CALIBRATION OF AIS DATA USING GROUND-BASED SPECTRAL REFLECTANCE MEASUREMENTS

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ABSTRACT

Present methods of correcting airborne imaging spectrometer (AIS) data for instrumental and atmospheric effects include the flat- or curved-field correction and a deviation-from-the-average adjustment performed on a line-by-line basis throughout the image. Both methods eliminate the atmospheric absorptions, but remove the possibility of studying the atmosphere for its own sake, or of using the atmospheric information present as a possible basis for theoretical modeling. The method discussed here relies on use of ground-based measurements of the surface spectral reflectance in comparison with scanner data to fix in a least-squares sense parameters in a simplified model of the atmosphere on a wavelength-by-wavelength basis. The model parameters (for optically thin conditions) are interpretable in terms of optical depth and scattering phase function, and thus, in principle, provide an approximate description of the atmosphere as a homogeneous body intervening between the sensor and the ground.

SUMMARY

AIS and Thematic Mapper Simulator (TMS) data flights were obtained under clear atmospheric conditions at Mono Lake, California, on October 31, 1984. The planned AIS flight lines were oriented in a north-south direction, extending 22 miles from north of Mono Lake, south across Mono and Inyo Craters; the approximate flight elevation was 20,000 feet above terrain. Both morning (solar elevation = 15 degrees) and noon (solar elevation = 43 degrees) observations were taken. All of the planned flights were carried out, excepting the northernmost (crucial) segment of the noontime series which was interrupted by failure of the Thematic Mapper Simulator.

The north shore of Mono Lake is characterized by broad contiguous beaches of (seasonal) bright evaporite crust and dark basalt pebbles that extend with more or less lateral continuity an arcuate distance of 10 miles in an east-west and northwest-southeast direction. Both AIS and TMS flight lines were laid out to cross the beaches orthogonally and with bright and dark swaths extending transversely across the image width. The bright and dark beach deposits, together with asphalt roads and other rock and volcanic deposits, provide a series of calibration targets for the construction of reflectance scatter plots. The bright and dark interface between beach deposits is an extremely sharp boundary that may be useful for study of the

atmospheric/instrumental modulation transfer functions. This boundary, together with the evaporite-water interface, may be useful in obtaining estimates of atmospheric parameters by yet another technique known as the two-halves method. The lateral continuity of uniform dark beach deposits provides multiple estimates of the atmospheric optical depth (for TMS data) which may also be used for comparison with estimates provided by the curve fitting and two-halves methods. The surface of Mono Lake provides a large uniform target for flat-field corrections.

An intercomparison of all the methods described plus experiments with TMS data on separation of directional effects of atmospheric and of surface origin, model studies on correction of the data for atmospheric effects, and geologic studies of the area will, to the extent possible, be worked out with these data.