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Net radiation is the main driver of surface energy balance and evapotranspiration; it expresses the balance of radiative energy at the Earth surface and thus the available energy for exchanges of sensible and latent heat between the surface and the atmosphere. Net radiation depends on several land surface variables, such as surface albedo, surface emissivity and surface temperature which are changing rapidly in space and time under the influences of the type of land use, water availability and incoming radiation. The emission term, which depends on surface temperature and land surface emissivity will be the focus of this study. Remote measurement of surface temperature allows assessing surface energy balance at various spatial scales from satellite and airplane platforms or from hand-held thermal infrared radiometers. However, surface temperature cannot be directly derived from thermal measurements. Measured radiation includes not only the radiation emitted by the surface but also the radiation emitted by the atmosphere. Moreover the signal from the surface is attenuated by the transfer through the atmosphere. Correction of these atmospheric effects requires knowing information on the atmospheric profile in temperature and vapor pressure. The emissivity effect must also be accounted, since it directly affects the level of emitted radiation at a given temperature, inducing additional uncertainties. Poor knowledge in either surface emissivity or atmospheric and reflection effects results in error in the determination of surface temperature from remote sensing measurement.

This study aims at evaluating estimates and uncertainties on surface temperature using Landsat-7 ETM+ images, and derived uncertainties on net radiation. The study was conducted over the lower Rhône Valley ('Crau-Camargue' and Avignon areas), South Eastern France, where a network of ground stations measuring surface energy balance components and meteorological variables is deployed. Surface temperature is estimated from top of canopy (TOC) brightness temperature by accounting for land surface emissivity and reflection of atmospheric radiation. Emissivity is estimated using a relationship with a vegetation index and a spectral database of soil and plant canopy properties in the study area. TOC brightness temperatures are derived from top of atmosphere brightness temperatures after removing the atmospheric effect using the atmospheric radiative transfer model MODTRAN and *in situ* radiosoundings launched close to the experimental area and the satellite overpass time.

By inspecting performances from comparison with ground measurements, we observe Root Mean Square Errors of ~1.7 K for surface temperature and ~20 Wm^{-2} (5%) for net radiation. The analysis reports an uncertainty in net radiation due to the emission term of ~8 Wm^{-2}. This contribution has to be compared with the uncertainties in the estimation of the net longwave radiation (20 – 40 Wm^{-2}) and the net radiation (50 – 90 Wm^{-2}), which vary spatially and temporally depending on the land use and the time of year. As demonstrated by the detailed uncertainty analysis presented by Mira et al. (2015), measurements of incoming shortwave and longwave radiation contribute the most to uncertainty in net radiation (10–40 Wm^{-2} and 20–30 Wm^{-2}, respectively), followed by uncertainties in albedo (<25 Wm^{-2}) and surface temperature (~8 Wm^{-2}). For the latters, the main factors were the uncertainties in top of canopy reflectances (<10 Wm^{-2}) and brightness temperature (5–7 Wm^{-2}). The generalization of these results to other sensors and study regions could be considered, except for the emissivity if prior knowledge on its characterization is not available. To conclude, although it appears that the uncertainty in surface temperature is not very relevant in the calculation of net radiation, its contribution to the sensible heat flux estimation, not evaluated here, cannot be underestimated.