

Response to comments of reviewer #1 (in italics – marked yellow in article with tracked changes):

This paper presents a review of trends in the mesosphere, thermosphere and ionosphere based on results published during the period 2018-2022. It is important to understand how the upper atmosphere is modified by global climate change and such a study can be an interesting contribution to the topic. However, a major revision of the paper is needed before it can be published in ACP.

A long list of publications has been reviewed, but the paper appears to be a long list of results obtained by the authors. It is difficult for the reader to extract the main results and understand how recent publications have improved our understanding of trends in the mesosphere, thermosphere and ionosphere. At the end of each section, a summary of the main results should be provided. This is particularly true for the very long section on the mesosphere and for the section on the ionosphere.

*Each section (except for Introduction and Conclusions) has now separated Summary.*

Further remarks are listed below.

Section 2, problems in calculating long-term trends.

This section focuses mainly on the impact of solar activity in the calculation of long-term trends. This is an important contribution to consider because of the strong response of the upper atmosphere to the 11-year solar cycle. However, other problems may arise when calculating long-term trends, in particular the impact of atmospheric tides where the local time of measurement is not fixed or where there are trends in the tides that make the trend dependent on the local time.

*The following paragraph has been added to section 2: “It should be mentioned here that an important problem of some trend calculations may be atmospheric tides. The impact of atmospheric tides via data sampling might be important when the local time of measurement is not fixed or where there are trends in the tides that make the trend dependent on the local time. One more problem is that particularly ionospheric trends might be strongly seasonally and diurnally (local time) dependent up to the change of trend sign as it is demonstrated in section 5; this is not the effect of tides.”*

Section 3: Trends are generally given in K/decade or %/decade but in some cases in K/year (lines 262 and 263) or %/year (lines 377 and 416). Please homogenise.

*All was homogenized to “per decade”.*

Line 289: Observations at the Observatoire de Haute Provence are made by Raileigh lidar, not by Rayleigh radar.

*I replaced “radar” by “lidar”. I keep “Rayleigh” as this name is used by authors of the paper related to original line 289, Ardalan et al. (2022), and also in other papers cited by Ardalan et al. (2022).*

Lines 424-428 and 452-462 concern trends in wind measurements. Please group the two sections together.

*Original lines 452-462 describe trends in dynamics, in wind and atmospheric waves. On the other hand, original lines 424-428 describe trends in the length of summer, not in winds; wind is only used as a tool for definition of summer length. Therefore if you do not mind, I keep these two paragraphs separately where they were originally.*