ESL AND CUTLSOM: A brief report on cloud detection work

John J. Remedios, Reinhold Spang,
Grant Allen and David Moore
University of Leicester, U.K

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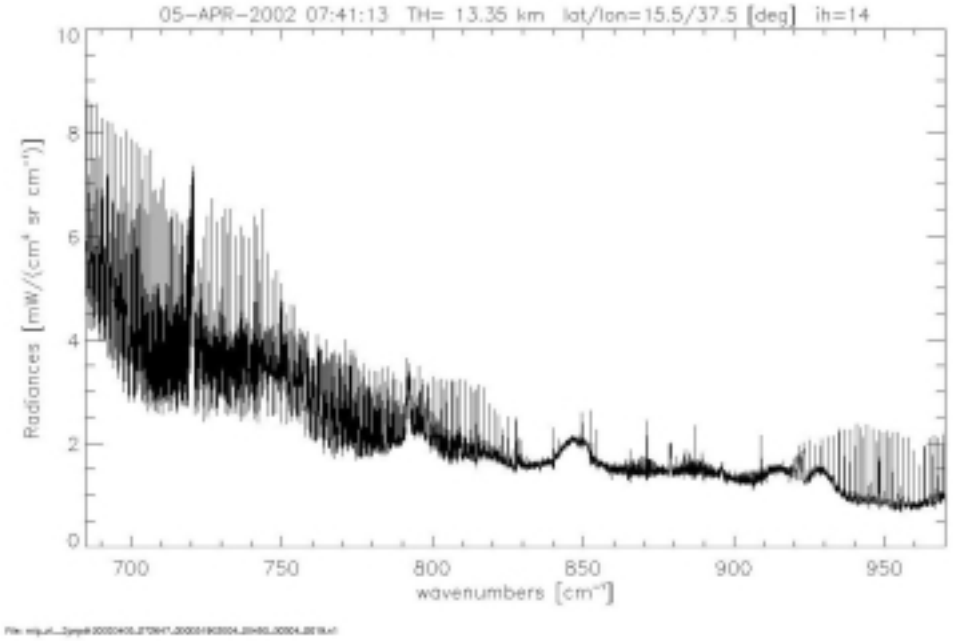
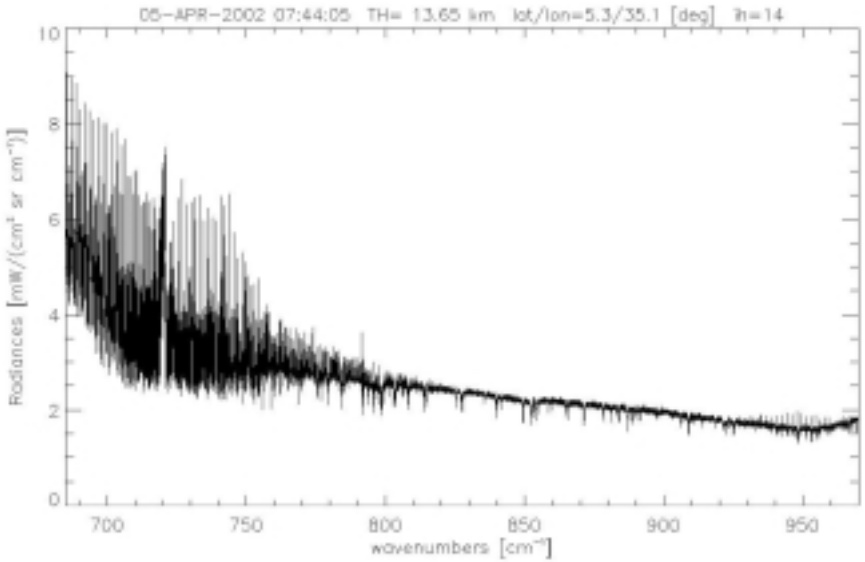
Cloud index work

- **All work shown has been performed on Orbit 504 data.**
- **Progress includes software to:**
  a) **Read level 1b data**
  b) **Read level 2 data**
  c) **Derive cloud indices**
  d) **Employ cloud index information in conjunction with level 2 data.**
  e) **Examine variations of key parameters around the orbit.**
- **The chief focus, at this stage, is on examining the effects of clouds on the MIPAS retrievals.**
- **In the following plots, it is always the line-of-sight altitudes that are plotted for consistency between level 1b and level 2.**

