



## **Analysis and Review of Heavy Snow Synoptic Conditions in North West of Iran by Using PCA and Clustering**

Karim Amininia<sup>1,\*</sup>, Hasan Lashkari<sup>2</sup>, Bohlol Alijani<sup>3</sup>, Ali M. Khorshiddoust<sup>4</sup>

<sup>1</sup>Science & Research Branch, Islamic Azad University, <sup>2</sup>Group of Earth Science, University of Shahid Beheshti; <sup>3</sup>Group of Geography, University of Tarbiat Moallem; <sup>4</sup>Group of geography, University of Tabriz

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**Abstract:** A heavy snowfall in mountainous areas plays a key role in creating superficial currents and feeding underground waters on one hand, and causes severe problems like disturbance in road and city traffic, avalanche and destroys rural residences on the other hand. Specific atmospheric conditions are required for such snowfalls to occur. Such circumstances happen in mountainous region of north-western of Iran with semi-arid climate mainly between November and March. According to the days with intensity of at least 15 cm of snowfall in 24 h, this study utilizes principal component analysis (PCA) and clustering techniques to describe the synoptic circulation pattern for 66 cases during the cold season. The area under study includes 25-55 ° N and 15-65° E and the period of study covers cold seasons from 1976 to 2008. The utilized methodology involves spatial standardization of the data used for PCA, an alternative approximation to decide the centroids and the number of groups for the *K*-mean, and the rejection of the iterations for this algorithm. This approach makes synoptically classification of days with heavy snowfalls possible and composite maps were drawn for sea-level pressure, 500 hPa geopotential high and 1000-500 thickness. Composite maps of six identified groups in sea level pressure indicate the influence of southern moist flows due to the activity of low pressure system over Iraq. Most of these groups are mixed with eastern or north-eastern cold air flow and functions as the leading factor of these snowfalls. The findings can be used to forecast heavy snowfalls, and to assist better and more exact regional prospects.

**Keywords:** *heavy snowfall days; sea level pressure; principal component analysis; clustering; North West of Iran*

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\* Corresponding: E-Mail: [araz183@yahoo.com](mailto:araz183@yahoo.com); Tel: +984262234694; Fax: +984262229632