Updates to SHSR

A major change was implemented in this module, which is an upgrade from the single-pol Vertical Profile of Reflectivity (VPR) correction to a new dual-pol VPR correction. The single-pol VPR scheme delineates bright band area (BBA) based on reflectivity and the model sounding at the radar site and assumes a horizontally uniform melting layer and an isotropic BB structure in the radar PPI. The assumption limited the accuracy of the single-pol VPR correction especially in frontal and orographic rain. The dual-pol VPR scheme delineates the BBA based on reflectivity, correlation coefficient and 2-D model freezing level heights and accounts for the spatial variations of the melting layer, which provides more precise BBA delineation and more accurate and consistent VPR correction, especially in areas where radar beam overshoot the melting layer. As a result, the radar QPE overestimation bias near the radar for low melting layer events were mitigated and underestimation at far ranges was significantly reduced (Fig 8). Furthermore, the uncertainties in the radar QPE were decreased.

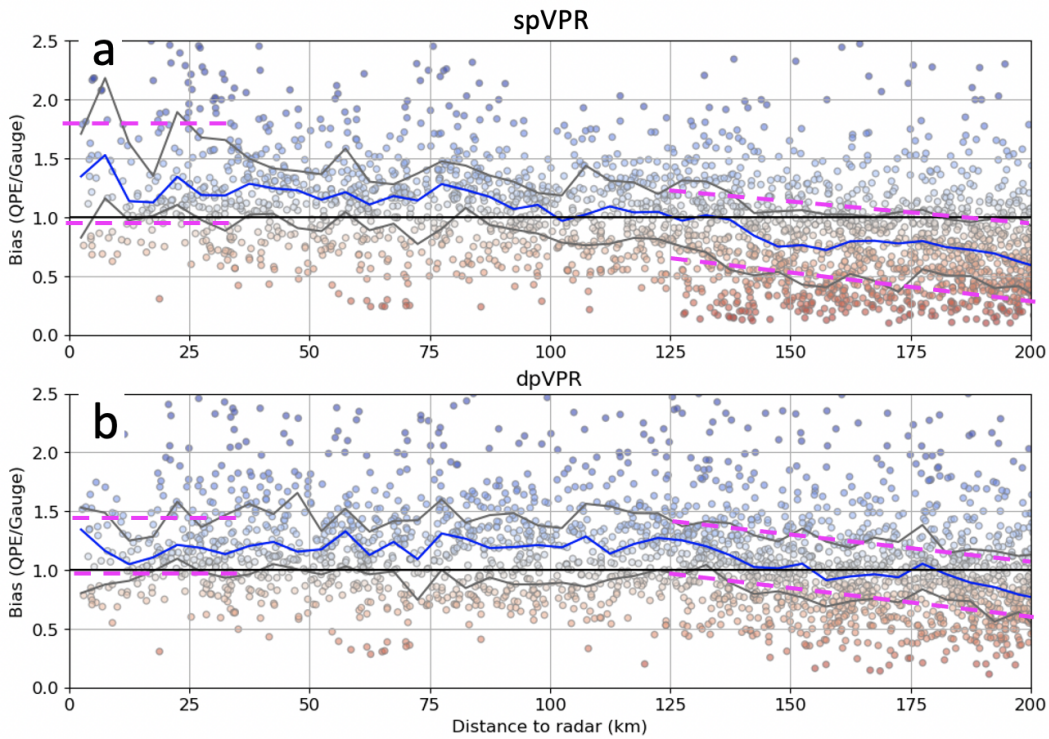

Fig 8. Mean bias ratio of radar QPE over gauge with (a) single-pol VPR and (b) dual-pol VPR as a function of range. Blue (gray) lines represent the median (inter quartile range) for each 5 km range interval. The dual-pol VPR correction reduces over- (under-)estimation biases near (far away from) the radar and also reduces the uncertainties in the radar QPE.

References:

Hanft et al. 2022: Dual-pol VPR corrections for improved operational radar QPE in MRMS. In preparation for submission to the J. Hydromet.

