Satellite data - Numerical Model synchronization at different scales

5-6 month internship at Sorbonne University LIP6 lab (Jussieu, Center of Paris)
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Scientific context

For several decades, a large variety of satellite sensors has allowed us to dramatically improve the knowledge of the state of planet Earth and its potential evolution thanks to satellite remote sensed imagery. Satellite sensors provide global coverage of the ocean. These sensors are diverse both in terms of remote sensed technology and in geometrical sampling. They observe a multitude of geophysical parameters with various sampling, in space as in time.

They have permitted to better know the ocean state such as **Sea Surface Temperature (SST)** with high resolution radiometers such as the AVHRR sensors launched onboard meteorological satellites, **Sea Surface Height (SSH)** which is a good indicator of ocean circulation with altimeters (Topex, Poseidon and then Jason altimeters) that is retrieved in a coarser resolution.

These satellite sensors have contributed to detect changes in the response of the ocean to global warming. The ocean is a major contributor to the climate state via air sea exchanges (radiative processes, latent and contact heat fluxes), latitudinal heat transport via ocean circulation, climate regulator via the atmospheric CO2 uptake and its enormous heat stockage capacity. These ocean contributions to climate are related to ocean currents through a large variety of scales spanning from basin-scale down to sub-mesoscale (Sasaki et al, 2014, McWilliams, 2016). Moreover, sub-mesoscale ocean currents may play an important role in structuring marine ecosystems (Levy et al, 2018).

These ocean data fields are therefore observed at different resolutions, but can also be calculated from physics based models such as NATL60 at any resolution. These numerical dynamical models of oceanic circulation are fine tuned, physics-informed predictive models that reconstruct the evolution of the ocean. The fields they produce are of high quality and consistent to the different physics governing the different scales at which we can observe the ocean. However the higher their spatio-temporal resolution is, the more expensive they are to run and they can **present biases compared to observation.**