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Are changing the marine boundary layer properties over the Atlantic Ocean?

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One of the key component in the Earth's climate system is the marine boundary layer (MBL). Its main characteristics as height, entrainment efficiency or energy and mass fluxes with the free troposphere are closely linked to the properties of the thermal inversion layer. Usually this structure acts as a cap and determines the top of the MBL. Moreover, one of the main sources of uncertainty in climate change models is the cloud response with changes in the MBL and in the inversion layer properties. Therefore, it is especially important to analyze whether the marine boundary layer properties have been changing in the last decades.
With this aim, we have analyzed the long-term trends of several MBL parameters in 33 stations in the Atlantic Ocean (40º N – 40º S). These parameters were derived from the radiosonde data launched from 1981 to 2010. To homogenize the temperature records in these data we have applied the RICH v1.4 methodology, whereas for the humidity data homogenization we have used that explained in Dai et al., (2011). All the trends were conveniently deseasonalyzed using Fourier analysis and generalized least squares with autocorrelated AR(1) errors was applied. We have observed decrease trends with time in the strength of the inversion layer (SIL), the thickness of the inversion layer (THK) and in the difference between the precipitable water vapor (PWV) within the free troposphere (WVF) and the PWV of the marine boundary layer (WVB). Moreover, in these 30 years we have obtained positive trends for the height of the bottom of the inversion layer (BIL), the lapse rates of virtual and equivalent potential temperatures (LPV and LPE, respectively), the PWV within the boundary layer (WVB) and the SST.
All these variations could have important consequences, both for the evolution of low cloud cover in a greenhouse-warmer climate, and for sensible local ecosystems, like "cloud forests".