

***Interactive comment on “Daytime SABER/TIMED observations of water vapor in the mesosphere: retrieval approach and first results” by A. G. Feofilov et al.***

**Anonymous Referee #1**

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This paper presents the details of the author's non-LTE retrieval algorithm for water vapor from the SABER instrument on board of the TIMED satellite. It presents the validation using concurrent satellite measurements not subject to non-LTE effects, and shows some representative results. This is probably intended to be the basic validation paper for the water vapor retrieval, and would provide the basic reference for any future publications of SABER water vapor. The scientific value of this paper is that it provides a sound physical basis for understanding thermal emission from molecules not in thermodynamic equilibrium with their surroundings. Only minor new scientific

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results are presented, relative to improved values for three rate coefficients. However the paper provides the springboard for ultimate release of the data, and allows users to evaluate the validity and errors in the data. The SABER data have great potential for new scientific results, particularly diurnal variations of water vapor, which should provide new understanding of the MLT region. Acceptance of this paper by the community will pave the way for this to happen. I find the paper to be of high scientific importance and deem the paper to be acceptable in its present form, but could be slightly improved with minor revisions which I offer below as suggestions for improvement. The paper is well written, clearly organized and thorough in its methodology. \*The abstract should contain the following information: quantitative errors, and the reason for concentrating on daytime observations. \*Because the rate coefficients are 'tuned' to allow best agreement with ACE data, there is the nagging question as to whether possible temperature dependence of the three coefficients is relevant, and whether the three values obtained by the chi-squared analysis are indeed unique. This is more of an observation than a criticism, because the authors have apparently worked very hard to obtain a unique set. Presumably the temperature dependence of the reactions is buried in the overall numbers because the comparisons were made under a number of different thermal conditions. \*During summer solstice at high latitude, I would have expected a hydration due to PMC sublimation near 80 km. I do not see this well-established feature in the plots, which should show up at the advertised resolution. However the plots are so small in my version of the paper, that it could easily have escaped my attention. It would be desirable for the journal to blow these plots up to something readable. \*The reference by Zsazsaky on ice particle nucleation is not appropriate, since that reference proposes a speculative mechanism that may or may not be operating at low temperature, and even if it is legitimate, probably only operates in the coldest regions of the summertime mesopause. A better reference to the classical (heterogeneous) nucleation is Keese, R. G. , 1989, Nucleation and particle formation in the upper atmosphere, J. Geophys. Res., 94, 14,63-14,692.

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