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Atmospheric Measurement Techniques Discussions

Interactive comment on "Application of tomographic algorithms to Polar Mesospheric Cloud observations by Odin/OSIRIS" *by* K. Hultgren et al.

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General Discussion

Observations of polar mesospheric clouds (PMCs) reveal substantial amounts of complex structure in both vertical and horizontal directions. Satellite measurements of PMCs typically resolve one of these directions well, while averaging extensively in the other (e.g. limb scanning can detect fine vertical structure, but averages over a long horizontal path). However, if sufficiently frequent limb scanning measurements are available, these data can in principle be inverted to determine the original 2-D field that

is being sampled.

This paper uses special data sets from the OSIRIS instrument on the Odin satellite to reconstruct the PMC field for specific orbits using tomographic inversion. By limiting the vertical range of the limb scans to the PMC altitude region, the sampling frequency was increased enough that horizontal structure at a scale of $\sim$350 km could be resolved simultaneously with the vertical structure at 1-2 km resolution. In comparison, while the CIPS instrument on the AIM satellite can resolve PMC horizontal structures at finer scales, it does not retrieve any information about vertical structure.

Confirmation of the new OSIRIS results through comparisons with CIPS data, as discussed in Section 6, would be valuable. Since the measurements needed for tomographic analysis require OSIRIS to be operated in a special mode, it is suggested that further such measurements be coordinated with CIPS observations as needed to maximize opportunities for comparative studies.

Specific Comments

1. p. 3700, line 12: The number of iterations required to get convergence for the volume emission calculations seems fairly high. Are there any concerns about the computational time required for this step? Would it be useful to loosen the convergence requirements to lower the number of iterations needed?

2. p. 3702, lines 10-14: How does the simulated noise level compare with typical OSIRIS mesospheric data? How does it compare to the special short scans?

3. p. 3703, lines 20-22: Does the MSIS climatology provide sufficient accuracy for the density profile? Would data from recent satellite missions such as SABER or ACE be more useful?

4. p. 3704, lines 7-11: The tomographic mode reduces the altitude range covered by a factor of 6-9, which should lead to the same change in horizontal distance between scans, assuming the same nodding speed for the Odin spacecraft. The nominal scan-

ning speed of 0.5 km/sec corresponds to a duration of 30 seconds for the 73-88 km scans and 22 seconds for the 77-88 km scans, which gives horizontal separations of 210 km and 154 km respectively. This can be compared with a typical separation of $\sim$500-1000 km as reported by Petelina et al (2006). Can you estimate the minimum number of scans (or maximum horizontal separation) needed for the successful use of the tomographic analysis technique? Would it be possible to apply this technique to normal OSIRIS data?

5. p. 3705, lines 4-6: The retrieved PMC structure appears to ignore possible false detections below $\sim$80 km that are typically an issue with limb PMC observations. The on-line figures also generally show this behavior, although those figures only cover the vertical range 80-85 km. Is this a consequence or result of using the tomographic technique?

Technical Corrections

p. 3696, line 16: "trough" should be "through"

p. 3702, line 11: "reproduce" should be "reproducing"

p. 3706, line 15: "25 m2" should be "25 km2"

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 3693, 2012.