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Propagation of coastally trapped waves in the Northern Benguela studied with hydrographic moorings and a regional circulation model

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Upwelling in the Northern Benguela is mainly driven by local winds but nutrient and oxygen conditions on the shelf are largely determined by the intrusion of South Atlantic Central Water (SACW) through the Angola-Benguela Front (ABF). The poleward spreading of tropical waters is related to the propagation of Kelvin and continental shelf waves originating from the Equatorial Atlantic and bending poleward at the African coast. The strength of this remote forcing is thought to be especially relevant to the interannual variability of the upwelling system.

We test the hypothesis that the poleward spreading of tropical water is driven by the combined action of both I) coastally trapped waves of equatorial origin bringing tropical water to the ABF zone and II) locally forced waves generating the undercurrent which advects SACW onto the shelf.

Signals of poleward propagating waves were found in satellite altimeter data up to 12°S. To detect the propagation of coastally trapped waves further south in-situ measurements have been conducted. Three hydrographic moorings equipped inter alia with ADCPs have been deployed and maintained within the framework of the projects GENUS, SACUS and PREFACE. For the first time, simultaneous current measurements on the Namibian shelf have been realized at three different positions. The moorings are located in the Cunene cell, the Northern Namibian cell and the Central Namibian cell.

By means of a regional circulation model based on MOM the propagation of coastally trapped waves are investigated with high spatial and temporal resolution (about 8km along the Namibian coast, 2-hour averages). It has been demonstrated that modelled meridional transports correspond well with long term measurements obtained by a mooring off Walvis Bay.

The power spectral density shows sharp peaks for the tidal and inertial frequencies. A large proportion of kinetic energy accounts for the sub-inertial frequency range. Meridional transport signals were found to propagate along the Namibian shelf which might indicate coastally trapped waves. A complex EOF analysis of measured currents has been performed and compared with results of the regional circulation model.