Part 1: Seasonal Variability

Variability in the South Atlantic Circulation

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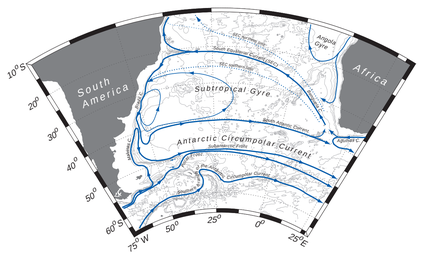
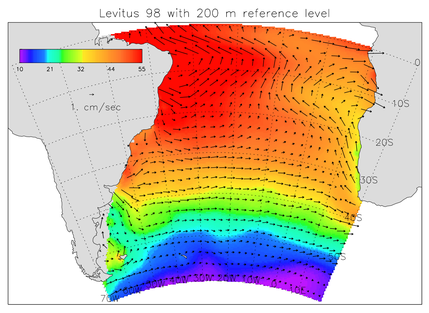
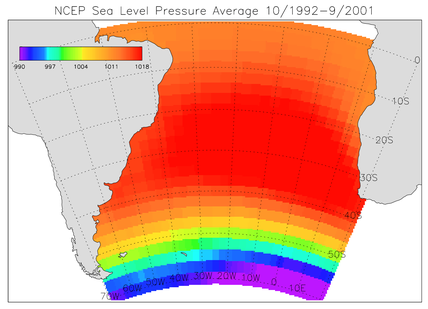
Schematic of Basin Circulation



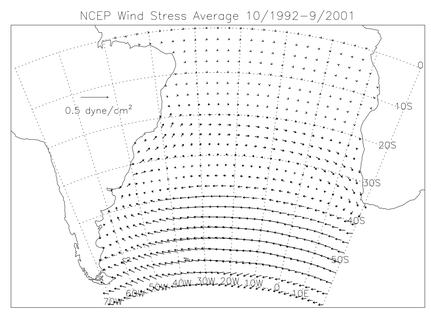
Climatological Dynamic Ht (0/200m)



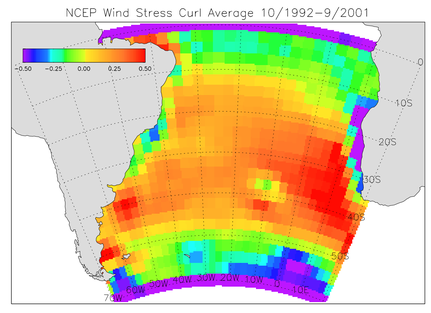
Mean SLP



Mean NCEP Wind Stress

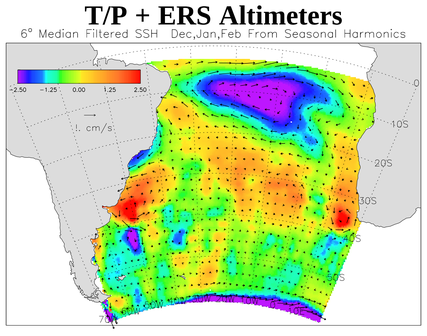


Mean NCEP Wind Stress Curl

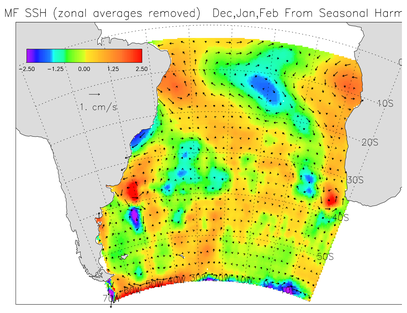


Mean

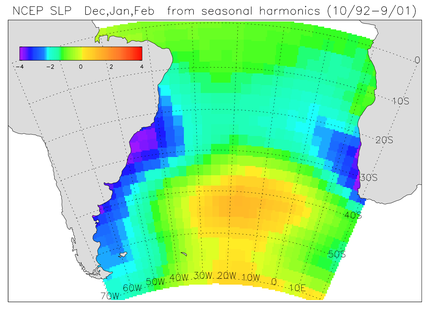
Sea Surface Height (SSH)
T/P + ERS Altimeters



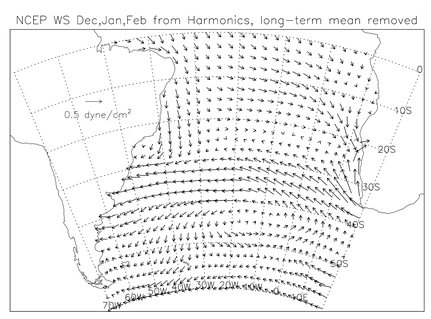
SSHZ (Zonal Mean Removed)



