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The Microwave Limb Sounder is one of four instruments on NASA's AURA satellite, which was launched on 15 July 2004 into a near-polar 705 km sun-synchronous orbit. It makes passive measurements of thermal radiation from the Earth's limb in  $\sim 1000$  channels in five microwave bands, from 118 GHz to 2.5 THz, scanning from the ground to 90km altitude at the limb every 25 seconds. From  $> 500$  million measurements, it produces  $\sim 5$  million estimates of atmospheric composition, temperature, humidity, and cloud ice at 70 pressure levels on  $\sim 3500$  orbit-track profiles per day. Geophysical parameters are estimated from microwave spectra by inverting the radiative transfer equation using a classical Gauss-Newton iteration. The Newton move is calculated by solving a least-squares problem in which the Jacobian matrix is augmented with apriori information, Tikhonov regularization, and Levenberg-Marquardt stabilization. Processing is carried out using a 48-node cluster, each node having two quad-core 3 GHz Intel Nehalem processors and 16 GB memory. Parallelization consists of assigning  $\sim 20$  scans of the antenna to each core, which then spend a few minutes communicating with a master before and after computing in isolation for  $\sim 15$  hours. (Received September 01, 2010)