

## Preface

### ISRO–NASA Airborne Hyperspectral Campaign

Imaging spectroscopy offers observations in spectrally continuous bands in different electromagnetic wavelength regions to detect and quantify physical and compositional traits or attributes of an object. Phase-1 airborne imaging spectroscopy data were acquired through hyperspectral campaign with NASA's AVIRIS-NG imaging spectrometer on-board ISRO's B-200 aircraft. This airborne campaign was conducted over 57 sites in India covering 22,840 km<sup>2</sup> area during a period of 84 days, viz. 16 December 2015 to 6 March 2016, under the ambit of ISRO–NASA joint initiative for HYperSpectral Imaging (HYSI) programme. The AVIRIS-NG instrument provides unprecedented imaging hyperspectral observations in the 400–2500 nm wavelength region at 5 nm spectral interval with high signal-to-noise ratio over the Indian subtropics. The observation sites represent agriculture, horticulture, forest, geology, coastal, ocean, river water, snow, urban, etc. The spatial resolution of airborne data varies from 4 to 8 m with flight altitude varying from 4 to 8 km and swath of 10–12 km. Collocated science field campaigns were also conducted. On-board data processing has been carried out to produce level-0 raw data. The level-1 (L1) at-sensor radiance data were generated using a processing software that uses calibration coefficients obtained through on-board and ground-based methods followed by geo-correction and ortho-rectification. The L1 data have been used subsequently to generate level-2 surface reflectance in 425 bands at 5 nm interval through newly developed atmospheric correction scheme, with retrieved atmospheric inputs from L1 radiance, look-up table and optimization.

This special section provides an overview of Phase-1 airborne campaign over India with AVIRIS-NG and highlights the results of hyperspectral data analysis covering calibration and validation, data processing and retrieval algorithms, thematic applications in seven areas, viz. agriculture, forestry, geology, coastal–ocean, river water,

land use and urban, and snow that are captured in 12 research articles. The results showed that airborne hyperspectral data are able to discriminate crops in mixed agriculture, horticultural orchards, forest species, and to assess their abundance and health. These were only possible using band continuum of sensitive wavelength regions in visible and near infrared, and shortwave infrared such as 400–900 nm, 1000–1700 nm and 1900–2200 nm. New rock and mineral types were identified using the spectra mostly beyond 2000 nm. Inversion schemes have been implemented to retrieve different water-quality parameters using band continuum of 400–800 nm and through development of bio-optical model. Medicinally important coral macrophytes have been identified and mapped using triple peaks around 646 nm. Quantification of some important atmospheric constituents such as water vapour, and aerosol loading parameters was possible using characteristic sensitive bands at 447, 550, 650, 740, 865, 940, 1009, 1140, 1240 and 2100 nm. Cloud microphysical properties such as cloud optical thickness and effective radius were retrieved using spectral matching technique from the entire hyperspectral observations in 400–2500 nm. Snow grain-size variability has been quantified using narrow-band continuum in the near infrared band region. The airborne hyperspectral data and knowledge gained would facilitate the building of spectral libraries with spectro-chemical characterization and development of analysis tools for general users. These will serve as reference or baseline for evaluating the performance and applications using data from future spaceborne hyperspectral missions.

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