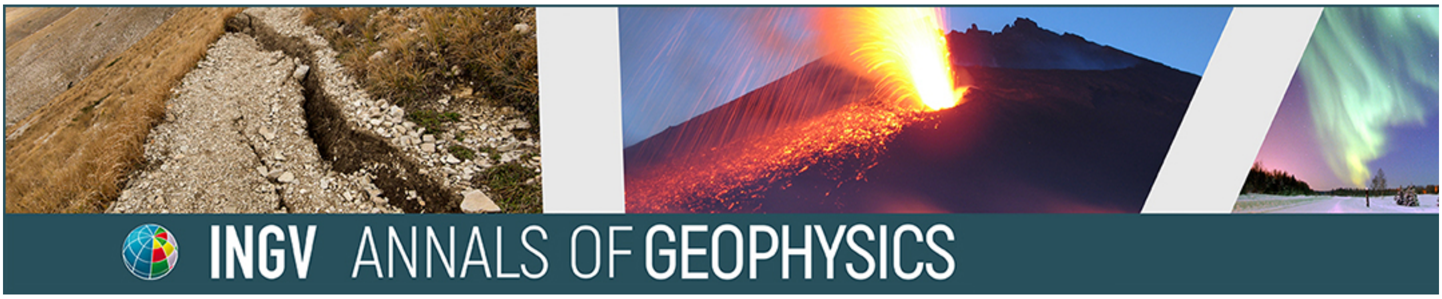

Assessment of water vapor content from MIVIS TIR data

C. Bassani, V. Cuomo, V. Lanorte, S. Pignatti, V. Tramutoli

Abstract

The main objective of land remotely sensed images is to derive biological, chemical and physical parameters by inverting sample sets of spectral data. For the above aim hyperspectral scanners on airborne platform are a powerful remote sensing instrument for both research and environmental applications because of their spectral resolution and the high operability of the platform. Fine spectral information by MIVIS (airborne hyperspectral scanner operating in 102 channels ranging from VIS to TIR) allows researchers to characterize atmospheric parameters and their effects on measured data which produce undesirable features on surface spectral signatures. These effects can be estimated (and remotely sensed radiances corrected) if atmospheric spectral transmittance is known at each image pixel. Usually ground-based punctual observations (atmospheric sounding balloons, sun photometers, etc.) are used to estimate the main physical parameters (like water vapor and temperature profiles) which permit us to estimate atmospheric spectral transmittance by using suitable radiative transfer model and a specific (often too strong) assumption which enable atmospheric properties measured only in very few points to be extended to the whole image. Several atmospheric gases produce observable absorption features, but only water vapor strongly varies in time and space. In this work the authors customize a self-sufficient «split-window technique» to derive (at each image pixel) atmospheric total columnar water vapor content (TWVC) using only MIVIS data collected by the fourth MIVIS spectrometer (Thermal Infrared band).
MIVIS radiances have been simulated by means of MODTRAN4 radiative transfer code and the coefficients of linear regression to estimate TWVC from «split-windows» MIVIS radiances, based on 450 atmospheric water vapor profiles obtained by radiosonde data provided by NOAA\NESDIS. The method has been applied to produce maps describing the spatial variability of the water vapor columnar content along a trial scene. The procedure has been validated by means of the MIVIS data acquired over Venice and the contemporary radiosonde data. A discrepancy within 5% has been measured between the estimate of TWVC derived from the proposed self-sufficient split-window technique and the coincident radiosonde measurements. If confirmed by further analyses such a result will permit us to fully exploit MIVIS TIR capability to offer a more effective (at image pixel level) and self-sufficient (no ancillary observations required) way to obtain atmospherically corrected MIVIS radiances.

Keywords

radiative transfer code;water vapor;split windows;MIVIS;atmospheric correction

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References

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(IMAA), CNR, Tito Scalo (PZ), Italy

V. Cuomo
Istituto di Metodologie per l'Analisi Ambientale (IMAA), CNR, Tito Scalo (PZ), Italy

V. Lanorte
Istituto di Metodologie per l'Analisi Ambientale (IMAA), CNR, Tito Scalo (PZ), Italy

S. Pignatti
Laboratorio Aereo Ricerche Ambientali (LARA), IIA-CNR, Tor Vergata (RM), Italy

V. Tramutoli
Dipartimento di Ingegneria e Fisica dell'Ambiente (DIFA), Università degli Studi della Basilicata, Potenza Italy

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