Position of the Malvinas current jets based on along-track sattelite altimetry data

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The Antarctic Circumpolar Current (ACC) manifests a dynamic nature, exemplified by the Subantarctic Front (SAF) within the Malvinas Current. This study analyses spatial and temporal variability of the Malvinas Current based on satellite altimetry, particularly focusing on the fine kinematic structure of its coastal and deep-water jets. Field measurements revealed that the Malvinas Current comprises a coastal jet (20 km wide) and a deep-water jet (150 km wide). These properties of the current influence fishery in the Southwest Atlantic. To overcome limitations in traditional satellite altimetry, this study utilizes along-track altimetry data with a spatial resolution of 6.2 km and a temporal resolution of 9 days 21 hours 58 minutes, spanning from 1993 to 2020. A long-term trend is identified, indicating displacements in the position of fronts relative to accepted levels of absolute dynamic topography (ADT). The accuracy of fixed ADT values for front position determination diminishes over time due to mean sea level variations. A statistically significant sea level rise trend is noted in the Subantarctic Front region, with is 4 mm/yr for the coastal branch and 2.5 mm/yr for the deep-water branch. Assessing spatial displacements, a steady trend reveals the southward displacement of the 23 cm ADT isoline by 1.6 km/yr. By 2020, this isoline has moved 45 km from its 1993 position, resting, on average, 75 km from the shelf edge. The -10 cm isoline also moves southward at a speed of 1.5 km/yr, mirroring the 23 cm isoline's speed. Analyzing trends in the SAF coastal along-slope jet position over time yields intriguing insights. The SAF-n, observed at levels of 27 to 28 cm in 1993, elevates to an average of 38 cm by 2020. The sea level rise trend in the SAF-n area surpasses the global trend 1.4 times. This study combines satellite altimetry data with extensive trend analysis, providing new data on the spatial and temporal dynamics of the Malvinas Current. These findings supplemented by field observations contribute significantly to our comprehension of this crucial oceanic system in the southwestern Atlantic.