Updates to SHSR Mosaic

Changes were made to the mosaic_shsr module to mitigate polygon-shaped artifacts at mid-point between neighboring radars. The discontinuity was due to 1) the different sensitivities of 88D radar at different VCPs, 2) different sensitivities between 88D and Canadian radars and 3) different radar beam propagation paths/heights among neighboring radars. When there is no rain at the surface, the reflectivity from the higher sensitivity radar of the neighboring radar pair would be removed right across the midpoint into the other radar's domain and thus result in a hard polygon boundary. To mitigate this effect, a "virga" probability was calculated near the midpoint between neighboring radars based on RQI and the hybrid scan reflectivity intensities. Virga echoes are then depleted gradually across the midpoint based on the virga probability rather than being removed abruptly once across the midpoint. The polygon artifacts were largely mitigated in the new SHSR fields (Figure 15).

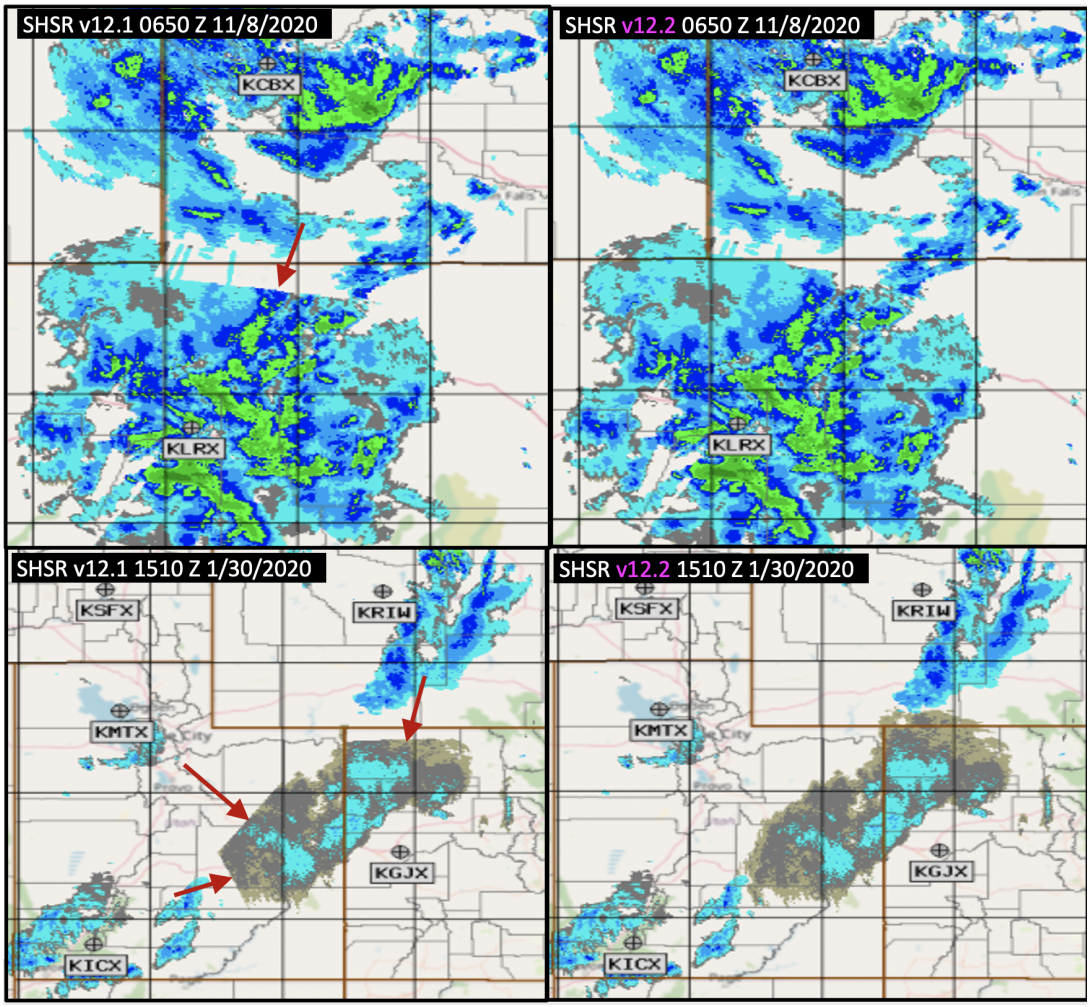

Fig 15. Seamless HSR mosaic fields from v12.1 (left column) and v12.2 (right column) valid at 0650 UTC 8 Nov. 2020 (top row) and 1510 UTC 30 Jan 2020 (bottom row). The red arrows indicate areas of polygon artifacts.