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Environmental implications of different circulation type classification methods

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The most important goal of synoptic climatology is to analyze the relationships between atmospheric circulation and surface environmental conditions; e.g. dust outbreaks, flash floods and air pollution episodes. The basic assumption assumes that the atmosphere can be partitioned to discrete circulation types as manifested by recurring map flow patterns. Since manual (subjective) classification can lead to different environmental implications as compared to automated (objective) classification, a comparison between a subjective and semi-objective classification was performed for the Eastern Mediterranean for 10 years (1995-2004). Among the 19 recurring synoptic types characterizing the circulation regime over the E.M., the overall frequencies of the 3 most common synoptic types – Red Sea Trough with eastern axis, Shallow Persian Trough and High to the West were similar for both classifications. The discrepancies on a day to day basis for these 3 types were 60, 53 and 69% respectively. However, for deep horizontal pressure gradient synoptic types, i.e. Deep Cyprus Low to the North and Cold Low to the West both classifications yielded the highest agreement (over 50%).
Classification results of synoptic types having important environmental implications in the E.M., i.e. Red Sea Trough with Western Axis, Deep Persian Trough and Sharav Low to the West differed substantially (over 90% disagreement) for both methodologies. The first type is associated with torrential rain inducing flash floods, the second is responsible for long range transport of pollutants and the last is prone for dust outbreaks. In order to show the influence of atmospheric circulation on the smaller scale surface environment two fundamental approaches were used: the “circulation-to-environment” and “environment-to-circulation”. These approaches were tested on three surface environment processes: air pollutants, desert dust intrusions and floods.
Preliminary methods were examined to provide insights on the suitability of the classification methods to better reflect surface environmental phenomena. Results obtained by both classification methods suggest a slight increase in the frequency of synoptic types associated with hot summer spells.