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Wind forcing and nontidal flow in the inlets of the Venice lagoon

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Connection between wind forcing and nontidal flow in the inlets of the Venetian lagoon is studied via Wavelet techniques. One of the problems to solve was the reason of why the 'Bora' wind shows higher correlation with currents even though it is not as aligned to channel axes as 'Scirocco'. Hourly time series of currents from bottom-mounted ADCP located in the three inlets of lagoon, ranging from 12 February 2002 until 29 April 2003, were obtained and detided in order to remove the astronomical forcing. Common-period record of wind was obtained from the platform 'Acqua Alta' of ISMAR-CNR, offshore the Venetian Lagoon. Wind time series were decomposed into their Principal Components (PCA) then wind-stress was computed according to the Large and Pond formulation. As expected, the axis of the largest variance corresponds to direction of Bora wind flowing, hence is labelled as 'Bora'; likewise the orthogonal axis corresponds to 'Scirocco' direction of flowing. Application of Wavelet decomposition to current and wind-stress has shown that energy of currents is mostly concentrated in the range of 4 to 32 hours containing the two principal seiches of the Adriatic Sea, also significant variability at longer time scales was individuated. However similar features were observed in the wavelet power spectra from wind-stress time series thus a bulk computing of linear correlation coefficients was performed to measure the connection between both phenomena. Results show 'Bora' is strongly and positively correlated with Lido currents at long time scales and negatively correlated with Chioggia seeming Bora to act as a forcing. On the other hand, the second component of wind has very low correlations with currents, the highest values occur at 8h to 12h time scale with 0.1 as the maximum, corresponding to Lido inlet. For better understanding of the mechanism of this connection, two Sea Surface Elevation

(SSE) time series from stations inside the lagoon have also been taken into consideration, one located in the northern part of the lagoon (Le Saline) and the second one in Chioggia-Vigo in the southern part. Detided series of SSE were Wavelet decomposed and correlations with winds computed. Some evidence of wind pumping water against southern part of the lagoon has been found since the highest values of correlation are reached between winds and the series of sea-level differences between the two stations. Additional investigation on typical episodes confirms this observation.