Terrain-Trapped Airflows and Orographic Rainfall along the Coast of Northern California. Part II: Horizontal and Vertical Structures Observed by a Scanning Doppler Radar

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Abstract

This study documents the mean properties and variability of kinematic and precipitation structures associated with orographic precipitation along the coast of Northern California in the context of terrain-trapped airflows (TTAs). TTAs are defined as relatively narrow air masses that consistently flow in close proximity and approximately parallel to an orographic barrier. Seven land-falling winter storms are examined with observations from a scanning X-band Doppler radar deployed on the coast at Fort Ross, California. Additional information is provided by a 915-MHz wind-profiling radar, surface meteorology, a GPS receiver, and balloon soundings. The composite kinematic structure during TTA conditions exhibits a significant horizontal gradient of wind direction from the coast to approximately 50 km offshore and a low-level jet (LLJ) that surmounts a weaker airflow offshore corresponding to the TTA, with a zone of enhanced precipitation evident between 5 and 25 km offshore and oriented nearly parallel to the coastline. Conversely, the composite kinematic structure during NO-TTA conditions exhibits a smaller offshore horizontal gradient of wind direction and precipitation structures are generally enhanced within km of the coastline. Interstorm variability analysis reveals significant variations in kinematic structures during both TTA and NO-TTA conditions, whereas significant variations in precipitation structures are only evident during TTA conditions. The interstorm analysis also illustrates more clearly how LLJ vertical structures evident during NO-TTA conditions exhibit ascent along the coast and over the coastal mountains, which is in contrast to TTA conditions where the ascent occurs offshore and over the TTA.

Palabras clave

Palabras clave de autor: Channel flows; Orographic effects; Precipitation; Coastal meteorology; Kinematics; Radars; Radar observations
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