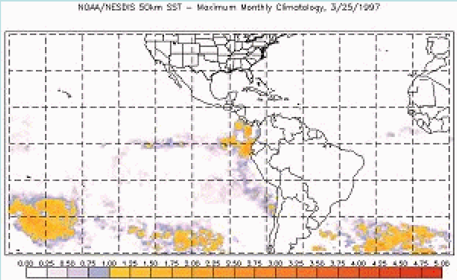
The clouds and cloud patterns in satellite imagery represent the ongoing effects of dynamic and thermodynamic processes in the atmosphere. We need to understand those processes, across scale, and use them in our various applications.

Ocean





Ecological



Land

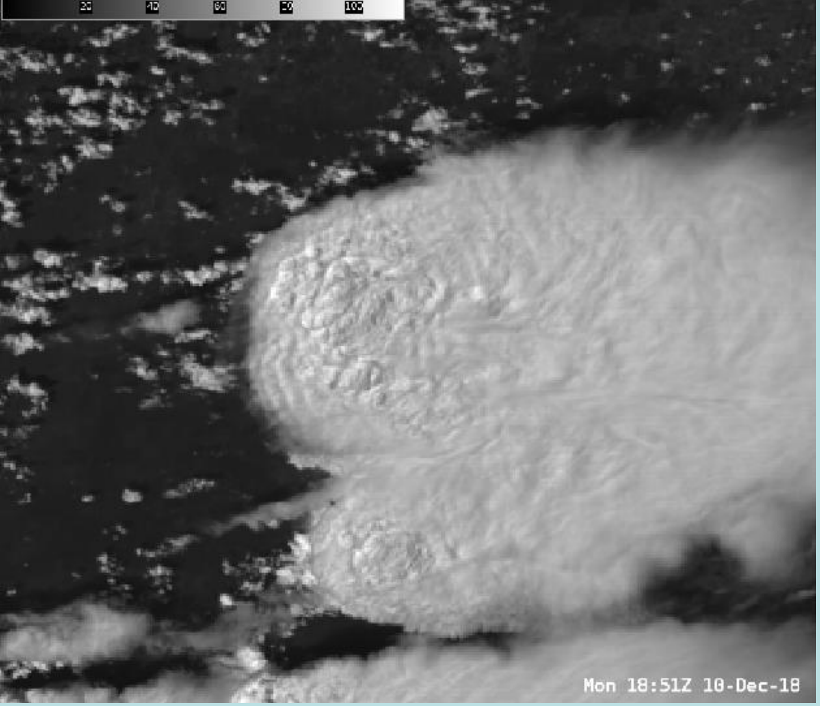
Two things to note in this animation (at least two things)

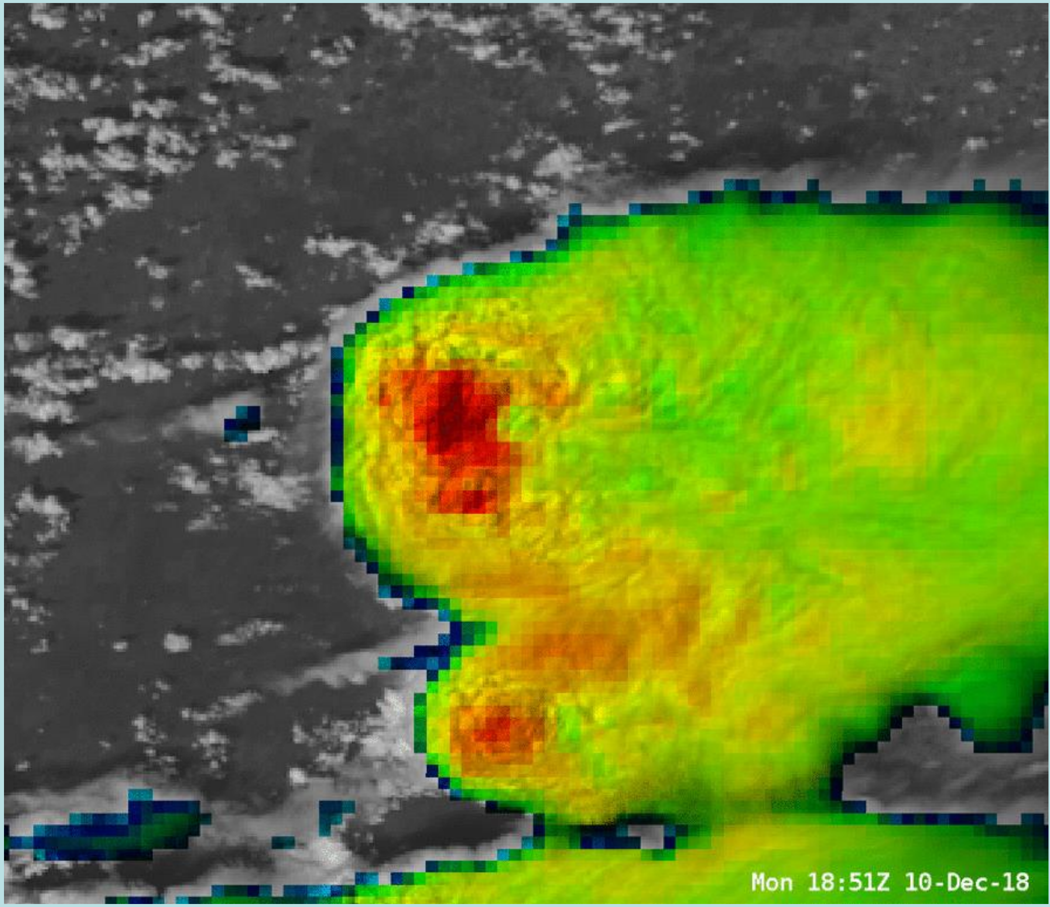
The cloud streets moving Northward in the loop appear to be almost rolling, which actually is a reflection of shear across that stably capped cloud street layer (water clouds).

