IPSL school - Caroline Muller - May 2021

How are clouds distributed on Earth? Information from space:

The following websites are examples of websites that provide satellite imagery:

- `https://www.windy.com/fr/-Satellite-satellite?satellite,2020-01-24-15,13.096,-59.616,4`
- `https://www.star.nesdis.noaa.gov/GOES/fulldisk_band.php?sat=G16&band=01&length=12`
- `https://www.ssec.wisc.edu/clavrx/realearth/himawari-8/`
- `https://www.star.nesdis.noaa.gov/GOES/`
- `https://worldview.earthdata.nasa.gov/`
- `http://www.ssec.wisc.edu` (this website lists several geostationary statellites, once on this site click Data/Imagery, Geostationary satellite images, Geostationary image browser : http://www.ssec.wisc.edu/data/geo/)

1. Satellite visualization from satellites in different bands

Browse the different websites indicated above. Check different satellites (GOES-E, GOES-W, Himawari...) and different bands (e.g. visible VIS, infrared IR, water vapor WV...). Try to always select the widest possible longitudinal and latitudinal extent of the satellite, typically referred to as"FULL DISK" (since we are interested in the large-scale distribution of clouds).
Here are some questions to help guide your investigation of satellite imagery:

(1a) What information on clouds do the visible VIS and infrared IR satellite pictures provide?

(1b) Pick a geostationary satellite (for instance "MET-PRIME" or "GOES-EAST"). Compare the VIS (for instance canal visible 1 for MET-PRIME or 2 for GOES-EAST) and IR (for instance canal IR10 for MET-PRIME or 14 for GOES-EAST). At what latitudes do the 2 products yield similar cloud cover? Conversely, at what latitudes do they differ? In that case, which one gives the largest cloud cover?
Can you explain those observations?

2. Spatial distribution of clouds and cloud top heights

Now find a satellite which includes a map of enhanced IR, or another indication of cloud top temperature.

(2a) Start at mid latitudes (approximately 45° latitude). What is the typical temperature range of the clouds there? Estimate approximately the averaged cloud top temperature. What altitude does this temperature correspond to? (Note: you may find it useful to find a map of mean temperatures versus latitude and altitude).

(2b) Continue at subtropical latitudes (approximately 30° latitude). What is the typical temperature of clouds there, and what altitude does that correspond to?

(2c) Finally, in the tropics (10° latitude or so), what is the typical temperature of clouds, and what altitude does that correspond to?