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**Thermodynamic Analysis of Heavy Precipitation resulted from Cut off Low in  
Central and South-West Regions of Iran  
(Case Study:Havy rain of 1th December 2008)**

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## Introduction

Occurrence of heavy and rainstorm events is among the characteristics of arid and semi-arid regions all over the world and particularly in Iran which is causing large floods and debris town. How ever, they can be used to supply and store water by controlling and exploiting the run off water floods. Indexes of atmospheric instability are very useful scientific instruments to understand the nature and predict atmospheric hazards of these kinds of precipitations. In this study, one of the heaviest precipitations of south-west and central regions of Iran (1 December 2008) is been for analysing of the studied within the periods at (2008 to2011) effective mechanisms on the occurrence of such precipitations. The main objective of this study is the thermodynamic analysis of the heavy rains in south west religion of Iran .

## Study Area

The study area is located in Central and South- West regions of Iran, including Kerman, Yazd, Fars, Bushehr, Chahar Mahal and Bakhtiari as well as Kohkiluieh and Boyer Ahmad provinces. These areas are affected by climatic systems originated from sudan and red sea areas.

## Material and Methods

The climatic and topographic conditions of the study area were evaluated first. In order to have a fairly complete coverage of Spatial distribution of precipitation over the study area and more detail information, the properties of most synoptic and rain gauge stations were provided. Given that the reason for the heavy rain on December 1<sup>st</sup>, 2008 was the presence of a low cut off system, heavy precipitation caused by this phenomenon were detected within the last 4 years and the statistics of precipitation rate of the selected dates were obtained from Iran's meteorological organisation website. the amount of precipitation on December 15/2008, Recorded as the highest amount during the years, there are it has been chosen as a case study for this paper chosen as a case study. In addition, to achieve to a clear vision of the structure of precipitation, the pressure maps of 500 Hpa level and sea level were drawn for the day of precipitation in GPADS soft were. Thermodynamic diagrams known as Skew-T were obtained from the website of the University of Wyoming for the selected date. for analysing the amount

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of instability, 8 indexes of instability (SI, KI, TTI, LI, CAPE, PW, SOI, SWEAT) were used from Shiraz and Ahvaz stations in the study area. Also to show the amount of vorticity, its relative vorticity map was drawn. In addition, specific humidity map and Holf - Moller diagrams were drawn to illustrate the vertical profiles of horizontal advection of specific humidity.

## Results and Discussion

The results carried out using 8 thermodynamic indexes including Skew-T diagram, specific humidity maps, Holf- Moller diagram, relative vorticity map, sea level maps and 500 hPa level indicate that the heavy precipitations somehow depend on the occurrence of vertical convection motions lower than 500 hPa. The results further demonstrated that there has been a quite strong positive floating power in the process of this dominant precipitation. The cause of this strong instability may be falling of cold air from the high latitude and formation a deep trough, separating the main system and turning into a cut - off low. This process has been increased the temperature of air mass than the surrounding environment and causes to up to 500 hPa level. Regarding the considerable rate of humidity and 24.1 and 19.54 mm of precipitable water in the atmosphere of region, the grounds for the condensation and humidity discharge were provided. The investigating relative vorticity of 500 hPa level concerning the studied precipitation shows that the maximum of this quantity during the precipitation has been on the south-west parts of Iran. Furthermore, combining the flows of wind with specific maximum of humidity cores over Sudan and the south of Red Sea has provided the required humidity for the occurrence of such precipitations which have been drawn to the south and southwestern regions of Iran through anticyclone formation over the Saudi Arabia peninsula.

## Conclusion

The results obtained from the instability indexes show that the instability rate has been a considerable factor for the heavy precipitations. The cause of this strong instability can be attributed to the downfall of cold air in lower latitudes, creating a deep trough separated from the main system and turning into a cut - off low. the specific humidity indicates a high humidity amounts during the days with heavy precipitations, map are which is injected on the south west and central areas of Iran through anticyclones located over the Saudi Arabia, Red Sea, Arabian Sea and the Gulf of Adan. The significant amount of relative vorticity is indicated the adjustment of the trough axis with, Its locating in the southern parts of Saudi Arabia and Persian gulf.

**Key Words:** Thermodynamic Analysis, Cut off Low, Heavy Precipitation, South- West and Central Iran.

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