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Consistency of observed sea surface height changes, bottom pressure changes and temperature, salinity variations in a South Atlantic transect of the Antarctic Circumpolar Current

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Improved estimates of temperature, salinity, and sea surface height changes are computed from radar altimetry, satellite gravimetry and Argo profiles, and validated by the in situ ocean bottom pressure measurements in a South Atlantic transect of the Antarctic Circumpolar current. Using satellite gravimetry and altimetry observations, separate contributions to the global sea level can be estimated, but a regional solution is more challenging. Furthermore, Argo derived steric sea level change suffers from spatio-temporal sampling problems, and some signals are not well captured, e.g. in the deeper ocean below 2000m, around the boundary currents, in the Arctic or in the shelf/coastal regions. Jointly processing radar altimetry, Argo and data from the Gravity Recovery and Climate Experiment (GRACE), would allow to correct the deficiencies of the individual datasets, and produce observation based estimates of consistent temperature, salinity and sea surface height changes. In order to pave the way for an advanced joint inversion scheme that additionally resolves for temperature and salinity, the observation equations are formulated which link the satellite observations to temperature and salinity at depth. Observations in the South Atlantic region are compared with simulations from the FESOM model in terms of variability and the model data is used to find the spatial coherence of the signals at the sites with the surrounding ocean. The experiment is performed in the Southern Atlantic Ocean, where the estimates can be validated using an array of in situ ocean bottom pressure observations.