Antarctic Data Impact Experiments with Polar WRF During the YOPP-SH Summer Special Observing Period

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Data impact experiments are conducted employing the Polar WRF model during the YOPP-SH summer special observing period (SOP) using the Antarctic Mesoscale Prediction System (AMPS) framework to determine the forecast impact of numerous additional radiosondes collected during the SOP. Hybrid variational-ensemble three-dimensional data assimilation is performed on model forecast domains over Antarctica and the Southern Ocean using all regular observations normally available (Experiment "NoSOP") and using the same set plus the extra soundings launched for the SOP (Experiment "SOP"). The SOP results show better near-surface temperature and wind speed forecasts than the NoSOP results, primarily over West Antarctica. Radiosonde profiles confirm that temperature and wind speed forecasts are improved throughout the troposphere with the addition of the SOP radiosonde data, but the results for relative humidity are variable. Temperatures are improved at lower levels early in the forecasts, whereas wind speeds are better at higher levels later in the forecasts. An evaluation against the ERA5 global reanalysis that provides a much broader perspective reveals that the improved forecast skill for the SOP experiment persists to 72 hours for temperature, wind speed, and relative humidity. The gains, however, are primarily confined to the Antarctic continent, consistent with the additional radiosonde spatial coverage being mainly poleward of 60ºS. With extra radiosondes concentrated over the Antarctic Peninsula, SOP forecasts of the region downstream of the Peninsula were significantly improved compared to NoSOP forecasts. The results also suggest that increasing radiosonde launches at lower southern latitudes would improve forecasts over the Southern Ocean.