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Inter-annual coastal-trapped wave in the South-Atlantic ocean : Remote versus local forcing

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Among the different eastern boundary upwelling systems, the Benguela Upwelling System (BUS) presents one of the highest primary production. The dynamic and the variability (physics and biogeochemistry) of the northern part of the BUS is under the influence of both, the equatorial remote forcing and the local forcing (Ekman dynamic associated to wind and heat flux forcing). The remote forcing is mainly associated with the propagation of Equatorial Kelvin Waves as well as the intrusion of warm, salty, high nutrient and low oxygen water. The relative influence of the remote versus the local forcing in the BUS have not been quantified yet.
We investigated the respective role of remote (Equatorial Kelvin Waves) and local (wind and heat fluxes) forcing on the BUS variability using a set of 4 numerical experiments based on an oceanic regional model (ROMS) at high resolution (1/12°) over the period 2000-2008. The experiments only differ by their boundary conditions (surface and lateral), which are either climatological or real-time.
Our results show that at sub-seasonal time-scales, the oceanic variability (Currents, thermocline depth and sea level anomalies) is mainly driven by the local forcing whereas at inter-annual time-scales it is largely explained by the remote forcing. At inter-annual time scale, remotely forced coastal-trapped waves (CTW) propagate poleward in sub-surface along the African west coast to the Northern part to the BUS (up to 25°S). Phase speeds of these propagations range from 0,9 up to 1,3 m/s. The inter-annual variability of the local forcing modulate the magnitude of the coastal interannual event. In particular, when the local wind stress forcing is in phase (out of phase), the magnitude of the inter-annual event increases (decreases). Then, the dynamics associated with the CTW propagations is further investigated using the online budget of the temperature tracer, for two intense inter-annual events that occurred in 2001 and 2004. Results show that significant temperature anomalies, mostly in sub-surface are primarily driven by alongshore and vertical advection processes, while cross-shore advection drive the anomalies offshore and surface forcing tend to weaken the event.