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Impact of climate change on the surface winds along the west coast of South America in a multimodel ensemble

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A main characteristic of the Humboldt Current system (HCS) is the upwelling of deep, cold, nutrient-rich waters which promotes a very rich ecosystem, from plankton to abundant small pelagic fish stocks. This upwelling is driven by the nearly along-shore surface wind constrained in part by the equatorial trade wind in the tropics and by the eastern flank of the South-East Pacific (SEP) anticyclone in the mid-latitudes.

In this study, we make use of a statistical downscaling method to diagnose the change in surface atmospheric circulation off the coast of Peru associated to anthropogenic forcing. The method is applied to the daily outputs of an ensemble of the IPCC AR4 coupled models for the present day conditions and those projected for the end of 21st century (A2 IPCC scenario). The results indicate that for the ensemble mean, warmer conditions are characterized by intensified alongshore winds in the region of the Coastal Jet of Central Chile, which is associated with the strengthening of the meridional pressure gradient over the subtropical Pacific. Over the central Peru, the ensemble mean exhibits a slight decrease in amplitude of the along-shore winds. However, the deviation between models is larger than over the Chile coast.

We further focus on two coupled models (GFDL-CM2.0 and MRI-CGCM2.3.2) that exhibit a contrasted behaviour in terms of their response to global change both in the tropical and subtropical latitudes. Whereas the GFLD model has a weak sensitivity to global warming in the tropics (the mid-latitudes), the MRI model experiences a significantly larger ENSO variability associated to change in equatorial mean thermocline and small change in the subtropical mean atmospheric circulation. Composite analysis of the downscaled winds of these two models is used to investigate the interannual variability in the South-Eastern Pacific in the context of climate change.