ANALYSIS OF DISAGGREGATION TECHNIQUES APPLIED TO SATELLITE IMAGES FOR THE ESTIMATION OF SURFACE THERMAL PARAMETERS AT DIFFERENT SCALES

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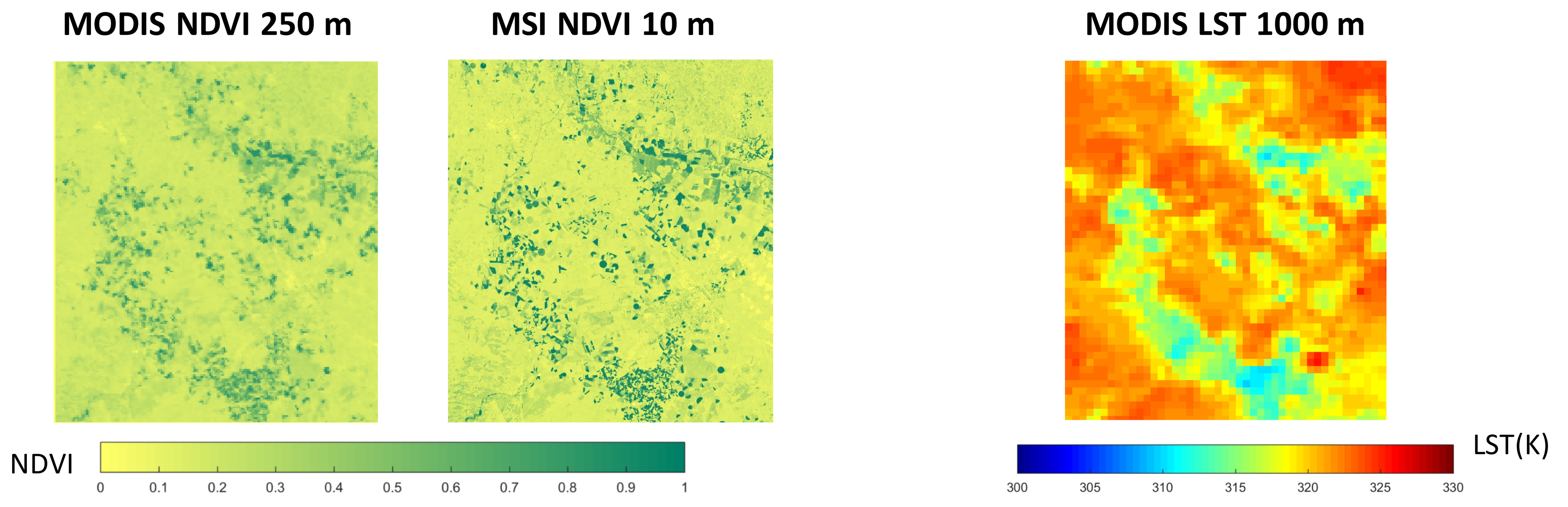
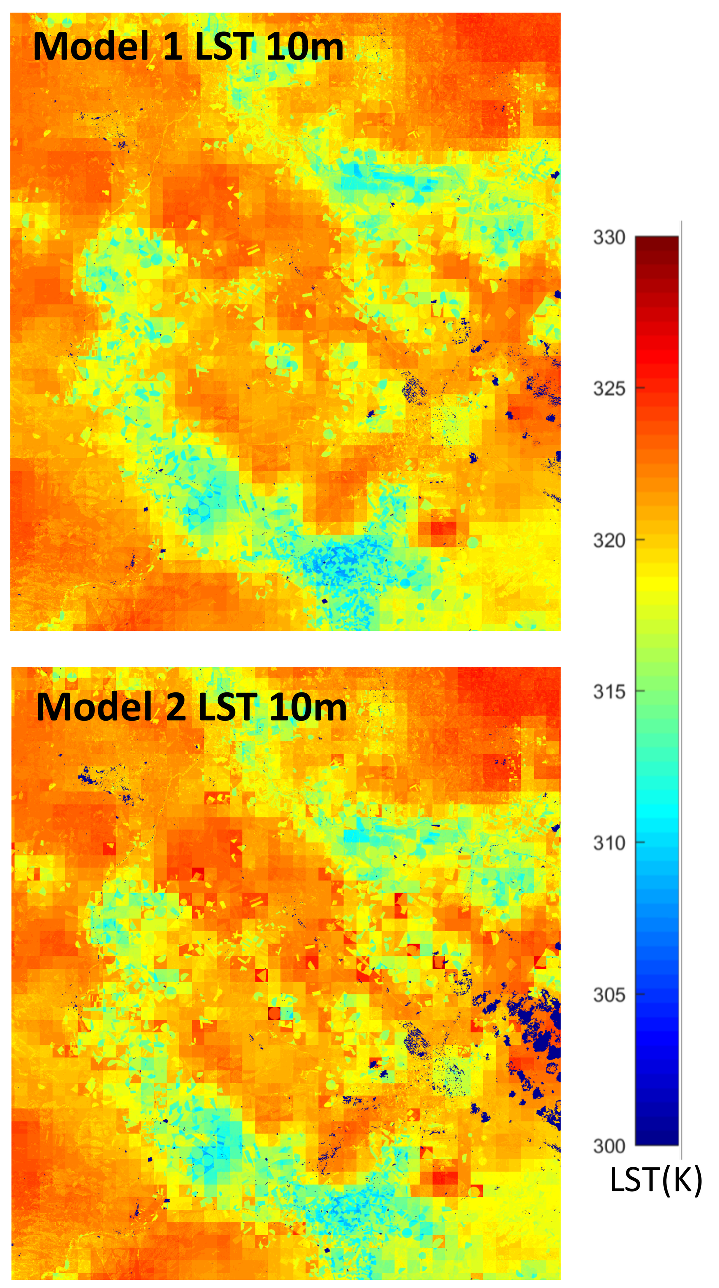
ABSTRACT.- During the last years, both the technological development and the greater availability of geospatial information have led to the emergence of new application areas for remote sensing techniques. This is also relevant in the case of thermal remote sensing. Applications such as crop tracking require a greater availability of thermal information with spatial resolutions appropriate for a more local level scope. However, and despite the increasing availability of remote sensing products that have appeared and are expected to appear in the coming years, thermal infrared data continue to be available at lower spatial resolutions than the visible and near-infrared data. Numerous authors have developed or tested methods to extract information at the sub-pixel level by using complementary remote sensing products with suitable results for using in applications at higher scales. Most of these methods are based on correlations between some vegetation indexes, such as NDVI, and radiative temperatures for a given cover. They are based on traditional mathematical models, such as linear or quadratic regression. Despite newer analysis tools like Support Vector Machines (SVM) or Neural Networks (NN) have become relevant in the last decade, their application on thermal remote sensing is in an relatively early stage of research and the use of traditional methods remains nowadays. The objective of this study is carrying out a comparison of these methods. A downscaling process from a MODIS temperature product scene has been developed using different methodologies. The results have been evaluated using "in situ" (ground-truth) temperature measurements showing an estimate of the accuracy and the potential of two different techniques.

