Trends in the South American Border of the South Atlantic High

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The annual pattern of the sea level pressure (SLP) in the western border of the South Atlantic high between 25°S and 45°S has shifted southward since 1950. This trend was found, both in the NCEP reanalysis and in the South American coastal synoptic data.

This annual shift was related to a change in the annual SLP cycle. To describe this annual cycle in a synthetic form, principal component (PC) analysis in T mode was applied to the correlation matrix of seasonal SLP means. The domain of this analysis was between 25°S - 45°S and 65°W - 45°W including southeastern South America. In this region, mean SLP is characterized by the meridional gradient corresponding to the west flow in the south, the southwester border of the South Atlantic high in the east and the Chaco low in the northwest.

In winter, the field corresponding to the west flow spans northward of its mean annual position, while in summer the South Atlantic high intensifies and moves southward. The first two PC patterns represent the winter and the summer fields, and jointly explain 90 % of the variance Their loading factors have a growing trend in the summer mode contribution to the total variance at the expense of the winter mode contribution, which is consistent with the observed southward shift of the regional SLP field.

GCM experiments available in the IPCC web page were checked against NCEP reanalysis, and four of them, namely those from HADCM3, GFDL-R30, ECHAM4/OPYC3 and CSIRO-Mk2, simulate correctly the observed SLP climatology. The same PC technique was applied to the SLP of these experiments finding PC patterns, similar to those found with the NCEP reanalysis. Their respective loading factors also present similar trends, indicating that they not only capture the basic features of the observed annual cycle, but also its trend. Since in these experiments, greenhouse gasses (GHG) and aerosol concentrations increases with time, their SLP annual cycle change could be attributed to them.

Optimal detection in the multi-model average indicate that the observed regional changes can be attributed with high probability to the GCM experiments forcing, namely, the increasing GHG and aerosol concentrations. Further evidence of the attribution of these observed changes comes out from the 2000/2099 outputs of the four GCM experiments (SRES A2 scenarios) because the observed trend continues in the future climate scenarios reducing the uncertainty due to other sources of variability.