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Temperature and pressure profiles retrieved from the ACE-MAESTRO space instrument

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The MAESTRO (Measurement of Aerosol Extinction in the Stratosphere and Troposphere Retrieved by Occultation) space instrument was successfully launched on Canada's SCISAT satellite in August 2003, along with a Fourier Transform Spectrometer (the ACE-FTS), as part of the Atmospheric Chemistry Experiment (ACE) payload. MAESTRO is a UV-Visible-NIR dual grating spectrometer taking solar occultation and nadir backscatter spectra of the atmosphere to investigate the dynamical and chemical processes affecting stratospheric ozone distribution. On-orbit solar occultation measurements of temperature and pressure vertical profiles are desirable for accurate retrievals of aerosols and trace gas species from the instrument, as well as for incorporation into dynamical models of the atmosphere. Atmospheric density, pressure, and temperature can be determined by measuring the number density of a well-mixed gas with a known mixing ratio. Molecular oxygen is used for MAESTRO pressure and temperature retrievals as it is vertically well-mixed in the atmosphere and radiatively active in the instrument's spectral measurement range, with three strong absorption bands in the visible (γ-band) and near-infrared (A- and B-bands). While the O_2 A-band is the strongest feature in this spectral region and traditionally better studied than the other bands, these retrievals also exploit the weaker B-band, which has less saturation and hence a more linear absorption, for pressure and temperature retrievals at low altitudes. This paper discusses the challenges of correctly forward modelling the O_2 bands for the low spectral resolution MAESTRO instrument, the retrieval algorithm, its characterization and expected retrieval uncertainty, and the temperature and pressure retrieval results from data collected on-orbit. The profiles derived from

MAESTRO are also compared with temperature and pressure profiles retrieved from the ACE-FTS instrument, which shares its line of sight, and coincident radiosonde measurements.