Atmos. Meas. Tech. Discuss., 5, C3197–C3199, 2012
www.atmos-meas-tech-discuss.net/5/C3197/2012/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Zernike polynomials applied to apparent solar disk flattening for pressure profile retrievals" *by* E. Dekemper et al.

M McHugh (Referee)

mchugh@gats-inc.com

Received and published: 11 December 2012

Overview

This paper presents an improved approach for refraction-based pressure/temperature sounding applicable to future solar occultation instruments. Refraction-based retrievals have recently been used successfully in the AIM mission and represent an important and powerful remote sensing capability. This paper explores a natural follow-on to the approach used in AIM. The authors describe a method that exploits the information from the not only the distortion of the outline of the solar disk, but the intensity variations across the Sun as well.

Their approach requires only a sequence of images of the Sun during an occultation, which they decompose into a set of orthogonal components (Zernike polynomials). There are essentially no pointing requirements, and the measurements can be broadband at any wavelength. This makes the technique very attractive and robust, and applicable to a wide variety of future missions. Using this decomposition presents the opportunity for fast onboard processing that relaxes downlink requirements.

Their simulations are based on the imagers on ACE/SciSat, and this approach is part of the proposed ALTIUS mission, but it has a much broader scope can be accommodated on nearly any solar occultation satellite instrument.

Comments

The general approach is very interesting and has a number of useful features, for example, the ability for fast onboard processing. Higher spatial resolution will directly improve results, but the data throughput increases with the square of the resolution, so onboard processing can be important.

Because this work represents the assessment of an important observational strategy, it would benefit from a more comprehensive set of simulations and error analyses. For example, random noise is generally the easiest to deal with, whereas dead pixels and optical imperfections typically cause more problematic issues (e.g. ACE Sci/Sat). Furtheromore, a set of ten random profiles is hardly sufficient to generate sufficient statistics. Also, it would be useful to see the actual temperature profiles used, not just the first three Zernike moments.

The issue of vertical resolution is not well addressed. It's not clear to me that the look-up table approach will be advantageous in resolving very sharp vertical temperature gradients. Suppose retrievals with ~100 m vertical resolution are needed in practice. What effect would that have on the computational burden?

In the parameterization by ω, I wondered, are there any deleterious effects if the orbit is elliptical, i.e. when dω/dt is changing during the occultation?

As discussed in the conclusion, what happens in the presence of clouds is an interesting question, and would be a nice topic to explore in a follow-on study.

I'm not sure why the pressure errors get so small at 80 km. DId I miss this explanation?

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 7535, 2012.