EGU2020-18578, updated on 28 Jan 2022
https://doi.org/10.5194/egusphere-egu2020-18578
EGU General Assembly 2020

High-resolution polarimetric radar network for improving urban resilience to natural disasters in a complex environment

Chandrasekar V. Chandra[1], Haonan Chen[1,2], and Rob Cifelli[2]
[1]Colorado State University, Fort Collins, United States of America
[2]NOAA Earth System Research Laboratory (haonan.chen@noaa.gov)

The operational Weather Surveillance Radar - 1988 Doppler (WSR-88D) network is an efficient tool for observing hydrometeorology processes and it forms the cornerstone of national weather forecast and warning systems. However, the observation performance of the WSR-88D network is severely hampered over the western U.S., due to 1) the radar network density is not as high as that over the eastern U.S.; 2) WSR-88D radar beams are often partially or fully blocked by the mountainous terrain in the western U.S.

For example, the San Francisco Bay Area in Northern California, which supports one of the most prosperous economies in the U.S., is expected to be covered by two WSR-88D radars: KMUX and KDAX. The KMUX radar is located in the Santa Cruz Mountains at an elevation of over 1000 m above mean sea level (AMSL) compared with the densely populated valley regions which are near the sea level. Typically, the storms in Northern California have freezing levels approximately 1–2 km AMSL. As the distance from the radar increases, the KMUX radar beam can easily overshoot the mixed-phase hydrometeors in the bright band or snowflakes above the bright band, even if it is raining at the ground. The KDAX radar is located near the sea level in Davis, California. However, the KDAX radar beams are partially blocked by the Coast Ranges at low elevation angles. The coverage limitations of the KMUX and KDAX radars are further compounded by the complex precipitation microphysics as a result of land-ocean interaction in the coastal regions and orographic enhancement in the mountainous regions. As a result, it is still challenging to monitor and predict the changing atmospheric conditions using operational radars in the Bay Area, which will make the Bay Area particularly susceptible to catastrophic flooding that disrupts transportation, threatens public safety, and negatively impacts water quality.

In this paper, we present an Advanced Quantitative Precipitation Information (AQPI) system built by NOAA and collaborating partners to improve monitoring and forecasting of precipitation and coastal flooding in the Bay Area. The high-frequency (i.e., C and X band) high-resolution gap-filling radars deployed as part of the AQPI program are detailed. A radar-based rainfall system is designed to improve real-time precipitation estimation over the Bay Area. The sensitivity of rainfall products on the occurrence of hydrologic extremes is investigated through a distributed hydrological model to improve the streamflow forecast. The performance of rainfall and associated hydrological impacts during the 2018-2019 and 2019-2020 winter storm seasons is

quantified in the context of improving urban resiliency to natural disasters in such a complex environment.