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Potential Impacts of Stratospheric Observations on Weather Forecasts

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This study examines the potential impact of novel stratospheric measurements on tropospheric weather forecasts. We focus on the upper stratosphere, where routine measurements of temperature and winds are sparse, and where there is potential to expand the current observing system using measurements from the ARISE (Atmospheric Dynamics Research Infrastructure in Europe) network. We consider 30 day forecasts initiated just before Sudden Stratospheric Warmings (SSWs). Previous studies have shown a small but significant impact on tropospheric forecast skill, for NWP forecasts after 5 days, when stratospheric initial conditions are severely degraded, and a similar increase in forecast skill when the stratospheric state is damped towards observed conditions. Using a version of the second technique we are able to reproduce previous results, which show around a 5% increase in tropospheric forecast skill when the stratosphere is damped towards its observed state. We then use the same technique to compare the quantitative impact of damping the stratospheric state towards observations in the lower and upper stratosphere (with a boundary at 40km), and for observations in the European sector only.