Fiche de stage M2/fin d'étude

Title: Mitigating low signal-to-noise ratio in geostationary satellite ocean colour observation.

Location: Méteo-France, CNRM, UMR 3589, Lannion, France.

Duration: 4 to 6 months beginning in early 2022.

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Co-supervisor: Dr Ewa Kwiatlowska (EUMETSAT)

Summary of the project:
Observation of the Ocean Colour (OC) using remote sensing techniques is possible since the late 70's from polar orbiting satellites with revisit time of typically one or two days. Meteorological geostationary satellites offer the advantage of providing data at a very high temporal frequency (typically every 10 to 15 minutes) necessary for meteorological applications. High frequency observation is also key for observing rapidly varying surface parameters (e.g. coastal dynamics) and to partially overcome the impossibility to observe the surface under clouds in visible and infrared channels.
Currently only the Geostationary Ocean Colour Imager (GOCI), a Korean instrument, is a geostationary satellite dedicated to observing the colour of water surfaces. Several studies have demonstrated the potential of the instrument SEVIRI (on-board the satellites of the EUMETSAT Meteosat Second Generation program) to observe water turbidity in highly turbid areas. EUMETSAT is about to launch its new generation geostationary program (Meteosat Third Generation): the first imager satellite will be launched in 2022. On-board this platform is the visible and infra-red radiometer Flexible Combined Imager (FCI) which has improved capabilities with respect to Ocean-Colour applications.
However, geostationary satellites like MTG are placed on a high orbit (altitude of about 36000 km) and their instrument's radiometry is not defined considering Ocean Colour specifications. Therefore, the quality of the acquisitions is poorer than those of instruments on-board of dedicated low orbiting satellites. This represents a major limitation in the process of retrieving Ocean Colour parameters from such observations. Indeed, water constituents responsible for the colour of the ocean contribute to a small extent to the overall top-of-atmosphere reflectance in the visible domain. A low signal-to-noise ratio (S/N) therefore results in high uncertainties in the geophysical parameters retrieved.
The objective of this internship is to explore ways of mitigating this effect. For instance, this could be done by temporally and/or spatially averaging pixel values of top-of-atmosphere reflectance, of water-leaving radiance or of geophysical parameter.

Methodology:

- Review the literature on Ocean Colour parameter retrieval from geostationary observations.
- Design one or more methodologies to mitigate the effect of the low S/N.
- Implement them on MSG or GOES or other proposed satellite data.
- Validate them by comparison to well established higher resolution Ocean Colour products (for example CCI or CMEMS data).

Requirements:

- Be experienced in using Linux environment and python scientific modules.
- Have some knowledge on remote sensing data processing.
- Have some knowledge about Ocean Colour remote sensing.
- Be highly motivated!