A global empirical model of the ion temperature for IRI

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Description of ion temperature (Ti) in the upper ionosphere, topside ionosphere and plasmasphere is one of the very important tasks for understanding of thermal balance in this system. We present results of our effort in developing a new model of the ion temperature primarily intended for improvement of the International Ionosphere Reference (IRI) model.
We have re-examined ion temperature data from older satellites (primarily available from SPDF: https://spdf.gsfc.nasa.gov/pub/data/) and combined them with newly available and thus we included data from OGO-6 in 1969 to more recent C/NOFS, DMSP F-15 and the latest ICON in 2020. All data sets were included into a unified data-base comprising in total Ti data from 18 satellites. This data-base has been used for the development of a new global empirical model of Ti. The model includes variations with solar activity. The solar activity variations of Ti are represented by a correction term of the Ti global pattern up to the second order to include possible non-linear dependence. Due to the limited data coverage, the altitude range described by the model is from 300km to 900km covering only the region where generally Ti is higher than the neutral temperature (Tn) and lower than the electron temperature (Te). This approach is consistent with the current description of Ti in the IRI model. But instead of the one anchor point at 430km that IRI is using our approach includes several anchor points. At altitudes above 1000 km the ion temperature is merged with the electron temperature described by the IRI-2016/TBT-2012 option [1].
We present validation of the model by comparing it with recent measurements from other sources especially from incoherent scatter radars.
We will also discuss some peculiar features (e.g. morning overshoot) described by the empirical model using simulations made by the physical FLIP model.
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References

[1] Truhlik, V., Bilitza, D., Triskova, L., 2012. A new global empirical model of the electron temperature with the inclusion of the solar activity variations for IRI. Earth Planets and Space 64 (6), 531-543.