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A global analysis of sea surface salinity variability from satellite observations

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The Sea Surface Salinity is a parameter of major importance to estimate the influence of oceans over climate. Unlike the temperature, it has no undirect effect on the air/sea exchanges. But it determines the convection or re-emergence of water masses, which are crucial for the seasonal to interannual variability of the global system. Unfortunately, measurements of SSS are expensive and very inhomogeneously distributed, so that even its seasonal cycle is still poorly known over much of the world's ocean.

An integral model of the oceanic mixed layer is used to estimate the anomalies of SSS caused by the atmospheric heat fluxes, the evaporation-precipitation budget, the wind friction and the perturbations of the geostrophic circulation. The input parameters are the air/sea fluxes derived from a meteorological model, as well as the wind stress, the surface temperature and the sea level anomaly from various satellite measurements. It is shown that the variations in the wind-induced transport is the first cause of salinity variability, but that the fresh water flux can dominate locally.

The model is first tested with high-frequency climatological forcings, in terms of time spectrum and spatial distribution of the salinity response. Then the analysis is performed over several recent years, from an optimal combination of space-borne observations and model outputs. The results are validated using in situ measurements from buoy arrays in the tropical Pacific and Atlantic, then using gridded fields from a set of drifters over the North-Atlantic. Finally, the interest of this method and its real-time application is examined in view of the future SMOS and Aquarius satellites, which will both be dedicated to the SSS retrieval.