Regional atmospheric circulation simulations in Chile during October 2000: upwelling impact of mesoscale wind variability forcing a regional ocean model

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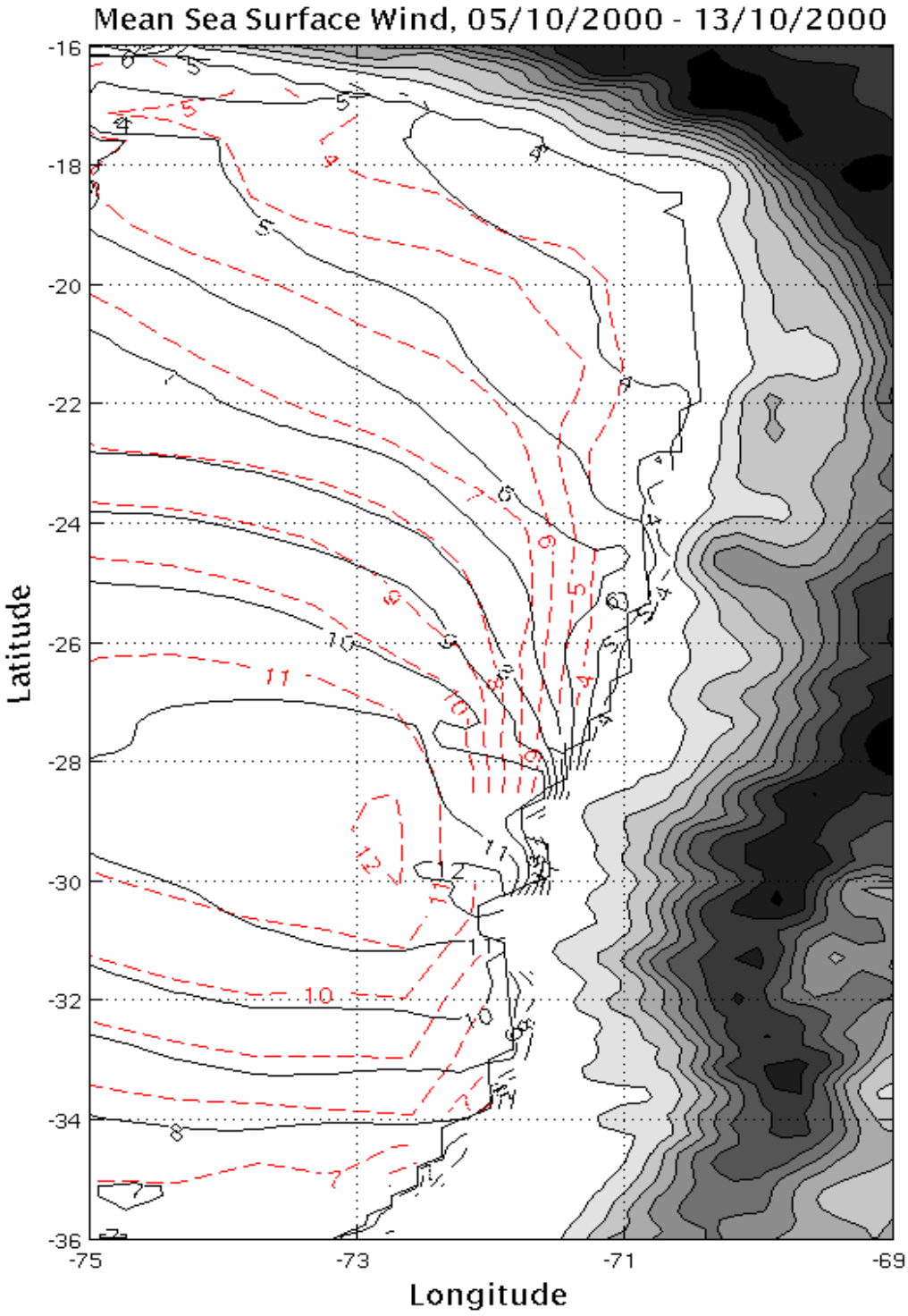
Main text

The study of regional oceanographic processes has undergone considerable development in recent years due to the expansion of in-situ observation networks, the increasing availability of satellite data, and the development of high resolution numerical models. Coastal zones are of special interest in regional applications as they are often the place of intense ocean mesoscale circulations which play a key role in coastal and deep-ocean exchange. In the case of the South American (SA) coastline, the regional wind-driven upwelling is modulated by ocean disturbances originally in the equatorial Pacific. Thus, an accurate representation of the atmosphere is likely to be important in studies seeking to evaluate coastal to deep-ocean transfer and to clarify the mechanisms associated with coastal wind variability.

In this study we use the WRF (Weather Research and Forecasting) regional atmospheric model to simulate the near surface atmospheric circulations along the SA coast between 15°S - 40°S using a multiple nested domain with grid spacing as low as 6 km. Simulations were performed for a sustained coastal jet event in October 2000 during which there was significant atmosphere-ocean interaction. A comprehensive validation of the model against in-situ meteorological and QuikScat satellite observations show that WRF was able to adequately simulate the low level winds in the vicinity of the coastline. However, while the model was capable of producing a well developed marine boundary layer (MBL), the altitude of the MBL was significantly underestimated, as has been noted on prior studies using the MM5 model (Muñoz and Garreaud, 2005 ,Garreaud and Muñoz, 2005). The spatial and vertical resolution was found to have a significant impact on the accuracy of the simulations, with higher resolutions generally giving superior results. We also present the results of preliminary experiments in which atmospheric fields produced by WRF at various resolutions were used to force the ROMS (Regional Oceanic Modelling System) ocean model in simulating coastal upwelling processes.



Mean Sear Surface Wind during the period 05/10/00 – 13/10/00. In red dashed-line, WRF with a 56 km resolution, in black solid line, WRF with a 18 km resolution

References

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