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Large Precipitation Gradients along the South Coast of Alaska Revealed by Spaceborne Radars

Shunsuke Aoki and Shoichi Shige
Kyoto University, Graduate School of Science, Division of Earth and Planetary Sciences, Japan (aoki.shunsuke@kugi.kyoto-u.ac.jp)

This study focuses on the considerable spatial variability of precipitation along the western coast of a continent at mid–high latitude and investigates the precipitation climatology and mechanism along the south coast of Alaska, using datasets of spaceborne radars onboard two satellites, namely, the Dual-frequency Precipitation Radar (DPR) KuPR onboard the Global Precipitation Measurement (GPM) core satellite and the Cloud Profiling Radar (CPR) onboard CloudSat. At higher latitudes, differentiating the phase of precipitation particles falling on the ground is crucial in evaluating precipitation. Classification of satellite precipitation products according to the distance from the coastline shows that precipitation characteristics differ greatly on opposite sides of the coastline. Above coastal waters, relatively heavy precipitation with CPR reflectivity larger than 7 dBZ from orographically enhanced nimbostratus clouds, which can be detected by KuPR, is frequently captured. Meanwhile, along coastal mountains, light-to-moderate snowfall events with CPR reflectivity lower than 11 dBZ, which are well detected by the CPR but rarely detected by KuPR, frequently occur, and they are mainly brought by nimbostratus clouds advected from the coast and orographically enhanced shallow cumuliform clouds. There is no clear diurnal variation of precipitation except in summer, and the amplitude of the variation during summer is still low compared with total precipitation especially over the ocean, suggesting that the transport of synoptic-scale water vapor brings much precipitation throughout the year. Case studies and seasonal analysis indicate that frontal systems and moisture flows associated with extratropical cyclones that arrive from the Gulf of Alaska are blocked by terrain and stagnate along the coast to yield long-lasting precipitation along the coastline. The results of this study illustrate the importance of using complementary information provided by these radars to evaluate the precipitation climatology in a region in which both rainfall and snowfall occur.