local connectivity factors, the shadowing effects of the hills cannot be ruled out. The final output map was the weighted map of connectivity. For evaluation of authenticity in our results, various locations were chosen for field visits involving our own cell phones. Among them, the location marked as 'UPES' (our university) is significant. As all categories of signal are present in the vicinity, the location was extensively studied. For example, the roads leading towards our university received poor signal, whereas the university fell under the good-signal category. Although cell phones are not suitable for quantification of signal strength, qualitative information was obtained after participatory interaction with the local people.

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Cross-calibration of Indian Mini Satellite-1 HySI data using Hyperion: effect on Normalized Difference Vegetation Index

Normalized Difference Vegetation Index (NDVI) has been widely used as one of the earliest indicators for estimation of various biophysical parameters such as green biomass, chlorophyll content, canopy water stress, Leaf Area Index (LAI) and Absorbed Photosynthetically Active Radiation (APAR)[1–5]. Remote sensing has become one of the primary sources to map NDVI owing to the presence of suitable spectral bands in the imagery. Also, attempts have been made to study the effect of spectral characteristics on the vegetation indices derived from remotely sensed images[6]. The presence of a large number of contiguous spectral channels of hyperspectral imagery along with their very narrow spectral bandwidths enables to derive spectra of different features[7]. Studies have been carried out to examine whether hyperspectral images provide advantage over multispectral datasets for the retrieval of vegetation properties[8]. It is observed that the existence of correlativity and mutual compensation in different bands of hyperspectral datasets allows viewing NDVI as a spectral transformation feature in image processing[9]. In this study, an attempt was made to retrieve NDVI from atmospherically corrected IMS-1 HySI (Hyper-Spectral Imager) data. The NDVI values so-obtained were compared with respect to those of MODIS standard 500 m NDVI product[10]. The comparison showed considerable mismatch and hence, an attempt was made to re-compute NDVI image after inter-sensor calibration of HySI with respect to Hyperion. This communication reports the effect of cross-calibration of Indian Hyperspectral Sensor IMS-1 HySI with respect to Hyperion[11] on NDVI values and their comparison with respect to those of MODIS product.

IMS-1 launched in April 2008 by PSLV C-11 carried a HySI for observation of Earth along with a Multispectral Camera (MX)[12,13]. The HySI sensor was designed for 64 contiguous channels with a spectral separation of 8 nm and spatial resolution of 506 m. An attempt was made earlier to retrieve acceptable reflectance profiles from HySI data using two atmospheric correction algorithms employing different inter-sensor-calibration techniques[14]. In this paper, the study area for 24 May 2009 of Rishikesh and surroundings, with scene centre latitude and longitude, 30.0018° and 78.4334° respectively, has been taken from HySI data (Figure 1). The Digital Number (DN) image was converted to radiance and then, atmospherically corrected using FLAASH[15]. NDVI values were computed from the so-forth reflectance image obtained. The NDVI image from HySI was then compared with that of MODIS NDVI product MOD13A1 which is a 16-day composite product at 500 m resolution[16]. Out of the 64 spectral bands of HySI, the bands whose central wavelength was close to those of the corresponding MODIS bands were chosen to compute the NDVI image. It was found that NDVI values obtained from HySI did not match well with those of the corresponding MODIS product of similar time period. Hence, an attempt was made to cross-calibrate the spectral bands of HySI data with respect to those of Hyperion.

In this approach, radiance values of pseudo-invariant features from the two sensors were compared and it was found that the values obtained from HySI differ from those of Hyperion in majority of the

Figure 1. IMS-1 HySI data for the area under study.

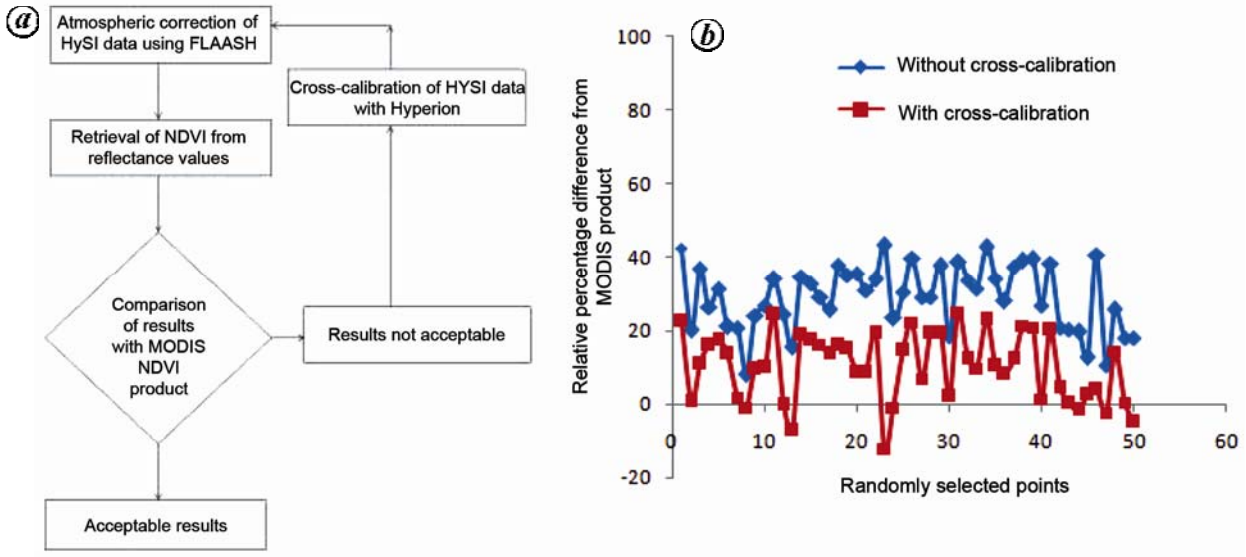

Figure 2. ***a***, Atmospheric correction of HYSI data using FLAASH. ***b***, Relative percentage difference of NDVI from those of MODIS product before and after cross-calibration of HySI data.

Near Infra-Red (NIR) bands. Hence, correction factors were computed using the approach described earlier[14]. The cross-calibration was applied only to those bands of HySI radiance image for which correction factors were greater than 1 so as to ensure minimum alteration of the original calibration constants supplied by HySI data. A closer observation revealed that correction factors greater than 1 were found mostly for NIR bands when compared with those of visible bands. Then, using these correction factors, new calibration constants were computed for HySI data. The HySI radiance image derived using new calibration constants was then atmospherically corrected using FLAASH and the NDVI values were retrieved thereafter. Figure 2 *a* describes the overall methodology of the processing.

The NDVI values obtained from original and new calibration constants of HySI were compared with those of MODIS product for 50 randomly chosen pixels (Figure 2 *b*). It was observed that the average relative percentage difference from that of MODIS is reduced from 29.14% to 10.12% after the inter-sensor calibration. The deviation in the results obtained after cross-calibration could be due to the assumptions made for inter-sensor calibration by Mehta and Agrawal[14]. The work can be extended by using more number of reference points for cross-calibration. The study showed improvement in the retrieval of NDVI values by using the cross-calibration approach, which can then be used as an input for further quantitative analysis.

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