STUDY AREA AND DATA USED

The study was carried out in the experimental farm "Las Tiesas", in the municipality of Barrax (Albacete, Spain; 39°02'57.4"N, 2°04'59.2"W). Ground-truth temperature measurements were taken "in situ" at eight different points of the farm and in different land uses. The measurements were taken along transects on July 26, 2016 coinciding with the pass of the satellites EOS-Terra and Copernicus Sentinel-2, with MODIS and MSI, respectively



RESULTS



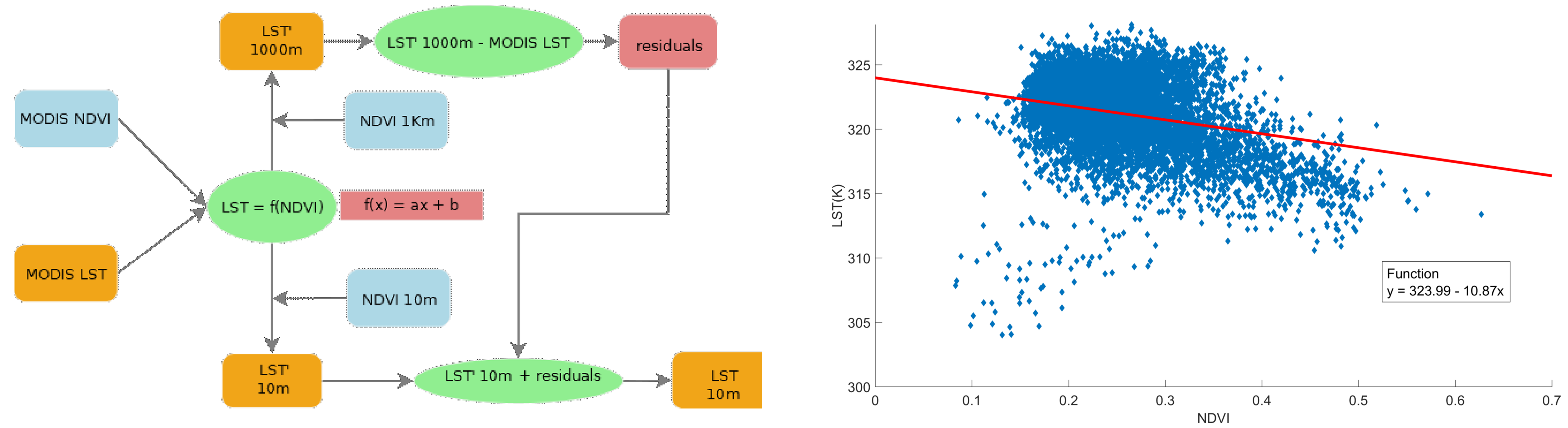
ID	Description	LST In situ (ºC)	LST Linear (ºC)	LST DisTrad (ºC)
1	Almonds	50.3	48.1	39.4
2	Wine	48.5	43.5	36.6
3	Corn	27.7	44.1	35.8
4	Barley 1	50.1	48.2	39.5
5	Barley 2	51.3	45.4	36.7
6	Fescue	33.5	41.1	34.2
7	Wet soil	30.9	44	37.2
8	Wet soil	31.3	45.5	36.7

