Sea Surface Salinity from SMOS satellite mission: major achievements after 7 years in orbit (2010-2017)

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Ocean salinity is an important driver of ocean circulation and near-surface values represents a key indicator of low-frequency changes in the global water cycle. Recent advances in observing sea surface salinity (SSS) from space have provided an unprecedented capability to further study the influence of salinity on ocean circulation and its relations to climate variability and the water cycle. The Soil Moisture and Ocean Salinity (SMOS) satellite mission has been launched in 2009 under the auspices of the European Space Agency (ESA) in collaboration with the Centre National d'Etudes Spatiales (CNES, France) and the Centro para el Desarrollo Tecnológico Industrial (CDTI, Spain). It is the first satellite mission that provided a global monitoring of sea surface salinity (SSS) from space. Since 2010, SMOS provides a quasi-synoptic monitoring of the global ocean every 3 to 5 days. In tropical and subtropical areas, the precision of monthly SSS anomalies at 50 to 100km resolution has been determined to be close to 0.2 pss. Here we review main scientific results achieved thanks to these novel measurements.

Large scale interannual SSS anomalies in the tropical Pacific Ocean, linked to El Niño/La Niña events (2010-2011 and 2015-2016) and in the Indian Ocean, linked to the Indian Ocean Dipole, have been detected by SMOS with a spatio-temporal resolution very complementary to Argo and ships of opportunity. These anomalies are related to freshwater fluxes as well as to ocean salinity advection anomalies. In the cold tongue region of the equatorial Atlantic Ocean, SST seasonal cycle has been shown to lag by 1-2 months the one of SSS due to vertical stratification. In addition, tropical instability waves in the equatorial Pacific and Atlantic Ocean have been observed to vary interannually. Another great advance with the SMOS data set has been to conduct unprecedented studies on the small scales of SSS at typical 50 to 100 km. This concerns in particular the propagation of eddies in the Gulf Stream, in North Equatorial Counter Currents, rings in the north Brazil current, the seasonal variability of the surface horizontal thermohaline structure in the subtropical Atlantic Ocean. The influence on the SSS variability of the freshwater flux relative to the ocean dynamics has been studied both in main river plumes and in rainy regions of the open ocean (fresh pool of the eastern Pacific Ocean, Intertropical Convergence Zones).