Generating Regional High-Resolution Air Temperature Fields Using MODIS LST Data

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The land skin/surface temperature (LST) retrieved from the Moderate Resolution Imaging Spectro-Radiometer (MODIS) TIR measurements (MODIS, 2001) with nominal accuracy of 1°C can be used successfully for linear regression estimates of daily air maximum and minimum temperatures at a regional scale (Kawashima et al., 2000; Jones et al., 2004; Mostovoy et al., 2006). MODIS LSTs have the relatively high spatial resolution of 1km and 5 km, revisiting frequency (twice a day), and global coverage. Previous studies (Florio et al., 2004) demonstrated that use of satellite-derived LST as an additional covariate resulted in an improvement of air temperature spatial interpolation quality over the areas not covered with meteorological observations.

Both *in situ* surface observations of the air temperature from 161 stations and MODIS LST data were selected for the period from June 2000 to the end of 2004. Two groups of MODIS LST products were used. They were available globally at approximately 10:30 AM/PM (*Terra* platform) and 1:30 AM/PM (*Aqua* platform) local solar time. This study was performed over the regular domain having extension of 4.0° in longitude and 5.5° in latitude, encompassing the entire state of Mississippi (Fig. 1).

Spatial interpolation accuracy of air temperature (both daily maximum and minimum) fields has been evaluated in terms of mae (mean absolute error), root-mean-square error (rmse), and bias (mean difference between interpolated and observed values). 18 sites evenly distributed over the state of Mississippi have been eliminated from interpolation procedures and used for accuracy evaluation (Fig. 1 shows the sites locations). The interpolation procedure utilizes thin-plate splines for spatial representation of air temperature and LST fields and has been performed in two basic versions: without (control case) and with MODIS 5-km LST data (LST case). Distribution of the interpolation errors showed marked spatial (Fig. 1) and seasonal features (Fig. 2) over the state of Mississippi with a distinct minimum of mae and rmse values during July-Aug. period and higher values of errors exceeding 2°C at winter months. Dashed lines in Fig. 2 stand for the control case and solid for the LST case. Fig. 2 provides a clear evidence that inclusion of MODIS 5-km LST data into interpolation scheme results in a persistent improvement of air temperature interpolation accuracy (both for daily maximum and minimum) seen as a reduction of mae and rmse values.

Seasonal weather variability and surface cover parameters have proven to be the most important factors controlling observed spatial and temporal variations of the interpolation errors (Mostovoy et al., 2006).

References

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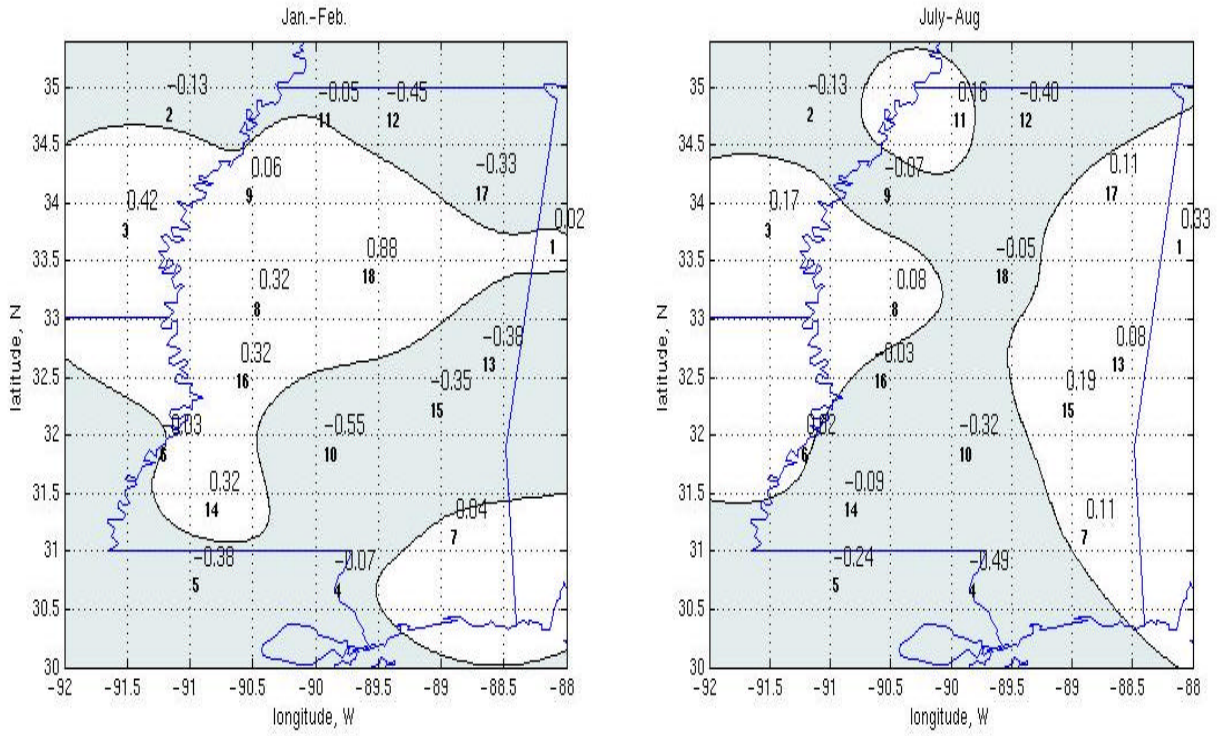

