Response to anonymous referee #1

"Semidiurnal solar tide differences between fall and spring transition times in the Northern Hemisphere2

By J. Federico Conte et al. submitted to Ann. Geophys.

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General Comments:
This paper is dedicated to research of semidiurnal solar tide (S2) behavior during the fall and spring transition times in Northern Hemisphere. Radar wind measurements by three meteor radars located at different mid-latitude sites have been used to investigate above-mentioned tide. It is observed an evident decrease of S2 during every autumn while the time of the decrease occurrence varies from year to year. There is the spring decrease as well but it is not so sudden. The next task that has been performed is to assess the contributions of different semidiurnal tidal components. To solve this problem the Hamburg Model of the Natural and Ionized Atmosphere (HAMMONIA) has been used. It is obtained that during the fall both migrating (SW2) and non-migrating westward propagating (SW1) semidiurnal tidal components decrease during the fall. During the spring, they behave in different ways. The observed behavior of the total semidiurnal tide S2 is mainly driven by superposition of SW2 and SW1 components. This is a good paper, which provides the readers with new information on the seasonal variations of semidiurnal tides. I believe that it will be accepted for publication in Ann. Geophys. after minor revision without an additional review.
I recommend that authors consider the following comments when revising the manuscript.

We would like to thank this anonymous referee for taking the time to read and revise our manuscript. Below, you can find the response to each comment.

Specific Comments:

Page 2, lines 1-2: It should be noted that another possible source of non-migrating tides is a nonlinear interaction between migrating tides and stationary planetary waves (SPWs). The results obtained demonstrate that during seasonal transitions the SW2 and SW1 changes simultaneously. This fact indicates that they are not independent and connected through the nonlinear interaction with SPW1. It would be useful to include a short discussion of this possibility in the conclusion.
R: thank you for this comment. We have added a paragraph explaining why we did not consider non-linear interaction between tides and stationary planetary waves in our analysis (no substantial planetary wave activity was found in the model during the fall and spring times). Nevertheless, we would like to point out that some of the co-authors have recently published an article where they study non-linear interactions between the semidiurnal solar tide and SPW1 using wavelet transforms, but during sudden stratospheric warming events (He et al., 2017 https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1002/2017JA024630**).**

Page 3, line 5 and page 6, line 4: It is not clear why the different windows in analysis of measurements (21-days) and when the authors investigate the tides and planetary waves (30 days) have been used. The observations show a strong intra-seasonal variability of atmospheric tides and it is not correctly to use different bins in the analysis. For a future, I would like to suggest the complex Morlet wavelet transform to investigate the intra-seasonal variability of atmospheric tides.

R: Thanks for this comment. We now explain in the manuscript the reason for selecting different windows: the number of daily unknowns to be determined from the model outputs, at each pressure level, is 111. Squared, this is 12,321. A fitting window of 21 days would be large enough to obtain a solution after applying least squares (21 [days] x 8 [time points] x 96 [longitude points] = 16,128). However, in order to reduce the error of the fitting process and avoid some numerical artifacts, we instead used a window of 30 days.

Page 6, line 12: It would be useful to explain shortly the difference between the total semidiurnal tide (S2) and SW2+SW1 (at least when we consider the results of simulation).
R: Thanks for this comment. We have added a few sentences describing the difference between the total S2 tide and SW2+SW1.

Technical corrections:

Page 2, line9 and page 10, line 17: It is better to use "time interval" instead of "time period".
R: Thanks for this suggestion. We have changed "time period" to "time interval".