An Examination of Spatial and Temporal Variability Statistics from FORMOSAT-3/COSMIC and Rayleigh Lidar Observations

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This paper details an initial study which utilises COSMIC satellite observations to examine the spatial and temporal variability of temperature observations in the stratosphere at a number of scales. This study also uses Rayleigh measurements from a ground-based Fe Boltzmann temperature lidar, which was located at Rothera station in the Antarctic, to examine temporal variability and compares and contrasts the results from these two instruments. In particular, we examine whether changes to instruments impact the correlation time measured.

This work focuses on short-term temporal scales (less than a day) and small-scale horizontal spatial separations (less than 1000 km). For the COSMIC observations this requires identifying the spatial separation and the time difference between pairs of profiles measured by all six of the COSMIC satellites and then using that information to select paired observations that are within some coincidence criteria in space and time. The fundamental aim of this work is to gain an understanding of how long and over what range a measurement made in the stratosphere remains 'representative'. However, the scales of spatial and temporal variability examined are such that the dominant variability is likely to be associated with internal gravity waves Thus, this study also provides information on the characteristics of these waves (particularly intermittency) and their impact on comparing temperature measurements from distinct instruments.