



## Aspects of cold intrusions over Greece during autumn

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This study is focused on the description of atmospheric disturbances that caused intense cold intrusions over Greece during autumn for a period of 25 years (1982-2006). The study was based on data analysis from the meteorological station network of the Hellenic National Meteorological Service (HNMS) and the European Centre for Medium Range Weather Forecasts (ECMWF). Initially, the days with temperature at the isobaric surface of 850 hPa less or equal to the mean temperature for the 10-day period the day under investigation belongs to are isolated, composing a new confined data set which was further used. An event of intense cold intrusion is identified based on a subjective set of criteria, considering the temperature decrease at the level of 850 hPa and its duration. In particular, the criteria that were used to identify a cold intrusion were: temperature variation between two successive days at the isobaric level of 850 hPa being equal or greater than  $5^{\circ}\text{C}$  at least once during the event and duration of the event of at least two successive days with continuous temperature decrease. Additionally, the synoptic analysis of the atmospheric disturbances involved using weather charts from ECMWF, revealed that all cases were related to low pressure systems at the level of 500 hPa, accompanied by cold air masses. Moreover, a methodology proposed to classify the cold intrusions based on general circulation characteristics of the atmosphere, resulted in seven major categories. More than half of the events belong in two categories, originated northwest of the greater Greek area (Greece and parts of neighbouring countries), between  $40^{\circ}$  and  $60^{\circ}$  N. Further analysis indicated that the frequency of events increases from September to November and the majority of the events lasted two to three days. Additionally, the non-parametric Mann-Kendall test was used for the investigation of the statistical significance of the trends appearing in the results. The tests revealed that over the 25 years, the slight trends identified, decreasing in the number of cold intrusions and increasing in the maximum temperature decrease at the level of 850 hPa were statistically insignificant. Finally, special attention is given to an exceptional event of cold intrusion which followed an extreme high temperature period for the season, in the beginning of October 1991. For this particular case, the underlying physical generation mechanism is studied thoroughly by analysing synoptic maps from ECMWF (0000 UTC and 1200 UTC) at the levels of 500 hPa, 850 hPa and MSL for the period 1/10/1991-6/10/1991. Additionally, the evolution of the cold intrusion as it passes over the country is examined in detail in conjunction with the observed physical phenomena such as gale force winds, moderate snowfall, heavy rainfall and thunderstorms.