The OMPS Limb Profiler instrument

Two-Dimensional retrieval algorithm

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The upcoming Ozone Mapper and Profiler Suite (OMPS), which will be launched on the NPOESS Preparatory Project (NPP) platform in early 2011, will continue monitoring the global distribution of the Earth's middle atmosphere ozone and aerosol. OMPS is composed of three instruments, namely the Total Column Mapper (heritage: TOMS, OMI), the Nadir Profiler (heritage: SBUV) and the Limb Profiler (heritage: SOLSE/LORE, OSIRIS, SCIAMACHY, SAGE III). The ultimate goal of the mission is to better understand and quantify the rate of stratospheric ozone recovery.
The focus of the paper will be on the Limb Profiler (LP) instrument. The LP instrument will measure the Earth's limb radiance (which is due to the scattering of solar photons by air molecules, aerosol and Earth surface) in the ultra-violet (UV), visible and near infrared, from 285 to 1000 nm. The LP simultaneously images the whole vertical extent of the Earth's limb through three vertical slits, each covering a vertical tangent height range of 100 km and each horizontally spaced by 250 km in the cross-track direction. Measurements are made every 19 seconds along the orbit track, which corresponds to a distance of about 150km.

Several data analysis tools are presently being constructed and tested to retrieve ozone and aerosol vertical distribution from limb radiance measurements. The primary NASA algorithm is based on earlier algorithms developed for the SOLSE/LORE and SAGE III limb scatter missions. All the existing retrieval algorithms rely on a spherical symmetry assumption for the atmosphere structure. While this assumption is reasonable in most of the stratosphere, it is no longer valid in regions of prime scientific interest, such as polar vortex and UTLS regions. The paper will describe a two-dimensional retrieval algorithm whereby the ozone distribution is simultaneously retrieved vertically and horizontally for a whole orbit. The retrieval code relies on (1) a forward 2D Radiative Transfer code (to model limb radiances within a non-uniform atmosphere and evaluate 2D analytical partial derivatives) and (2) an optimal estimator inversion routine. The algorithm uses the typically sparse nature of the kernel matrices as well as fast matrix inversion techniques to allow for fast inversion of limb data with efficient memory management (as was done for MIPAS data processing). While the method has so far only been developed in the context of Single Scatter, the paper will show how the CPU intensive Multiple Scatter modeling can be implemented using parallel CPU processing. Initial results will be presented in terms of retrieved ozone profiles and code performance.