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Inconsistencies in sea level pressure trends between different atmospheric products. Impact on sea level trend estimation

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Long term climate datasets are of great importance to understand the processes behind climate variability, to evaluate the performance of climate models and to identify signals of climate change. Among the different atmospheric variables, sea level pressure (SLP) is the basic dynamical variable and is the most widely analyzed quantity. From the ocean perspective, SLP is of crucial importance for a dynamical interpretation of sea level records. In order to isolate the contribution to sea level variability of circulation and heat and freshwater contents, a common practice is to remove the sea level fluctuations induced by SLP. At seasonal and longer time scales, sea level is expected to react as an inverted barometer (IB) to changes in SLP. Therefore, provided that accuracy of available SLP data is high enough, the atmospheric contribution to sea level variability can be isolated and removed from sea level records. This is routinely done for tide gauge records, altimetry or sea level reconstructions.

Different atmospheric gridded products spanning the last decades are nowadays available. On the one hand, there are historical SLP datasets where observations from land stations and ocean observations have been interpolated into a regular grid. On the other hand, there are reanalyses where an atmospheric model is run assimilating the historical data. Both kind of products have been extensively used in recent years either directly (i.e. to analyse the SLP evolution) or indirectly (i.e. through the removal of IB effect on sea level records). However, it is well known that the quality of those products may not be homogeneous on time. In this contribution, we compare long term SLP trends from different atmospheric products (reanalysis and gridded historical datasets), and evaluate the uncertainties introduced by them in the sea level trend estimations. The results show that discrepancies between datasets can induce an uncertainty up to 0.5 mm/yr for the period 1958-2001 on sea level trends. The uncertainties are larger in the Southern Ocean but also significant in other places as the Mediterranean (0.3 mm/yr) or the Indian and South Atlantic oceans (0.2 mm/yr). Finally, implications on the estimation of global mean sea level trends will also be discussed.