

# ***Interactive comment on “Single Footprint Retrievals for AIRS using a Fast TwoSlab Cloud-Representation Model and All-Sky Radiative Transfer Algorithm” by Sergio DeSouza-Machado et al.***

## **Anonymous Referee #1**

Received and published: 26 September 2017

### General comments:

Most operational hyperspectral retrieval systems perform cloud-clearing of the observed radiances before the atmospheric parameters are retrieved. The process of cloud-clearing has some significant drawbacks; it not only introduces errors (and fails under certain cloud conditions) but also reduces the spatial resolution from single footprint resolution to a 3x3 footprint array. Larger footprints prevent accurate retrieval of small-scale atmospheric features and parameters, which are highly variable such as water vapor. Deriving accurate temperature and sounding profiles under cloudy condi-

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tions is still a challenging task, but detailed information about the vertical atmospheric structure for every single footprint is absolutely necessary to have a positive impact in weather, environmental and climate applications. This paper describes a retrieval method, to be used eventually in operations, that uses a forward model with a two-slab cloud presentation and an optimal estimation technique to retrieve temperature and humidity profiles for every single footprint. A detailed description of the retrieval approach and its proof-of-concept is given, and promising results are shown, evaluated and discussed adequately. I recommend the paper for publication after minor revision, which should include a careful rewrite of the material in more concise, coherent sentences and paragraphs.

Specific Comments:

Page 2, lines 4-8: In addition to (or instead of) citing [Weisz et al. 2007] I suggest the following more recent paper

Weisz, E., W. L. Smith Sr., and N. Smith (2013), Advances in simultaneous atmospheric profile and cloud parameter regression based retrieval from high-spectral resolution radiance measurements, *J. Geophys. Res. Atmos.*, 118.

Furthermore, Kahn et al. (2014), who also performs cloud parameter retrievals on individual scenes, should also be mentioned here first rather than on page 30.

Regarding climate studies, a publication worth mentioning is

Smith, N., W. L. Smith, E. Weisz, and H. E. Revercomb (2015), AIRS, IASI, and CrIS retrieval records at climate scales: An investigation into the propagation of systematic uncertainty, *J. Appl. Meteorol. Climatol.*, 54, 1465–1481.

which describes change in the climate system using single field-of-view hyperspectral retrievals under all sky conditions.

Section 2.1: Please state which AIRS channel property file you are using to extract the 'good' channels as well the corresponding NEDT values (shown in Fig. 2)

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Section 2.3.2: Can you state what version of PCRTM is used here?

Section 4.2: the motivation for using the 1231  $\text{cm}^{-1}$  channel in the figures and results that follow should be clearly stated here first. It would be also useful to state the corresponding wavelength and the MODIS band equivalent.

Technical Comments:

Please make sure the manuscript undergoes thorough and careful editing. Many sentences are too long, unclear and/or confusing, and the usage of abbreviations, parentheses, spacing, etc. is inconsistent. For instance,

Page 3, line 3: remove 'could'

Page 3, lines 13-15: this sentence is unclear, please rewrite

Page 6, line 13: use 'added' instead of 'adding'

Page 6, line 26: add space after 'does'

Page 7, line 3: add space after the comma in (CLWC, CIWC)

Page 11, line 18: use lower-case "L" in 'TwoSlab'

Page 11, lines 19-21: should be 'become' (not 'becomes'), 'show' (not 'shows'), and 'are much smaller' instead of 'is much smaller'.

Page 11, line 26: use 'were proportional' (not 'was proportional')

Pages 11, 14, 15 etc.: 'SARTA TwoSlab' or 'SARTA/TwoSlab'? Please use consistent terminology.

Page 13, line 13: remove the comma after 'differences'

Page 13, line 15: inconsistent use of parentheses for in-text citations (throughout the paper)

Page 14, line 10: (PDFs) instead of (PDF)s.

Page 14, line 13: please rewrite 'as is evident in from Figures 4 and 5'

Page 16, line 1: use 'shows' instead of 'plots'

Page 16, line 3: there is a space missing after the comma in (1),(2)

Page 16, line 6-7: suggest using 'decreases' instead of 'lowers'

Page 16, line 21: 'led' instead of 'lead'

Page 17, line 2: use either 'pdfs' or 'PDFs'

Page 17, line 17,18: please rewrite "They could either at too low an . . ."

Page 20, line 23: use 'is a block diagonal matrix' instead of 'is block diagonal'

Page 21, line 3: 'physically-based' (not 'physically-gased')

Page 21, line 29: add full name for MERRA

Page 24, line 9: delete repeated 'after the retrieval'

Page 24, lines 15-16: remove parentheses

Page 27, line 4: remove "]" after 14

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2017-261, 2017.

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