Testing thermal sharpening techniques for land surface temperature retrieval in support of urban and suburban area mapping

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Remotely sensed thermal infrared data (TIR) contains information on emitted radiation that is complementary to that in the visible (VIS) and near infrared (NIR) spectrum. Despite the unique radiometric properties of thermal bands, applications using TIR data has been rather limited. The main reason lies in the coarser spatial resolution of these bands, which often do not suffice for highly heterogeneous (sub)urban areas.

We aim at a line of research in which we focus on algorithms and techniques to improve land surface temperature retrieval, urban land-use/land-cover mapping and evapotranspiration estimation using TIR data. A first objective of our research is to sharpen the thermal information. Thermal sharpening refers to the use of information of other bands with a higher spatial resolution to refine the spatial resolution of the thermal band. These other bands can be the VNIR/PAN bands from the same sensor or from another sensor.

Several thermal sharpening techniques will be tested to obtain sharpened thermal information and examine the effectiveness of integrating high(er) resolution TIR data as complementary information. During the past years a number of sharpening methods have been developed. Examples are TsHARP, an algorithm for sharpening thermal imagery based on the assumption that a unique relationship between radiometric surface temperature and vegetation index exists at multiple resolutions, and MMT, a multi-sensor multi-resolution technique based on unmixing and fusion algorithms.

In this study, different sharpening methods will be applied on the thermal band of a Landsat/ETM+ image (2001) for the city of Dublin and surroundings. For the higher spatial resolution data the VNIR/Pan bands of the same Landsat/ETM+ image and a Quickbird image (2003) will be used. It is expected that the sharpened thermal band will not only result in a more accurate estimation of the land surface temperature, but also in improved land use/land cover mapping accuracies and evapotranspiration estimates in (sub)urban areas.

Key words: Thermal remote sensing, thermal sharpening, land surface temperature, urban area mapping, evapotranspiration estimation