

Review of the paper:

Exploring earth's atmosphere with radio occultation: contributions to weather, climate and space weather
by R. Anthes

My comments are based on a web version, which I've downloaded end of February.

Congratulations, the paper is a wonderful review of the GPS radio occultation technique and lights several aspects in more detail, where the GPS RO has advantages compared to other atmospheric measurements techniques. There is not much potential for improvements.

I recommend to publish the paper nearly as it is and suggest only minor modifications and some additional references based on my personal view.

page 136, Abstract

may be adding GPS in front of RO is better

page 136, Introduction

The Science paper from Kursinski (1996) wrt GPS/MET should be cited here. Another appropriate non-US and often cited paper, and one of the very early and excellent GPS/MET studies is Hocke (1997). See below.

page 137

May be GRACE (already introduced in the abstract) can be mentioned here also, since it was operational and assimilated (together with CHAMP) before the COSMIC measurements (MetOffice, Sept. 2006). References with more information on the history of the GRACE measurements is in Wickert et al., 2009 (see below). May be the operational effort, which was made with CHAMP/GRACE before COSMIC can be somehow better mentioned here, but it is not a must. (It was one of the reasons that COSMIC could be assimilated so early after launch).

I also add a very recent reference regarding TerraSAR-X (Beyerle et al., 2011), which can be cited here or at another part of the paper (since it was available late after launch of COSMIC).

page 141, line 9

The high "theoretical" accuracy ..

is a bit misleading, it seems that practical GPS RO is not accurate, please think on another formulation.

page 148, climate applications

e is missing Foelsche

may be the effort of the GFZ group can be cited here, they did initial tropopause investigations (already published in GRL 2008), a more recent paper, giving an update to this paper is:

page 152

Since the cited sporadic E investigations are of major interest here, I suggest (if wanted) to cite a more detailed paper on these results (Arras, 2010) see below is the related complete PhD work and contains much more information on these investigations.

page 158

Foelsche (missing e)

Fig. 2

Are 2 similar pictures here ok?

Schmidt, T., Wickert, J., and Haser, A., Variability of the upper troposphere and lower stratosphere observed with GPS radio occultation bending angles and temperatures. *Advances in Space Research*, 46, 2, 150-161, DOI: 10.1016/j.asr.2010.01.021, 2010.

Arras, C., A Global Survey of Sporadic E Layers based on GPS Radio Occultations by CHAMP, GRACE and FORMOSAT-3 / COSMIC, Scientific Technical Report STR10/09, German Research Centre for Geosciences, GFZ, ISSN 1610-0956, Potsdam, 2010.

Beyerle, G., Grunwaldt, L., Heise, S., Köhler, W., König, R., Michalak, G., Rothacher, M., Schmidt, T., Wickert, J., Tapley, B. D., and Giesinger, B.: First results from the GPS atmosphere sounding experiment TOR aboard the TerraSAR-X satellite, *Atmos. Chem. Phys.*, 10, 28821-28857, doi:10.5194/acpd-10-28821-2010, 2010.

Wickert, J., Michalak, G., Schmidt, T., Beyerle, G., Cheng, C. Z., Healy, S. B., Heise, S., Huang, C. Y., Jakowski, N., Köhler, W., Mayer, C., Offiler, D., Ozawa, E., Pavelyev, A. G., Rothacher, M., Tapley, B., Arras, C., GPS radio occultation: results from CHAMP, GRACE and FORMOSAT-3/COSMIC. *Terrestrial Atmospheric and Oceanic Sciences*, 20, 1, 35-50, DOI:10.3319/TAO.2007.12.26.01(F3C), 2009.

Hocke, K., Inversion of GPS meteorology data, *Ann. Geophysicae*, 15, 443-450, 1997.