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Dynamics governing the collapse of the typical Etesians wind pattern over the eastern Mediterranean during summer 2002

Evangelos Tyrlis (1) and Jos Lelieveld (1,2)

(1) The Cyprus Institute, Energy, Environment and Water Research Center (EEWRC), Nicosia, Cyprus (e.tyrlis@cyi.ac.cy), (2) Max-Planck Institute for Chemistry, Mainz, Germany

The summer circulation over the Eastern Mediterranean (EM) is dominated by large-scale subsidence and a persistent northerly flow (Etesians) featuring a July-August maximum. Both phenomena are key ingredients of the characteristic Mediterranean-type climate and their annual recurrence is controlled by the summer South Asian monsoon. The large-scale signal induced by the monsoon is often enhanced or masked by higher frequency variability originating in the mid-latitudes. Thus, the summer EM circulation variability is a fusion of mid-latitude and direct tropical influences on various timescales. This study attempts to untangle the signal contributions from these two sources during the summer of 2002, an extreme case of collapse of the Etesians and subsidence over the EM especially during July. The daily evolution of the synoptic conditions leading to this collapse is investigated, while the use of daily indices allows the study of the detailed evolution of the intensity of the monsoon and the Etesians, as well as their relation.

This major climatic anomaly coincided with prolonged spells of major failure of the Indian Monsoon. Under normal monsoon activity, frequent Rossby wave 'pulses' are triggered by outbreaks of deep convection over the region. This activity takes the form of sharply-defined warm anomalies associated with stronger than normal subsidence that travel westward and reach the EM within a week. During most of July and early August 2002 this activity is absent or very weak, which is indicative of the possible importance of the monsoon failure for the relaxation of subsidence over the EM. However, the mid-latitude dynamics appear to play a crucial role by controlling the exact timing of the collapse of EM subsidence and the Etesians that potentially enhance the monsoon induced signal. Frequent development of blocking anticyclones over northern Europe that often appear to retrogress towards the Atlantic are the dominant circulation feature during this period. Unseasonably deep cut off lows that are part of the blocking dipole formation develop over the Mediterranean that bring unsettled weather resulting in the southern displacement of the mid-latitude storm track. All the observed spells of convective activity and weakening of the Etesians over the EM coincide with the formation of these cut-off lows. The anomalous southerly flow over the Mediterranean (weak Etesians) lead to the northward moisture transport towards central Europe that contributed to the well-known European floods and it can be seen as an integral component of the observed continental-scale climatic anomaly.