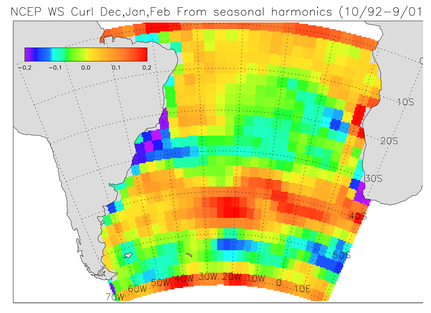
Sea Level Pressure (NCEP)



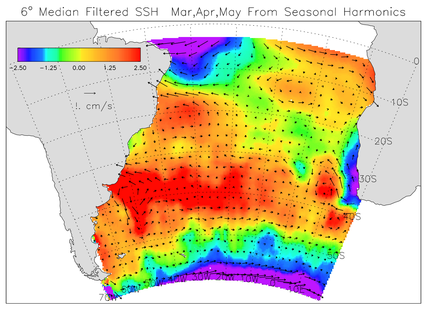
Surface Wind Stress (NCEP)

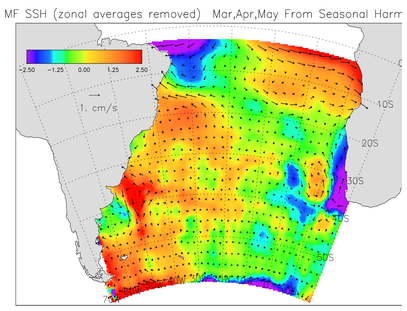


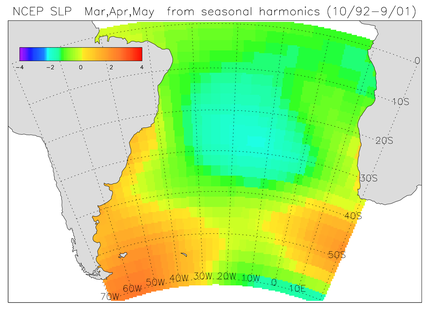
Wind Stess Curl (NCEP)

