Influence of river discharge on the seasonal circulation of the Eastern Brazilian Shelf (8^{o}S - 19^{o}S)

A regional model based on ROMS-RUTGERS, configured with a refined grid (1/36^{o}) and realistic forcings (6-hourly winds and surface fluxes, daily large scale oceanic forcing and tides), was implemented to investigate the seasonal circulation within the Eastern Brazilian Shelf (EBS), a passive continental margin forced by a combination of Western Boundary currents which flow at the slope, winds and local topography. The control experiment (with no river discharge) show that for the northern limit (8-10^{o}S) the northward North Brazil Current/Undercurrent (NBC/NBUC) system is the dominant pattern at the shelf-break/slope and the surface circulation at the inner and mid shelves is more influenced by the wind forcing. At the middle (14^{o}S) and southern (16-18^{o}S) domains, there are an alternate dominance of the southward Brazil Current (BC) and the northward NBC for the first 150 m of the water column. However, the annual net transport is southward oriented, despite the change of the mean shelf circulation, which experience a complete reversal of the mean flow between spring/summer (southwards) and autumn/winter (northwards) seasons, as a response of a similar change in the wind field. With the addition of the river discharges we could indentify that three main rivers interact with the local circulation, mainly during the summer season when the net discharge is about two times the winter one. For instance, at the northern limit, the density gradient associated with the Sao Francisco (SF) river discharge during summer, generates a northward flow near the coast and a southward flow at the outer-shelf. The northward flow opposes the mean southward local circulation and decreases the velocity near the coast, on the other hand, the outer shelf flow increases and seems to accelerate the coastal border of an anti-cyclonic eddy which is a recurrent feature in the central part of the domain during the summer season. During the winter season, the SF river discharge decreases and is deflected to the north, following the forcing balance between the density gradient and the preferential northward wind and current circulation. The southward density flow due to the river discharges in the middle and southern domains increases the local southward circulation, which did not change significantly between seasons, due to the topographic circulation constraint at these regions.

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