

## ***Interactive comment on “Spatial patterns in timing of the diurnal temperature cycle” by T. R. H. Holmes et al.***

### **Anonymous Referee #2**

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#### General Comments

This work presents an interesting analysis of the phase of land surface temperature, as obtained from different air-borne sensors – infrared and micro-wave imagers – and from numerical weather prediction models. The study provides a new insight on the character of the variables being measured and particularly, on how well the surface temperature is represented in the NWP model considered, namely NASA’s reanalysis for satellite data based on GEOS version 5 data assimilation system.

The article is overall very nicely presented and it is worth publishing, subject to minor revisions.

#### Specific Comments

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1) This type of analysis makes sense for clear sky diurnal cycles of surface temperature, since under cloudy conditions the timing of cloudy and clear sky periods would be a source of uncertainty for the phase of surface temperature. This is somehow implicit in the text; e.g. condition #2 in page 6 limits the occurrence of cloudy cases; IR temperatures are also naturally clear sky values. However, it is not indicated whether cloudy estimates were excluded from NWP and micro-wave temperatures. I suggest the analysis explicitly excludes cloudy estimates of NWP and micro-wave temperatures. The results will be easier to interpret if such filtering is performed.

2) The results clearly show that the heat capacity of the model is too low: the phasing of maximum daily temperature is significantly lower than any of the satellite data considered. Except for forest areas, the model surface temperature is said to refer to a layer of less than 1mm depth. Does this mean that the heat capacity should be tuned to model a daily cycle somehow between that of micro-wave and infra-red satellite temperatures?

3) It is concluded that the timing of Ka-band observations is just 0-10 min after that of infrared outside desert areas (lines 585-590). I do not see this being corroborated by Fig. 4d, unless the authors consider the region between 10S and ~30S being “desert area”.

#### Editorial:

1) Please check and correct colour code of Fig.5: according to all figures and results discussed in the main text, T<sub>NWP</sub> presents the earliest phase. This would be consistent with the red bars in Fig. 5, but these are labelled as T<sub>IR</sub>.

2) Clarify the meaning of MERRA in the abstract. The acronym is now first described in line 270-271.

3) Line 84: “between model and in situ could be” instead of “between model and in could be”

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