

Investigation of a Nocturnal Cold-Air Pool in a Semiclosed Basin Located in the Atacama Desert

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Abstract

In desert environments, intense radiative cooling of the surface during the night leads to rapid cooling of the adjacent air, resulting in a strong temperature inversion conducive to cold-air-pool formation. In this work observations are analyzed to investigate the structure of a nocturnal cold-air pool inside a semiclosed basin located near Sierra Gorda in the Atacama Desert in Chile and its effect on dust dispersion in the area. The measurement campaign was conducted over a 5-day period (14-19 August) in 2017 and included ceilometer data, vertical profiles of temperature, a grid of fixed ground stations, and mobile temperature sensors. We focus our attention on the conditions during periods of high levels of dust pollution, in order to understand the atmospheric conditions that contribute to these episodes. The analysis of the available data confirms the development of an intense nocturnal cold-air pool, which is reflected in a strong nocturnal potential temperature inversion (18 K in 150m) and a 30 degrees C diurnal temperature range. A comparison of the vertical distribution of dust and temperature shows that the capping inversion controls the location of the dust cloud. As a consequence, the highest dust concentrations were observed inside the cold pool, below the capping inversion, proving that within the basin the dust is confined to the layer where its source is located.

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