Geophysical Research Abstracts
Vol. 17, EGU2015-7216-1, 2015
EGU General Assembly 2015

Seasonal mixed-layer salinity balance in the Tropical Atlantic ocean

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Ocean and atmosphere interact by exchanging momentum, heat and freshwater. In the ocean, these exchanges take place in the upper mixed layer which depends on the ocean stratification, hence on both temperature and salinity. A regional numerical simulation is used to investigate the different processes that control the seasonal cycle of the mixed layer salinity in the Tropical Atlantic ocean. The simulated variations are validated against recent observations. The seasonal mixed layer salinity budget reveals a weak amplitude of the seasonal variability in comparison to the atmospheric and oceanic contributions taken separately. In most of the Tropical Atlantic regions, this is mainly explained by the adjustment of the oceanic dynamics (horizontal and vertical dynamics) to the atmospheric flux which compensate each others. In evaporative regions, the mixed layer is mainly freshened by the strong vertical entrainment around the SSS maxima, where the subsurface salinity gradient is destabilizing, while the horizontal Ekman advection plays a dominant role eqautorward of these maxima, where the subsurface salinity gradient is stabilizing. In regions dominated by precipitation and river run off, the mixed layer salinity seasonal variability is more marked, but by increasing the vertical salinity gradient, the freshwater surface input contributes to enhance the vertical diffusion which mitigates the freshening. In the eastern Equatorial Atlantic, the mixed layer salinity is controlled by the ocean dynamic alone, advection of freshwater being compensated by vertical dynamics.