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Recent decadal trends in Iberian water vapour: GPS analysis and WRF process study

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A 24-year simulation of the recent Iberian climate, using the WRF model at 9km resolution forced by ERA-Interim reanalysis (1989-2012), is analysed for the decadal evolution of the upwelling forcing coastal wind and for column integrated Precipitable water vapour (PWV). Results indicate that, unlike what was found by Bakun et al. (2009) for the Peruvian region, a statistically significant trend in the upwelling favourable (northerly) wind has been accompanied by a corresponding decrease in PWV, not only inland but also over the coastal waters. Such increase is consistent with a reinforced northerly coastal jet in the maritime boundary layer contributing to atmospheric Ekman pumping of dry continental air into the coastal region. Diagnostics of the prevalence of the Iberian thermal low following Hoinka and Castro (2003) also show a positive trend in its frequency during an extended summer period (April to September). These results are consistent with recent studies indicating an upward trend in the frequency of upwelling in SW Iberia (Alves and Miranda 2013), and may be relevant for climate change applications as an increase in coastal upwelling (Miranda et al 2013) may lead to substantial regional impacts in the subtropics.

The same analysis with ERA-Interim reanalysis data, which was used to force the WRF simulations, does not reveal the same signal in PWV, and indeed correlates poorly with the GPS observations, indicating that the data assimilation process makes the water vapour data in reanalysis unusable for climate change purposes. The good correlation between the WRF simulated data and GPS observations allow for a detailed analysis of the processes involved in the evolution of the PWV field.

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