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Wave analysis for different time scales contributing to the anomalous long-lasting blocking high over Eastern Europe during summer 2010

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Many studies show that the anomalous long-lasting Russian heat wave in summer 2010, linked to a long-persistent blocking high, appears mainly as a result of natural atmospheric variability.
This investigation analyzes the large scale flow structure based on ERA-Interim data. The anomalous long-lasting blocking over Western Russia including the heat wave occurs as an overlay of a set of anticyclonic contributions on different time scales: (i) A regime change in ENSO towards La Nina modulates the quasi-stationary wave structure in the boreal summer hemisphere supporting the eastern European blocking. The polar Arctic dipole mode is enhanced and shows a projection on the mean blocking high. (ii) Together with the quasi-stationary wave anomaly the transient eddies maintain the long-lasting blocking. (iii) Three different pathways of wave action are identified on the intermediate time scale ($\sim$10-60 days). One pathway commences over the eastern North Pacific and includes the polar Arctic region; another one runs more southward and crossing the North Atlantic, continues to eastern Europe; a third pathway southeast of the blocking high describes the downstream development over South Asia.