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Non-rainy cloud cover dynamics and their influence on temperature variability in Chefchaouen, Western Rif, Morocco

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ABSTRACT: Non-precipitating cloud cover plays a significant role in modulating surface temperature by altering solar radiation and longwave heat retention. However, its thermal impacts remain underexplored in Mediterranean mountainous regions. This study investigates the influence of non-precipitating cloud cover on daily and seasonal temperature variability in Chefchaouen, Western Rif, Morocco, over a six-year period (2015–2020). The research classifies non-precipitating cloudy weather into three categories: (1) stable atmospheric conditions, (2) unstable atmospheric conditions, and (3) conditions at the periphery of frontal systems. High-resolution meteorological data, MODIS and NOAA satellite imagery, and synoptic weather maps were employed to analyze cloud-atmosphere interactions. Results reveal that stable cloud cover reduces the diurnal temperature range (DTR) by mitigating daytime heating and enhancing nocturnal warming. In contrast, unstable clouds increase thermal variability due to dynamic atmospheric processes. Seasonal effects were most pronounced in summer and winter, with notable moderation of temperature extremes. The findings highlight the role of synoptic-scale atmospheric structures, including sea-level pressure systems and 500 hPa geopotential height configurations, in shaping temperature variability under non-precipitating cloudy conditions. This study provides critical insights into Mediterranean climate dynamics and emphasizes the importance of integrating cloud-related processes into regional climate models to enhance temperature forecasting accuracy.

KEYWORDS: non-precipitating cloud cover, temperature variability, mediterranean climate, Chefchaouen, synoptic circulation patterns

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