

Interactive comment on “Lower thermosphere – ionosphere (LTI) quantities: Current status of measuring techniques and models” by Minna Palmroth et al.

Anonymous Referee #1

Received and published: 9 August 2020

Overall quality of the manuscript (general comments):

The manuscript “Lower thermosphere - ionosphere (LTI) quantities: Current status of measuring techniques and models” by Palmroth et al. is a well written review of the lower thermosphere and ionosphere, with the focus on the open questions with a lot of them cannot be addressed without high-quality in-situ measurements and describing the state of the art of measuring this region. The manuscript is motivated by the Daedalus mission. In my opinion the manuscript is a very valuable contribution to the literature of the LTI region and will most likely be used by many researchers.

Addressing individual scientific questions/issues (“specific comments”):

C1

line 5: should the wind dynamo be mentioned?

Line 8: does directly mean “in-situ” or without any elaborate assumptions?

Line 17: I think the mesosphere was originally termed “ignorosphere” since it is too low for satellites and too high for airplanes and weather balloons. So maybe change “this region” to the “LTI region”

Line 44: “the motion of the atmosphere is driven by both solar irradiance and waves.” Do the authors mean thermal atmospheric tides caused by solar irradiance? Maybe reformulated so that it fits to the waves.

Line 85: There are other efforts of whole atmosphere models: WAM (), GAIA ().

Figure 2: Is the depicted neutral wind the total horizontal wind? Similar for the ion drift- is this the ExB drift and is the one perpendicular to the magnetic field?

Line 199: “total upward energy flux by resolved waves at 100 km” Does this refer to only 100km waves or also larger ones?

Line 201: “horizontal scales less than 200 km are poorly resolved” Shouldn’t waves be resolved with wavelengths approximately 4x the resolution? How does this fit to the 100km in line 199?

Line 518: “resolution ranges from one orbit to several days” It is not clear to me what is meant here? Orbit averaged to several day averaged? Is this temporal resolution-one measurement pre orbit or every few days?

Line 661: Maybe the Weimer (2005) empirical ion convection model based on DE-2 data could be mentioned

Line 715: section 3.6 Magnetic fields: I may have missed it but the summary does not mention that the Swarm was able to derive currents without any assumption of current flow due the constellation with nearby satellites. I find this an important point since at the end of the section, the E-region is mentioned and this is the region where

C2

strong currents flow. So the interpretation of magnetic fields with respect to current flow without constellation is a challenge (e.g. see the modeling of Maute & Richmond 2017). Maute, A., Richmond, A.D. F-Region Dynamo Simulations at Low and Mid-Latitude. *Space Sci. Rev* 206, 471–493 (2017).

Line 757: “which are essential also for FACs” It is not quite clear to me what this means? That FAC flows along magnetic fieldlines?

Line 773: “Above the E-layer, electrons and ions drift together and the ionospheric current vanishes.” I do not think the authors mean that there is no ionospheric current above the E-region as the sentence suggests. Could this be further explained?

Technical corrections at the very end (“technical corrections”)

Line 125: Fig 2. Remind the usual -> reminds of the

Figure 1: I suggest to add the altitude or pressure range of the plots. Does it go from the surface to approximately 500km?

Figure 2: It would be easier to add approximate solar local times to the geographic locations of the profiles in the captions.

Line 146: reference frames with the neutral gas velocity -> of the neutral gas?

Line 212: “In this topic, the” Should this read “in this study/review”?

Line 300: suggested: to the lower atmosphere

564: Should planetary waves be mentioned?

Line 600: Any reason to use speed instead of velocity?

Line 648: metre-> meter

Line 449: analyser -> analyzer (at least that is the spelling UTD is using)

Line 835: engineering grade magnetometer

C3

Line 1083: “propagating tides” upward propagating? Tides can also propagate eastward and westward. Not all tides reach the F-region.

Interactive comment on *Ann. Geophys. Discuss.*, <https://doi.org/10.5194/angeo-2020-42>, 2020.

C4