Soil moisture modeling in the As-Sehoul commune (Morocco)

Integrating spatial simulation models and Earth observation techniques for surveying complex patterns of top soil moisture

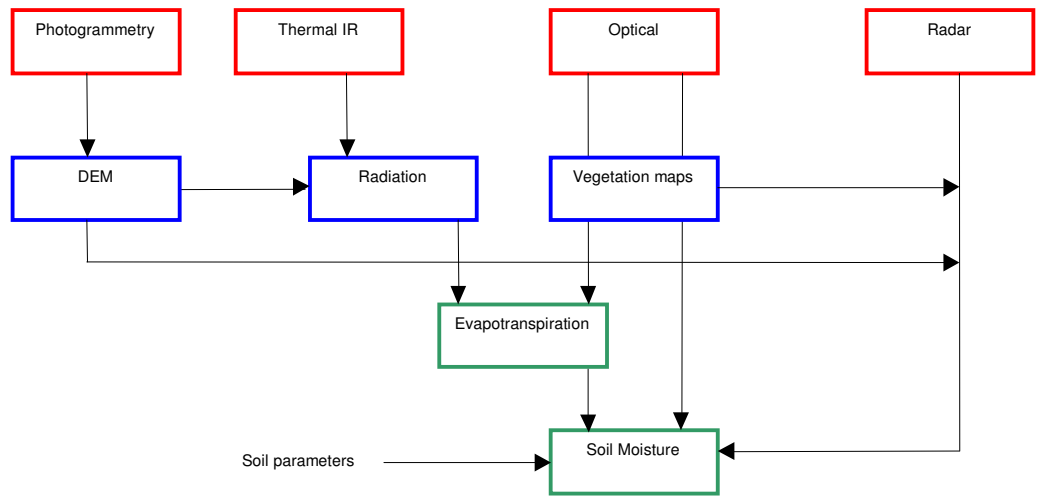
J. van der Kwast

Centre for Geo-Ecological Research, Faculty of Geosciences, Utrecht University
P.O. Box 80115, 3508 TC Utrecht, The Netherlands

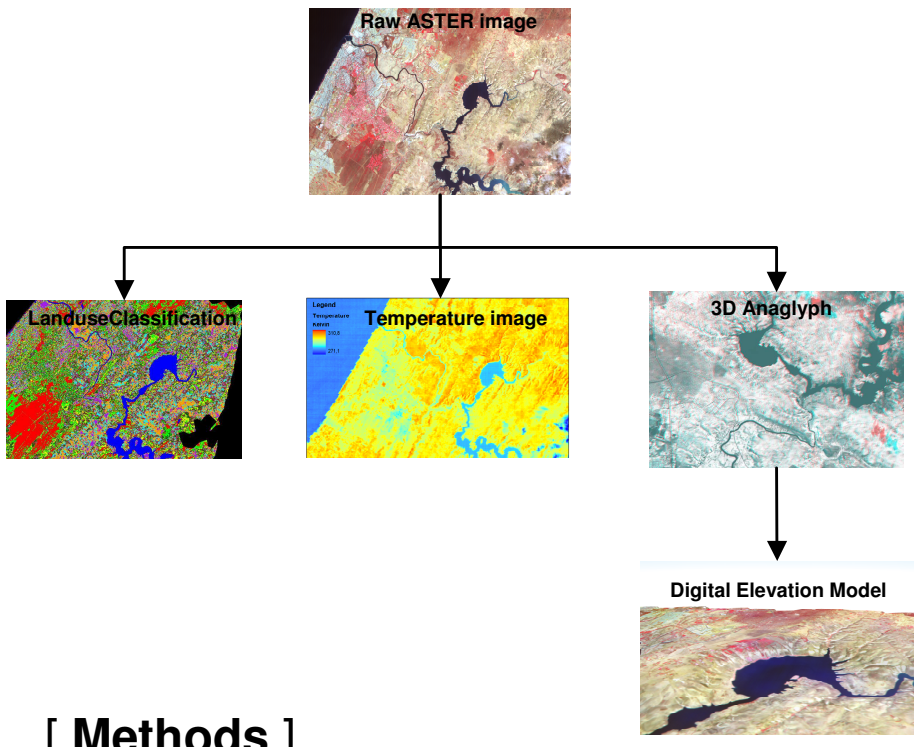
[Introduction]

Topsoil moisture and its spatial and temporal distribution over the landscape is an important input variable in various landscape process simulation models e.g. evapotranspiration, crop growth, soil erosion, surface runoff models. In theory, soil moisture patterns can be mapped by Earth observation techniques. In practice, however, this is hampered by crop and vegetation cover, topography and a complex relation between the reflected electromagnetic signal and soil moisture.

Flowchart of the integration of remote sensing in soil moisture modelling



Combination of ASTER data with conventional field measurements



TDR measurements

Meteorological station

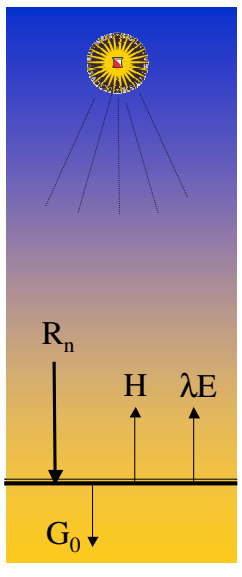
[Integration]

In this study we propose to develop a GIS based model to predict the spatial and temporal distribution of top soil moisture patterns on the basis of rainfall patterns, topography, soil and landcover. The relation of this simulated soil moisture pattern with radar backscatter, thermal remote sensing and optical reflectance signals is investigated and determined. It is anticipated that the combined use of GIS based simulation models and earth observation techniques will yield improved survey methods for soil moisture patterns.

[Methods]

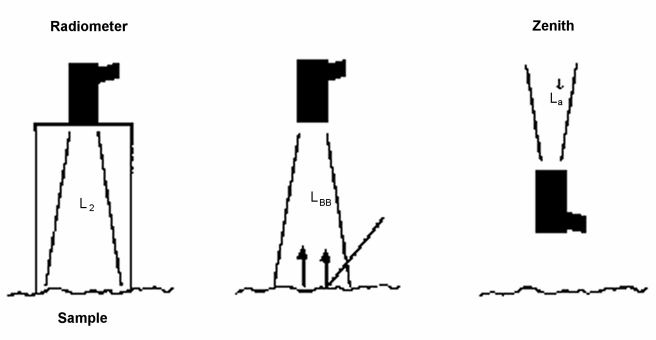
A number of conventional and state-of-the-art techniques will be combined:

- DEM extraction from ASTER imagery and aerial photographs, using DGPS measurements
- Emissivity measurements using the 'box-method' (Rubio et al., 1997, 2003)
- Surface Energy Balance modelling (SEBS; Su, 2002) with ASTER data
- In-situ TDR measurements for model validation
- Land Cover Classification from ASTER imagery
- Meteorological measurements



Surface Energy Balance

Emissivity measurement



L_2 = blackbody at sample temperature
L_{BB}= sample radiance + environment
$L_a\downarrow$ = environmental irradiance

$$\varepsilon = \frac{L_{BB} - L_a\downarrow}{L_2 - L_a\downarrow}$$

Universiteit Utrecht

E-mail: j.vanderkwast@geog.uu.nl; Internet: http://www.remotesensing.tk

Centre for Geo-ecological research