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Can we detect water stressed areas in forest thanks thermal infrared remote sensing?

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In Mediterranean and mountainous areas, an increase of mortality in forest is observed after important drought events. In the context of climate changes, a study of the impact of drought stress on forest is necessary. In order to detect water stress over the whole forest at different periods of the year, we propose the use of a spatialisable indicator, easily measurable: crown surface temperature. As previous works were not conclusive concerning the potentiality of this indicator in forest (Duchemin, 1998a, 1998b, Pierce et al., 1990), we set up an experimentation to study the surface temperature evolution linked to the transpiration at tree scale, during the spring and summer periods on silver fir (Abies alba) forest of Mont Ventoux (south of France). At the same time, several thermal infrared images of the mountainside were acquired corresponding to different levels of transpiration. The signal of surface temperature is studying via the evolution of the difference between measured surface temperature and calculated surface temperature for a tree at maximum transpiration rate. At tree scale, there is a difference of 4 °C of amplitude in the signal of surface temperature between maximum and zero transpiration conditions. The difficulty resides in taking into account the influence of climatic conditions, source of variability in the signal uncorrelated with transpiration evolution. Indices of surface temperature, built to include this influence of climatic conditions, permit to reduce this variability. Another source of variability lies in the percentage of branches present in the area of measurement. Indeed branches have a thermal dynamic differing from the needles one and, considering comparison between trees, the percentage of branches varies. At the mountainside scale, contrasted areas in terms of surface temperature indices are observable. By comparing different dates, corresponding to different levels of drought, it is possible to locate areas with precocious water stress signal. The amplitude of the signal, between wet and dry conditions, is at an average of 3 °C. Thus, by analysing the temporal evolution of this signal, thermal infrared is an interesting tool to detect water stress and identify different levels of stress between forest areas.

Duchemin B., D. Guyon, J.P. Lagouarde, 1998. Potential and limits of NOAA-AVHRR temporal composite data forr phenology and water stress monitoring of temperate forest ecosystems. International Journal of remote sensing, volume: 20, 5, p 23.

Duchemin B., Lagouarde J.P., 1998. Apport des capteurs satellitaires à large champ pour l'estimation de variables de fonctionnement des écosystèmes forestiers tempérés. Thesis. p120.

Pierce L. L., Running S.W., Riggs G.A., 1990. Remote detection of canopy water stress in coniferous forests unsing the NS001 Thematic Mapper Simulator and the Thermal Infrared Multispectral Scanner. Photogrammetric engineering and remote sensing, volume: 56, 1, p 8.