In the table, comparison between ground-truth and model estimated temperatures is presented. Ground-truth data were acquired during the measurement campaign and are used here as control points. Although the number of control points is reduced in order to cover the complete area of interest, we show here preliminary results from which some conclusions can be drawn.

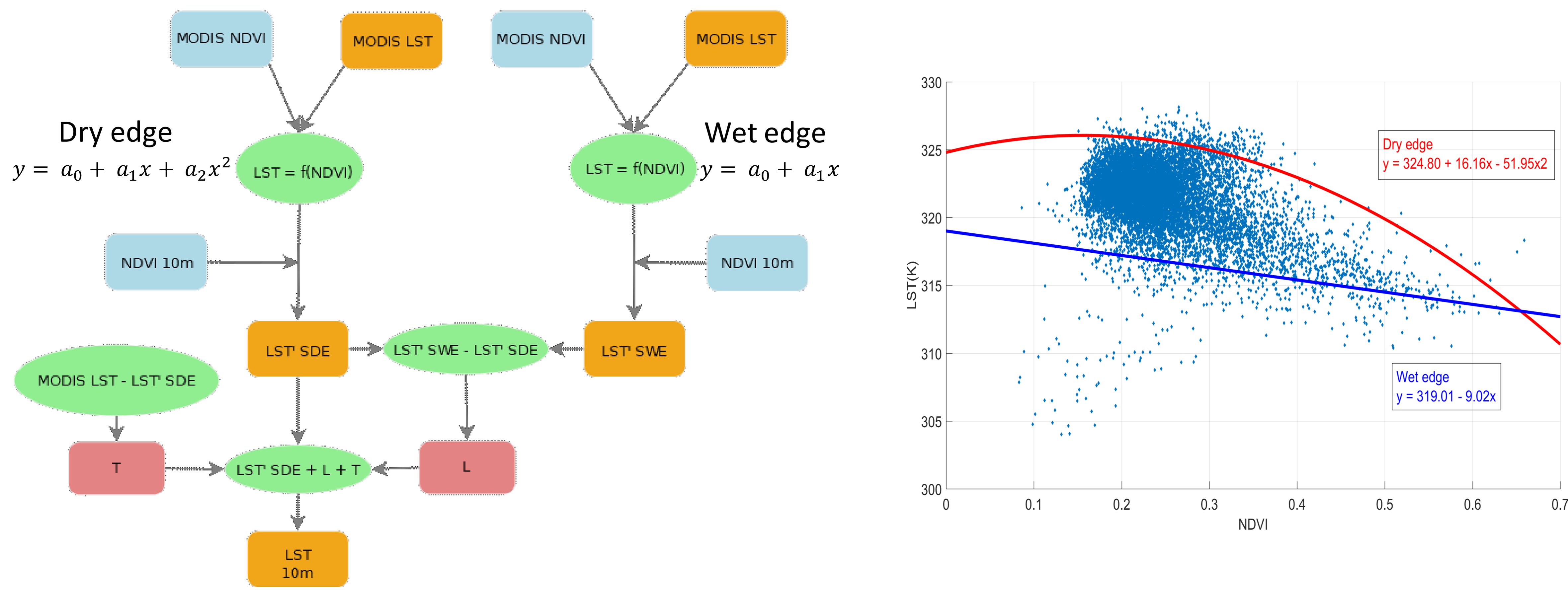
METHODOLOGY

Two methodologies have been tested:

1.- Linear Model: LST = b + a·NDVI (Eq. 1) (Agam et al. 2007a; Bisquert et al., 2015)



2.- DisTrad (Bayala et al. 2014)



The product result in both cases is a new LST image with ground sample distance (spatial resolution) of 10m.

CONCLUSIONS

- The lack of pixels with NDVI values higher than 0.7 and lower than 0.1 difficults to estimate the best adjustment curve in both cases.
- A higher number of control points would have been advisable. We are working to get a wide range of ground-truth temperatures to better estimate the accuracy of the models.
- However, it can be concluded that these methodologies present difficulties to deal with extreme temperatures.
- These preliminary results show that model 2 works better at the lower ground LSTs, but model 1 seems to work better at the higher LSTs.
- Model 2 shows less dispersion than model 1. The differences between model and ground LSTs for both models are a consequence of these dispersions and the range of the data used for the regressions in terms of both LST and NDVI.

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