

## **Understanding the change in the coastal and oceanic winds off Peru at seasonal to interdecadal timescales.**

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### Abstract

Due to its connection to the equatorial dynamics, the upwelling off Peru is influenced by climate variability at a variety of timescales. Of particular interest is the change at decadal timescales which may impact the ecosystem resources. In this study we investigate the variability of the along-shore winds off Peru which are a main driving force of the upwelling. The focus is on change in seasonal cycle and interannual to interdecadal variability timescales: As a first step, the seasonal cycle of the winds and its variance in Callao is presented for the periods before and after the 1976/77 climate shift. The climatological along-shore winds increases in winter and are the weakest in the summer. It exhibits a clear change in seasonal cycle associated to the 1976/77 climate shift with an increase in amplitude more important in winter than in the summer season. Such long-term increase in the winds is associated to an increase in ENSO variance from the 80s. In particular, at interannual timescales, winds increase during El Niño periods and decrease during La Niña event, with a significant asymmetry of the response to interannual anomalies traducing the nonlinearity of ENSO.

In order to investigate the consistency between winds and oceanic conditions, the results of the analyzis of in situ SST data along the coast of Peru and an index of upwelling in Callao are provided. SST data reveal a significant meridional variability in terms of long term tendencies. Whereas the SST increases in the Northern part of Peru, it decreases in Callao and further South. On the other hand, the upwelling index in Callao has a positive trend. It is suggested that the apparent inconsistency between SST and wind data in Callao traduces the presences of a decadal climate mode. In particular, a negative tendency in the winds is found for the data after 2000. The comparison of the *in situ* observations with a downscaled product of the NCEP/NCAR Reanalysis over the period 1948-2008 is presented in order to document the wind variability over the open ocean.