Hands-on: Cloud observations from space
ICTP
July 2, 2024

Purpose: To explore different satellite web tools in relation to clouds and convection.

Additional educational resources
- COMET modules (requires registration, https://www.meted.ucar.edu/sign_in.php, search on satellite)

Overview
You will use three different websites and explore their capabilities for different satellite orbits, instruments, and wavelengths. Consider the following questions as you examine the different cloud scenes:

- What can you say about the observed clouds (e.g., their type, phase, evolution, organization)?
- What does the image tell us about the large-scale tropical circulation?

1. Open the RAMMB/CIRA slider: https://rammb-slider.cira.colostate.edu

Note that the default product is **GeoColor**, which combines VIS and IR channels. During the day, the imagery looks approximately as it would when viewed with human eyes from space. At night, the blue colors represent liquid water clouds such as fog and stratus, while gray to white indicate higher ice clouds, and the city lights come from a static database.

   a. Click through the different geostationary satellite (e.g., GOES-16, Meteosat-10, and Himawari-9) and compare their coverage and cloud features. Feel free to zoom into a particular region or explore other Products (the best availability will be for GOES-16).

   b. Choose Meteosat-10 and zoom into the tropical/subtropical region covering the Atlantic and Africa. Describe the cloud features, including whether they are low-level (water) or upper-level (ice), and the factors controlling their location and cloud type. Consider environmental factors (like SST and land surface type) or dynamical factors (like the ITCZ and monsoon).

   c. Focus on a region of active deep convection over the East Atlantic or West Africa. Describe the evolution of the convective cloud features (e.g., size, intensity, overall organization).

2. Open NASA Worldview: https://worldview.earthdata.nasa.gov/

Overview documentation: https://www.earthdata.nasa.gov/s3fs-public/imported/2019_Worldview_4Pager_RevNov2019.pdf

   a. Click back one day to 2024 July 1. Compare the cloud scenes over the East Atlantic and West Africa (the swath pattern, time of day, etc.) between the different polar-orbiting

satellites (e.g., MODIS on Aqua and Terra, and VIIRS on NOAA-20 and 21) and to the geostationary Meteosat-10 by clicking on the eye next to each satellite/instrument.

b. Click on Add Layers. Search for GMI (the passive MW instrument on GPM) and choose Brightness Temperature (Ascending). Compare it to the swath pattern from Terra/MODIS.

c. Click on Add Layers and choose Precipitation (Ascending). Compare it to the cloud reflectance from Aqua/MODIS.

d. Add a layer from another instrument of your choice! Also note that you can download data from this interface under the Data tab.

3. Open Giovanni: https://giovanni.gsfc.nasa.gov/giovanni/

You don't have to register, but it is relatively quick and gives you more functionality.

a. Under Measurements, click on Cloud Fraction. Click on a monthly data source and choose a time to average over (ideally something short, like a few months or year). Press button for Plot Data.

b. Do a time averaged map for another measurement of interest, or of another plot top (the list is under the Select Plot pull down).