6 years time-series of estimation and validation of land surface temperature from Landsat 5 & 7 archive on 3 plots of south-west of France

Vincent Rivalland, Gilles Boulet, Maria Mira Sarrio, Aurore Brut, Albert Olioso

6 YEARS TIME-SERIES OF ESTIMATION AND VALIDATION OF LAND SURFACE TEMPERATURE FROM LANDSAT 5 & 7 ARCHIVE ON 3 PLOTS OF SOUTH-WEST OF FRANCE

***Vincent Rivalland*[1]*, Gilles Boulet*[1]*, Maria Mira*[2]*, Aurore Brut*[1]*, Albert Olioso*[2]**

[1]CESBIO, UMR5126 (CNES-CNRS-UPS-IRD), 31401 Toulouse cedex 9, France

Tel: (33) 05 61 55 85 06

Email: vincent.rivalland@cesbio.cnes.fr

[2]INRA, EMMAH-UMR 1114, 84914 Avignon, France

Land Surface Temperature (LST) is the key remotely sensed variable to monitor the surface water stress status. It can be used in agro-meteorology to in water allocation and irrigation planning. LST is also a key boundary condition in many remote sensing-based land surface modeling schemes. Currently, national agencies provide preprocessed data from available satellite thermal infrared sensors such as MODIS with the common used MOD11A1 LST product with its 1 km spatial resolution and a repeat cycle of 16 days, or ASTER with its Kinetic Temperature product at 90 m pixel resolution. Automating the correction is possible thanks to the availability of several thermal bands that enable the application of split window algorithms. In the case of mono-window remote sensing data such as Landsat (5-120 m, 7-60m and 8-100m), the estimation of LST from thermal infrared band (10-12□m windows) requires both the knowledge of the surface emissivity and the use of a radiative transfer model and consequently the knowledge of the atmospheric profile (H2O, Air temperature) over the zone of interest to correct at-sensor radiance from atmospheric perturbations.

In a first time, we evaluate the performance of the atmospheric correction tool developed by Barsi et al. 2003 (http://landsat.gsfc.nasa.gov/atm_corr) associated to the estimation of emissivity from NDVI proposed by Wittich 1997, to estimate LST from Landsat 5 and 7 data archive and extractions on 3 plots of Southwest France over 6 years of ground measurements. Extraction and correction algorithms are detailed. The results for these three plots show on a good agreement between Landsat LST estimation after correction (atmospheric and emissivity) and LST ground surface measurements, with correlation coefficients between 0.8 and 0.9 and root mean square errors between 3K and 4.5K. In a second time, we studied through a sensibility analysis the impact of the atmospheric correction parameter's range from radiative transfer model and the emissivity estimation from Normalize Vegetation Index (NDVI), on the top of atmosphere (TOA) to top of canopy (TOC) surface temperature absolute correction. We show that absolute correction between Tb TOA and Tb TOC are among 0 to 10K with greatest values in summer. The analysis focuses on both quantitative and qualitative (temporal and spatial patterns) criteria in order to associate an error on parameter (atmospheric and emissivity) estimation to the final LST product accuracy. Finally, we propose a methodology and current modifications aimed at improving the full Landsat scene thermal band correction.

RAQRS 2014

Programme and Abstract Book

4th international symposium

RECENT ADVANCES IN QUANTITATIVE REMOTE SENSING

22 – 26 SEPTEMBER 2014

Torrent (Spain)

4th INTERNATIONAL SYMPOSIUM

RECENT ADVANCES IN QUANTITATIVE REMOTE SENSING

PROGRAMME AND ABSTRACT BOOK

22 – 26 SEPTEMBER 2014
TORRENT (VALENCIA) SPAIN