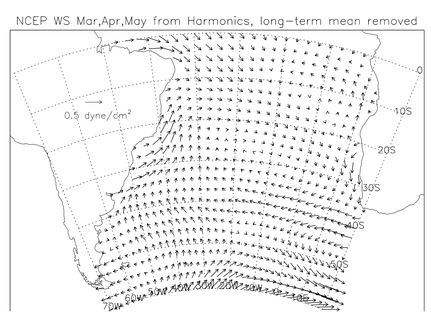


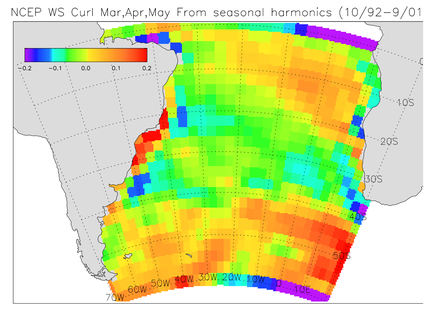
Summer



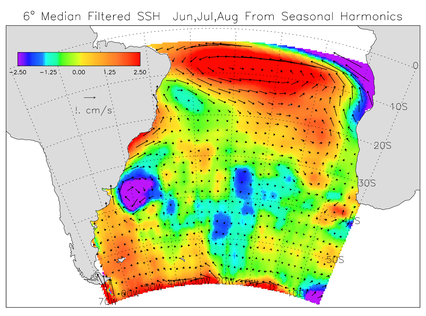


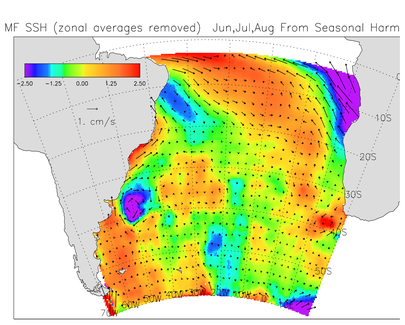


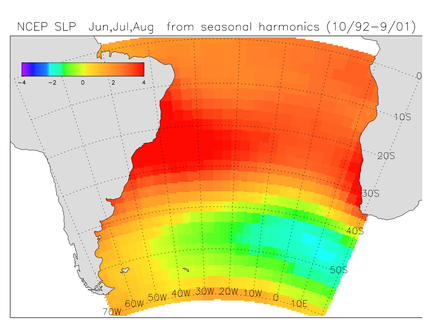


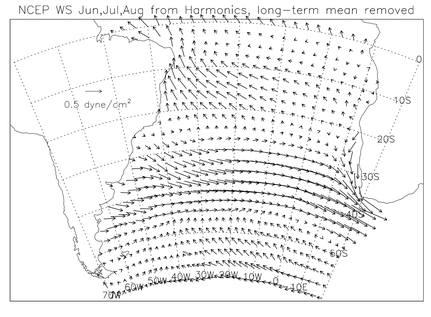


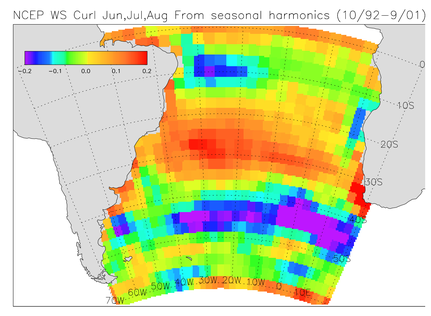
Autumn



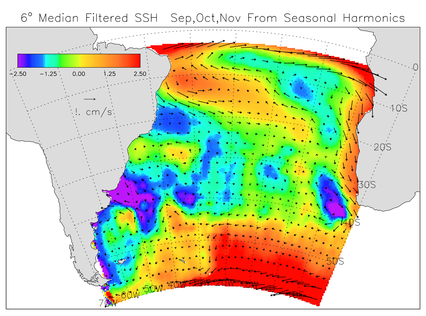


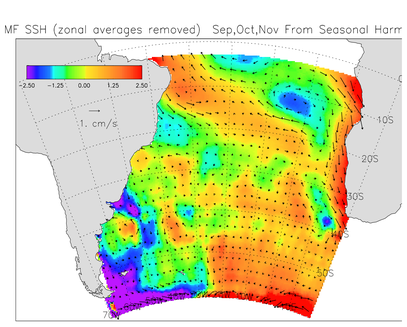


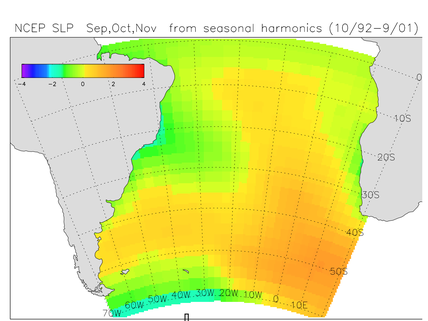


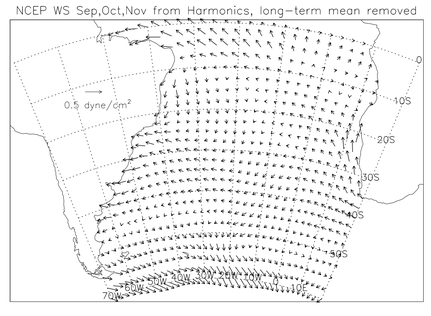


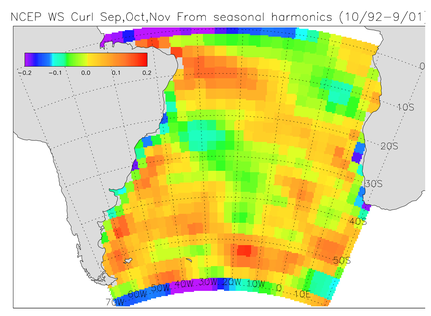
Winter











Spring

Formation of SSH Fields

SSH fields are formed from 35 days of data, centered every 10 days, over the 9 years of data. ERS and T/P data from the NOAA/NASA Pathfinder project are used, removing the spatial mean of each data set for each period considered. This removes any large-scale offset in orbit errors and also removes some of the steric heating. The long-term mean is also removed. The left hand column shows the seasonal mean residual fields of these SSH fields, after a 6-degree median filter is applied. The top figure is a schematic of the mean basin circulation, which has been removed. The column second from the left shows the seasonal fields of data from which zonal means have been subtracted (to remove some steric effects). Removing the zonal mean does not change the main features and makes the fields more noisy, so we use the data without removing the zonal mean. This accurately describes seasonal changes in the top 200m of the ocean, including steric heating. The top figure of this column is the mean dynamic height from Levitus climatology, relative to 200m. The next three columns show the mean (top) and seasonal residuals of SLP, Surface Wind Stress, and Wind Stress Curl.

Seasonal Patterns (References are to Austral seasons)

The seasonal changes in the SSH (and SSHZ) fields include the following robust features: (1) In the region of the Brazil-Malvinas Confluence, there is a high (north) and low (south) dipole in summer, strengthening the mean height gradient and eastward flow away from the confluence. In winter this dipole reverses, weakening the gradient and flow. (2) SSH next to SW Africa in the Benguela Current upwelling region decreases in autumn, following the strongest equatorward winds, which occur in summer. (3) SSH is low in the Equatorial "Cold Tongue" during austral summer in the eastern Equatorial Atlantic, when the SE trades are strong. This cold tongue collapses and high SSH is found along the eastern Equatorial Atlantic and down the west coast of Africa in Austral spring, even as upwelling winds increase next to SW Africa. This connection to the Equator may delay the appearance of low SSH due to upwelling in spring and summer. In winter, SLP reinforces the mean gradient and strong westerlies between 30-45S. In summer, SLP develops a high seasonal anomaly in the middle of the basin south of 30S, weakening the westerlies and increasing upwelling along SW Africa. The curl fields reflect the winds and are similar in many regions to the patterns of the SSH three months after the curl fields.

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