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Background and Objective: Particulates can cause respiratory problems or can trigger cardio-vascular diseases. Some European cities, besides local PM, may also suffer from additional impact of remote sources of particles, which is independent from the local emissions. For these settlements, it is important to identify source regions of the transported particulates and to quantify their contribution to the local urban PM10 levels. The aim of the study is to identify long-range transport patterns that may have an important influence on PM10 levels in four European cities of different latitude, namely Thessaloniki, Szeged, Helsinki and Oulu.
Methods: Trajectory positions are computed using the HYSPLIT model. 4-day, 6-hourly 3D backward trajectory positions at the above locations at 1200 GMT are produced on each day during the 5-year period 2001-2005. Non-hierarchical cluster analysis with k-means method is applied using a Mahalanobis distance.
Results: 2D clustering procedure proved to be more efficient for each city than 3D cluster analysis. The analysis of variance, performed on the basis of the mean PM10 values, detected significant difference in the mean PM10 levels among clusters retained for each of the cities. Results of the cluster analysis assume that for Thessaloniki, Szeged and Helsinki, clusters of the trajectory positions originating from North Africa and/or Sahara are strongly associated with the highest PM10 episodes, though with different frequency; while for Oulu, the farthermost source regions are the Mediterranean, the Near East and Kazakhstan.
Conclusions: The study represented that the application of the HYSPLIT model together with different statistical techniques on pollutant data might be a useful tool to detect long-range transport patterns influencing air quality in given European cities. In order to clarify a more detailed relationship of the clusters to local PM10 exceedances, meteorological variables at the trajectory positions should also be taken into account.