Problems in the MLT Region of the Atmosphere Which Need a new Approach

David. E. Siskind, Space Science Division, Naval Research Laboratory, 4555 Overlook Ave SW, Washington DC, 20375, siskind@nrl.navy.mil

Introduction: The mesosphere-lower thermosphere (MLT) region of the atmosphere (80-120 km) is important as the boundary between the terrestrial environment and the ionospheric/space weather regime. It is the region where gravity waves break, where meteors ablate and where the atmosphere changes from well mixed to a heterogeneous composition. It also represents the base of the ionosphere. Despite its importance, it remains relatively unexplored both due to the difficulties in accessing this region for in-situ observations and in interpreting remote sensing data.

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Discussion: Several key observables have resisted our attempts at quantification. Here I summarize some of these problems with an emphasis on how reliable, in-situ access to the MLT region might solve them. Specific examples include the problem of imaging the products of meteoric dust ablation, measuring the carbon dioxide abundance and measuring the wind shears which seem to be relevant for the surprisingly rapid, world-wide transport of space shuttle plumes. With the advent of global meteorological models of the entire atmosphere, from the surface to the thermosphere and ionosphere, the need for reliable MLT data to feed assimilation systems is likely to increase in coming years. An example from a current prototype system, NOGAPS-ALPHA (Navy Operational Global Atmospheric Prediction System- Advanced Level Physics High Altitude) is shown in Figure 1[1].

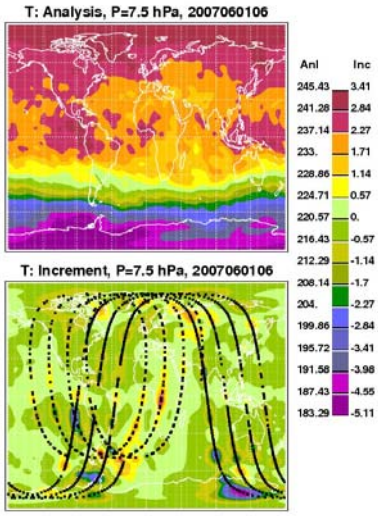

Figure 1: Sample of a temperature field from a middle atmosphere data analysis system. The top panel is an analysis field for 7.5 hPa (about 35 km). The bottom panel shows the temperature increments caused by the injection of temperature data from the AURA/MLS instrument (orbit is the solid black curve which goes pole-to-pole) and the TIMED/SABER instrument (dashed black curves which go from 50S to 80N).

The data requirements for future versions of these analysis/forecast systems will be discussed along with suggestions for meeting these anticipated needs.

References:

[1] Eckermann, S. D et al., (2009) *J. Atm. Solar Terr Res, 71,* 531-551.