

Interactive comment on “Temperature decadal trends, and their relation to diurnal variations in the lower thermosphere, stratosphere, and mesosphere, based on measurements from SABER on TIMED” by Frank T. Huang and Hans G. Mayr

Anonymous Referee #1

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This manuscript presents a study on the relationship between diurnal variations in the temperature and its decadal trends from the stratosphere to the lower mesosphere, based on SABER measurements on the TIMED satellite. This study is useful because it is important to understand the evolution of temperature in the middle and upper atmosphere in relation to global warming at the surface, but the analysis of satellite observations can be biased by their non-uniform local solar time. Most satellites are sun-synchronous, always measuring at two fixed local times for a given latitude. In

addition, some of these satellites are affected by local time drifts during their lifetime. SABER is the only satellite providing temperature data at all local times in the mesosphere and the lower thermosphere, making it possible to separate the contribution of diurnal tides in temperature evolution. This study indicates that the estimation of temperature trends is not only biased by local time sampling but also by trends in the amplitude and phase of thermal tides. This is a new result that deserves to be published in *Annales Geophysicae*. However, I recommend to improve the content and the organization of the manuscript to make it more convincing as explained below.

The separation between diurnal variations and the long term evolution in temperature measurements by SABER is made using a least squares fit of a two dimensional Fourier series. This method is explained in details in Huang et al. (2010) and only very shortly described in the present paper. Such a detailed description is not needed in the present paper. However it would be useful for the readers to give a more complete synthesis of the method. In particular some parameters have to be fixed in the analysis as for instance the time length of the 2-D Fourier series, fixed to one year in Huang et al. (2010). Is it the same in the present study? It is important to know these parameters to understand the signification of decadal trends in mean temperature and in thermal tides.

The analysis provides the characteristics of the tides and their evolution over time. There is a detailed discussion of comparisons of temperature trends inferred from SABER data with published results from terrestrial lidars and AMSU satellites for several fixed local hours. These comparisons are very interesting and show a good general agreement, but results on the decadal evolution of tidal parameters (amplitude and phase) are not presented, except for the example given in Figure 2. I don not know any published results on the evolution of tidal parameters in the middle atmosphere and this would be a very valuable result.

Concerning the organisation of the paper, it is rather unusual to give some conclusions in the introduction section as it is done in lines 81-89. This part should be moved to the



summary and conclusion section.

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