Hyperspectral retrieval of biophysical variables through inversion of radiative transfer models. Solving the ill-posed inverse problem

Clement Atzberger

International Institute for Geo-Information Science and Earth Observation (ITC) – Department of Natural Resources, Enschede, The Netherlands, www.itc.nl/personal/atzberger

PRESENTATION ABSTRACT

Hyperspectral remote sensing offers the possibility to map biophysical variables such as leaf area index or leaf chlorophyll content with high precision. Biophysical variables are required in a range of applications, ranging from global change to precision agriculture. The use of statistical models for analyzing such data sets is limited by the fact that established regression equations are often site- and sensor-specific. A transfer to other study areas and/or seasons is generally not possible.

Physical based radiative transfer models are much less site- and sensor-specific, as almost no site-specific calibration is involved. However, the inversion of radiative transfer models is hampered by the fact that the inversion is generally ill-posed. This means that for a given spectral signature, several possible solutions exist. To “solve” the ill-posed inverse problem, the inversion of such models must be in some way constraint.

The presentation aims: (1) to describe, illustrate and explain the ill-posed inverse problem, and (2) to provide an overview over possible “solutions”. To solve the ill-posed inverse problem, we present approaches ranging from the use of external prior information, to the exploitation of temporal and spatial consistencies in the data sets. The possible solutions to the ill-posed inverse problem are easy to implement and should further promote the use of radiative transfer models. As the approaches are not restricted to vegetation modelling, we believe that the presentation is also of interest for scientists working on topics such as wetlands, oceans/water, soils, etc.