CLOUD-EXPLORER: An exploratory analysis on the relationship between cloud top VIS/IR radiances and precipitation intensity

Quantitative precipitation estimation (QPE) in tropical and subtropical regions is currently difficult because of very sparse rain gauge networks and the lack of ground weather radars. In most regions, the installation and maintenance cost of such systems is prohibitive for both local and national authorities. However, in such regions, visible (VIS) and infrared (IR) imaging sensors onboard of geostationary (GEO) satellites provides km-scale high-frequency (10-min) information on the development of precipitating cloud systems. Characteristic cloud features in VIS/IR imagery such as enhanced V-feature (Brunner et al., 2007) overshooting tops (Jurković et al., 2015, Setvak et al., 2013) and above anvil cirrus plumes (Bedka et al., 2018) have been observed in association to reported severe weather at the ground.

The source of information provided by GEO VIS/IR imagery is currently underexploited in global precipitation products, and the aim of this project is to analyze the relationship between VIS/IR cloud top properties and the precipitation intensity. To this end, the project will exploit a computational pipeline already developed at LTE in the past year to collocate data from GEO VIS/IR imagery with the infrequent simultaneous precipitation estimates provided by a tropical-orbiting spaceborne weather radar.

The project will be divided in two tasks which can be performed in parallel.

1. In a first step, the student will design the code to download, read and access the GEO VIS/IR imagery of the satellite Himawari-8. To facilitate this task, the student will benefit from a software template developed at LTE to retrieve data from other GEO satellites. Once the code is implemented, it will be possible to automatically perform the collocation with the spaceborne radar data (see Figure 1).

2. In the second part of the project, the student will focus on analyzing the relationship between VIS/IR cloud properties and the surface precipitation estimates provided by the spaceborne weather radar. The student will have the choice to exploit data generated in the first part of the project, or alternatively use a pre-existing dataset already compiled by LTE.

Objectives

- Development of software to access Himawari-8 VIS/IR imagery
- Perform an exploratory data analysis on the relationship between cloud features and precipitation intensity

Requirements

- Good programming skills in python
- Interest in hydrometeorology, remote-sensing and GIS

References

Figure 1: True Color GEO imagery (left) and the superimposed simultaneous precipitation estimate derived by the spaceborne radar (right).