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Synoptic analysis of frost days in Zanjan Province of Iran

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Abstract
As a general rule it is accepted that every change in the environment is controlled by the changes in the pressure patterns or varying synoptic systems. We are witnessing intensive floods, damaging cold waves, or highly polluted air every year, all of which are related to some extent to the pressure patterns such as intensive cyclones or subsiding anticyclones. The frost days are one of these environmental conditions that are caused by these pressure patterns especially in the case of synoptic frosts. The Zanjan province of Iran with mountainous nature and higher elevations is one of the frost prone regions in the country. Most of the years this region suffers from intensive and damaging frosts such as the one occurred in December 2006 and January 2007. In order to advise planners and users, and lower the damages of such frosts, this study tried to analyze the synoptic origin of the December 2006 frost. To achieve the objective of the study the frost days of the province during months December 2006 and January 2007 were selected. During these months all of the four stations of the Province (Zanjan, Khorramdarreh, Khodabandeh, and Mahneshan) had experienced sub-zero temperatures. The daily zero GMT surface and 500 hPa. maps of the region were extracted from the National Center of Environmental Protection (NCEP) site for the selected days. The pressure patterns of both levels were analyzed and assigned into different groups.
The results showed that the main synoptic patterns responsible for the frosts of the region are the Caspian trough, Siberian high pressure, moving western anticyclones, upper level blockings, and cut off lows. When the Caspian Sea trough deepens it brings the westerly anticyclones to the area. Under its eastward displacement, the Siberian High develops and sends its ridges towards the study region. Some times the upper level blocking of the Siberian area brings the cold air masses to the study region. In general, the development and displacement of both Mediterranean and Caspian troughs control the cold air masses invasion to the Zanjan Province. Therefore it is highly recommended that the users and planners should watch the behavior of these troughs carefully and prepare themselves in advance.
Key words: frost days, widespread frosts of Zanjan Province, synoptic analysis of frost days, hazards, environmental hazards.