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Time-space dependent downscaling of wind stress data for ocean modellings

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The present talk is devoted to a development of a statistical scheme for downscaling the wind stress data to the order to few kilometers in order to perform regional modellings of ocean circulations. A particular attention is paid on the heterogeneity of the wind stress field both in time and space. Thus, a time-space dependent scheme is to be developed.

Our direct motivation stems from our own efforts for the simulations of the circulations of the Mediterranean Sea. The ocean model requires a horizontal resolution of the order of 10 km, whereas a standard atmospheric data only provides a wind field of the order to 100 km. Even with a "zoomed" regional simulation of an atmospheric model (with the smallest grid side of 50 km), the effective resolution still remains the scale above 100 km. Thus a downscaling of an atmospheric data is to be called for.

Although substantial efforts are devoted for linear statistical methods for downscalings, they are expected to be ineffective to the dynamical regime under the disposal due to its high nonlinearities, and possibly a turbulent nature. Thus, a possibility of a scaling-based approach is sought.

In order to evaluate the feasibility of this approach, a 2-year time series of hourly buoy wind measurements over Mediterranean Sea is analyzed by wavelet. The wind time series follows a scaling law (as quantified as an instantaneous power spectra in the wavelet space) typically up to the few-day time-scale with a power exponent tends to represents a two stable values -3/5 and -1. A methodology for implementing this time-space dependent downscaling will be discussed.