Figure 1. Normalized difference of rmse bimonthly-averaged values between interpolation of daily maximum air temperature without (control case) and with LST. Grey shading indicates improvement area (lowering of rmse relative to control case) of interpolation accuracy due to use of MODIS LST from *Terra* platform.

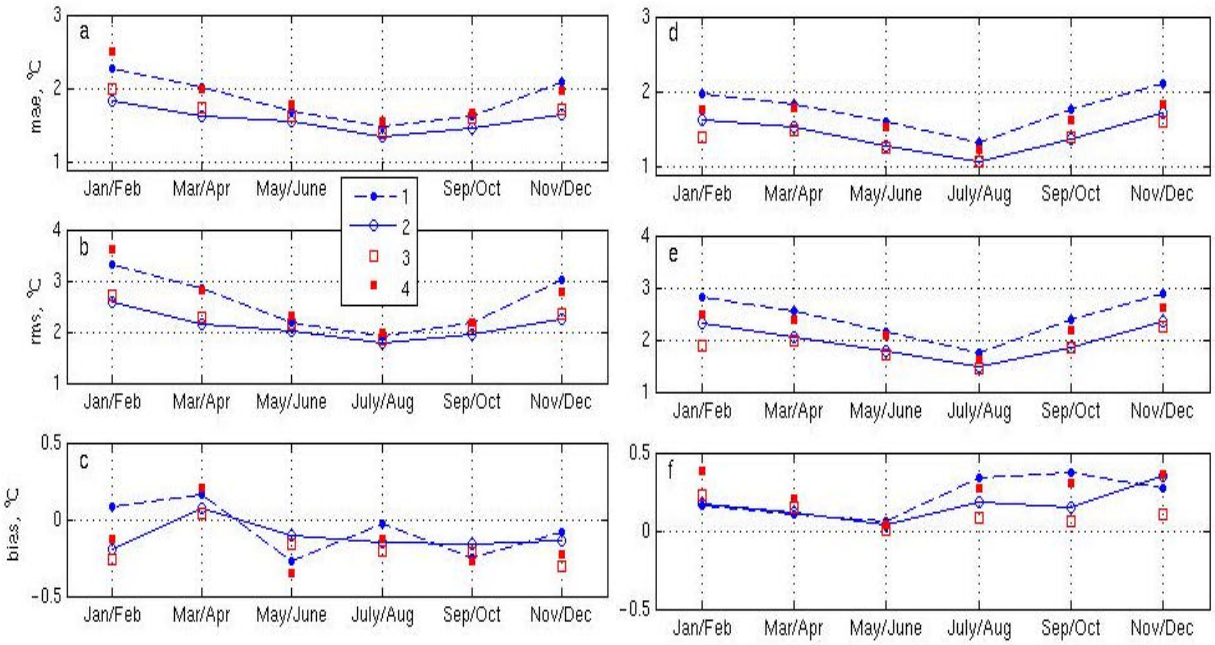

Figure 2. Seasonal variations of mapping accuracy statistics (mae [a, d], rmse [b, e], bias [c, f]) for daily maximum (a, b, c) and minimum (d, e, f) air temperatures. Averaged values over 18 sites shown in Figs. 1 and 2 are depicted. 1, 4 – control interpolation (without LST), 2 and 3 – accuracy statistics for interpolation with *Terra* and *Aqua* 5-km LST, respectively.