

Lognormal distribution of the observed and modelled neutral thermospheric densities

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For analyzing measurements of any kind, besides other things, it is important to estimate the probability distribution of the measurement errors. When modelling the observations using the least-squares fitting, the distribution of the errors plays a vital role in choosing the merit function (chi-square) to be minimized, as unnormally distributed errors (e.g. outliers, or displaying asymmetry around the mean) may substantially skew a least-squares fit of model parameters. Using the CACTUS accelerometer data covering heights of 230–750 km and other observations of different types, we will show that the statistical relationship between the commonly used semi-empirical models of neutral thermospheric density (MSIS, DTM) and the observed densities is consistent with lognormal distribution, i.e. the logarithm of the ratio of the measurements to the predictions is approximately normally distributed. Some of the consequences of this experimental fact for neutral thermosphere modelling will be discussed.