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South Atlantic Circulation and its impact on the MOC

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The South Atlantic Ocean (SA) is an active passage through which the deep southward flowing branch of the Meridional Overturning Circulation (MOC) is compensated by northward inflows of upper and intermediate waters from the Pacific and Indian Oceans. In this study, we focus on understanding the dominant patterns of large-scale variability of the SA circulation, along with their impacts on the strength of the MOC and asssociated heat transport, using results of the Simple Ocean Data Assimilation Model (SODA). EOF analysis of the model's SSHa and SSTa show three distinct modes of low frequency variability, which are associated with the circulation in the Subtropical Gyre, the Brazil/Malvinas Confluence and the Agulhas Retroflection Region. These modes have spectral peaks at intra-decadal ($\sim$12 years) interannual (mostly ENSO-like, 4-5 yrs) and quasi-biannual ($\sim$2.5 yrs) time scales. Time-series of the volume and heat transport anomalies at several zonal cross-sections are strongly correlated and are characterized by a relatively large seasonal variation with a maximum during the austral winter and a minimum during the austral summer. The deseasonalized anomalies indicate a northward increase in magnitude of volume transport and heat anomalies with high latitudinal coherence and spectral peaks well correlated with ENSO cycles. The anomalies are positive during El Niño years and negative during La Niña years. To investigate the relationship between the MOC and the SA circulation we computed the EOFs of the MOC streamfunction and its correlation with the SSHa modes. The most significant correlation is between the second mode of the MOC and the second mode of SSHa. The second mode of SSHa has a spatial structure almost colocated with the Subtropical Gyre and we postulate that the variability shown in the surface layer of the second MOC mode is related with the variability of the Subtropical Gyre, especifically the South Equatorial Current. The second peak of variability is related with the variability of the zonal jets detrained from the Deep Western Boundary Current at this latitude and depth.