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Summertime wind climate in Yerevan: valley wind systems

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Abstract

1992–2014 wind climatology analysis in Yerevan is presented with particular focus given to the summertime thermally induced valley wind systems. Persistence high winds are observed in Yerevan during July–August months when the study region is strongly affected by a heat-driven plain–plateau circulation. The local valley winds arrive in Yerevan in the evening hours, generally, from 1500 to 1800 UTC, leading to rapid enhancement of wind speeds and dramatic changes in wind direction. Valley-winds significantly impact the local climate of Yerevan, which is a densely populated city. These winds moderate evening temperatures after hot and dry weather conditions observed during summertime afternoons. On the other hand, valley winds result in significantly higher nocturnal temperatures and more frequent occurrence of warm nights (tn90p) in Yerevan due to stronger turbulent mixing of boundary layer preventing strong surface cooling and temperature drop in nighttime and morning hours. The applied WRF-ARW limited area model is able to simulate the key features of the observed spatial pattern of surface winds in Armenia associated with significant terrain channeling, wind curls, etc. By contrast, ECMWF EPS global model fails to capture mesoscale and local wind systems over Armenia. However, the results of statistical verification of surface winds in Yerevan showed that substantial biases are present in WRF 18-h wind forecasts, as well as, the temporal variability of observed surface winds is not reproduced adequately in WRF-ARW model.

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