Atmospheric Correction of Airborne POLDER Polarimetric Imagery Using Vectorized 6S

Christoph Borel[1] and Clyde Spencer
Ball Aerospace & Technologies Corp., Systems Engineering Solutions
2875 Presidential Drive, Fairborn, OH 45324-6269
cborel@ball.com

Conference theme:

- Advanced preprocessing and processing of remotely sensed data
- Physical modeling in remote sensing
- Radiative transfer based approaches
- Remote sensing applications

ABSTRACT

We are interested in using wide-field-of-view polarimetric imagers such as airborne POLDER (LOA, University of Lille) and AMPI (NASA) to study polarization signatures of surface targets. The airborne POLDER instrument has a field of view +/- 43º in along-track and +/- 51º cross-track. It records imagery through a rotating filter wheel with spectral filters, and in two spectral bands with linear polarization filters orientated at 0º, 60º, and 120º while flying at 70 m/s, generating images that need to be registered before spectra or the Stokes vectors can be computed. The atmospheric contributions, particularly in the short-wavelength visible bands, are anisotropic due to the scattering from molecules and aerosols, and the contrast is quite low, making automated image registration impossible. Thus, it is necessary to remove the polarized upwelling atmospheric contributions from the at-sensor radiances before the images can be registered, and target-leaving Stokes parameters can be derived. We accomplished the atmospheric correction by using the recently released vectorized version of the Second Simulation of the Satellite Signal in the Solar Spectrum (6Sv) from Eric Vermote *et al.* 1997. We wrote a front-end in IDL to run 6Sv over a range of viewing zenith and azimuth angles. The resulting Stokes parameters are then interpolated to a grid of input viewing coordinates for the sensor. Next, the Stokes hemispherical path radiances are converted to match the data of the airborne POLDER instrument for the linear polarization angles of 0º, 60º, and 120º. The upwelling atmospheric intensities are subtracted from the respective polarimetric intensity images and the difference is divided by the transmission multiplied with the solar irradiance. This atmospheric correction significantly reduces the low-frequency variations in intensity in the images resulting from atmospheric scattering. The atmospherically corrected intensity images at 0º, 60º, and 120º are then used to calculate the Stokes parameter images in the usual fashion. From the Stokes parameter images we calculate the degree and azimuth of linear polarization images for the surface.

[1] cborel@ball.com, phone 1 937 320-7034 ;fax 1 937 429-1687;
http://www.ballaerospace.com/