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Interactive comment on “Validation of the Aura High Resolution Dynamics Limb Sounder geopotential heights” by L. L. Smith and J. C. Gille

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Dear Anonymous Referee #1, thank you for your comment.

Your comments re. page 1006 are helpful. Referring to this quantity as precision rather than uncertainty is a convention in the field of satellite instrument development. We will consider changing this throughout the paper to facilitate understanding.

Re. page 1007: The geopotential height is the height above the geoid, a surface of constant gravitational attraction over the Earth. This could be thought of as sea level over the ocean. This has many irregularities due to the presence of mountains, oceans, underground irregularities of rock density, etc. For many purposes it is acceptable and convenient to use the ellipsoid, a more regular and more easily used shape. The height

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of the Aura S/C was referenced to the ellipsoid.

Re. ERA-Interim data: The European Centre for Medium-Range Weather Forecasts interim reanalyses (ERA-Interim) is the latest global atmospheric reanalysis product created by ECMWF and describes the state of the atmosphere from 1 January 1989 onwards. ERA-Interim produces global estimates of the basic dynamical fields that are consistent with observations and physical coherence, i.e. the estimated parameters must be consistent with the laws of physics. The ERA-Interim reanalysis is produced via a sequential data assimilation scheme in which available observations (approximately 10^7 per day as of 2010) are combined with prior information from a forecast model to estimate the evolving state of the atmosphere and its underlying surface. The ERA-Interim data were validated via predictions of future observations and accurate representations of variability on interannual and decadal time scales. For these reasons, and since as the referee mentions, ERA-Interim utilizes data from multiple instruments on multiple platforms, including sondes and satellites, as well as an excellent forecast model, we consider it to be a valuable dataset for comparison. Specifically, we utilized the standard daily global ERA-Interim geopotential height, zonal wind, and meridional wind fields.

For more information about ERA-Interim, please see: Dee, D. P., Uppala, S. M., Simmons, A. J., et al., 2011: "The ERA-Interim reanalysis: configuration and performance of the data assimilation system," *Quart. J. Roy. Met. Soc.*, 137, 553-597. DOI: 10.1002/qj.828. and references therein.

Regarding ERA-Interim precisions and/or accuracies: Poli et al (2010) discuss assimilating radio occultation data in ERA-Interim and observe adding such data improves the standard deviation fit of the ERA-Interim reanalysis to radiosonde temperature and wind observations. Since geopotential height and temperature are so closely related, presumably ERA-Interim geopotential heights have similar improvements, and the same accuracy as radiosonde temperature and wind observations

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For more information, please see: Poli, P., Healy, S.B., Dee, D.P., 2010: “Assimilation of Global Positioning System radio occultation data in the ECMWF ERA-Interim reanalysis,” *Quart. J. Roy. Met. Soc.*, 136, 1972-1990. DOI: 10.1002/qj.722. and references therein.

The authors would welcome any additional information about quantitative ERA-Interim precisions and accuracies.

Re. geopotential height biases: It is possible we overuse the word “bias.” In most instances we mean merely differences of HIRDLS data with respect to other data. It is not definitive which dataset(s) are closest to “the truth.” However, since the HIRDLS version 7 temperatures have a useful range of 1000–0.0042hPa with estimated accuracies of +/- 1K for pressures above 10hPa and +/- 2K for pressures less than that, and HIRDLS GPH is created via these temperatures, we strongly suspect the HIRDLS GPH are close to the truth, particularly above 1hPa. Notice there are very few other existing GPH datasets above 1hPa. Possibly our language is too tentative; we’re examining this.

Re. additional figures: The referee’s suggestion to include the referenced figures comparing HIRDLS GPH with GEOS5, WACCM, and NCEP/NCAR via some other medium is a great idea. We are working with the AMT editorial staff to include all referenced figures as supplementary materials.

Re. readability of fonts: The original figures were all significantly larger and thus reduced in size for inclusion in the paper. Increasing all the font sizes in figures is a very good idea. We’re implementing this.

Re. the standard deviation color bar: The original standard deviation color bar was created to be the same as the color bar for the mean for easy comparison. However, since there are no negative standard deviations, it does make sense to include only positive values in the color bar.

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