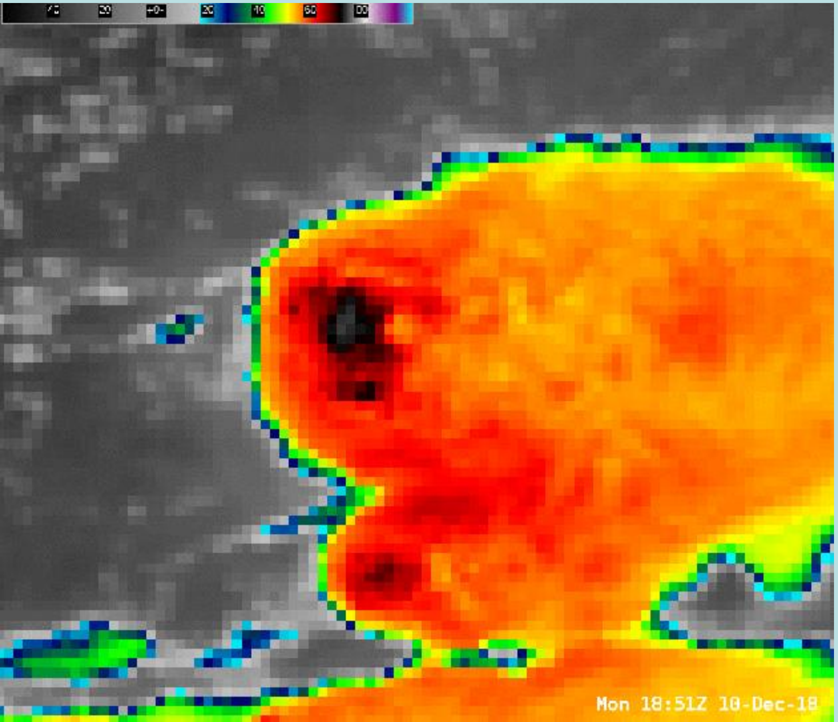
Inspection of the two prominent storms as they evolve: the cloud streets can be seen being "tilted" upward into the storm due to increasing vertical motion and buoyancy.

A visual representation of the "tilting term" in the vorticity equation

$$\left(\frac{\partial w}{\partial y}\frac{\partial u}{\partial z} - \frac{\partial w}{\partial x}\frac{\partial v}{\partial z}\right)$$







The spatial and temporal domains of the phenomena being investigated drive the satellite's observing requirements as a function of space, time, spectra, and signal to noise

Spectral Bands And Their Applications

James F.W. Purdom

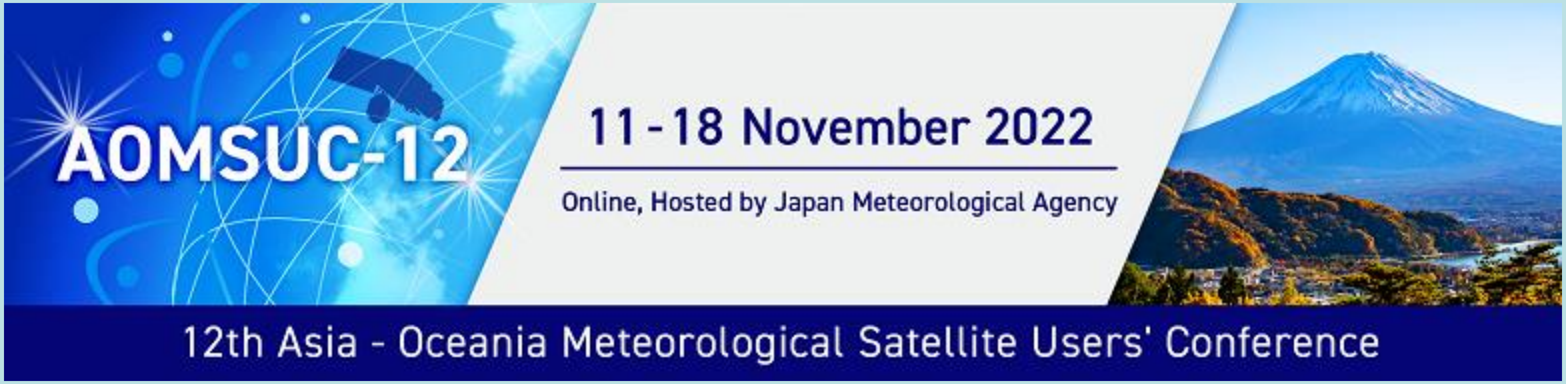
Understanding Utilization

You have a very well-planned training course over the next two days. Relax, enjoy and learn. It’s followed by the AOMSUC Conference

Three days of wonderful presentations. Most sessions begin with Key-Note Presentations that are “State of the Art” from a User’s Perspective. Register and look at the Program yourself. Don’t miss it, it’s going to be great!

Let the training portion of AOMSUC-12 Begin!!!

Relax, enjoy and learn.



AND ONCE AGAIN

THANK YOU TO ALL INVOLVED IN PUTTING THESE EVENTS TOGETHER