Cloud spectra

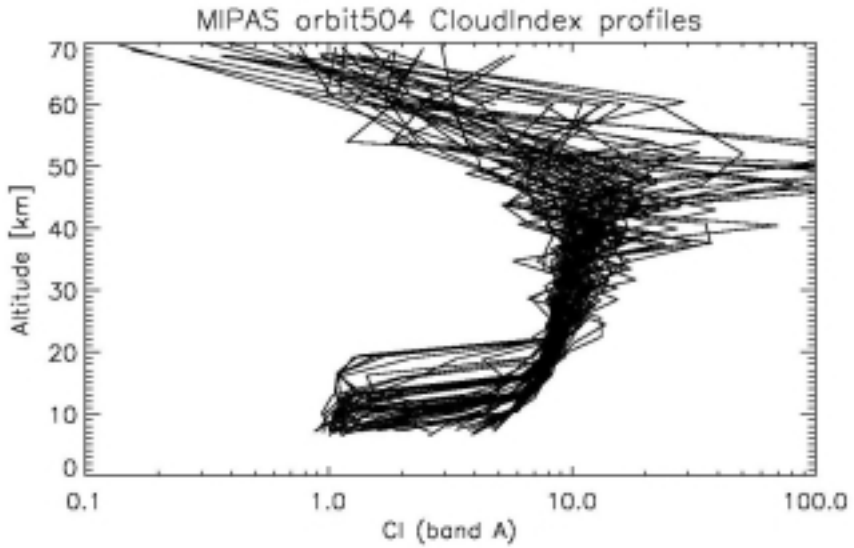
- **Spectra have been examined for evidence of cloud effects.**
- **For the thickest clouds (right hand plot), there is clear evidence of absorption lines rather than emission lines.**





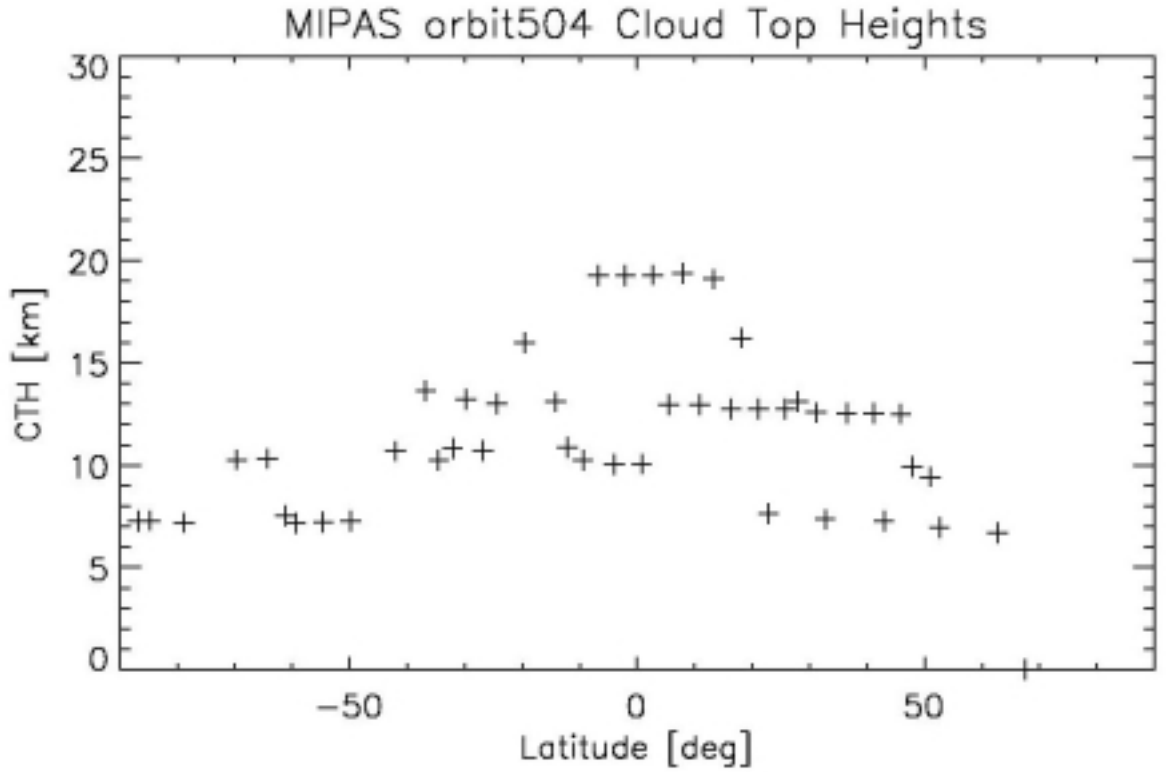
Cloud index profiles

- **Cloud index profiles have been derived from the primary pair of MIPAS microwindows for clouds.**
- **Initial results shows that to use a threshold near 2, the upper altitude for the threshold test will most likely have to be reduced below 50 km because of the signal-to-noise effects.**



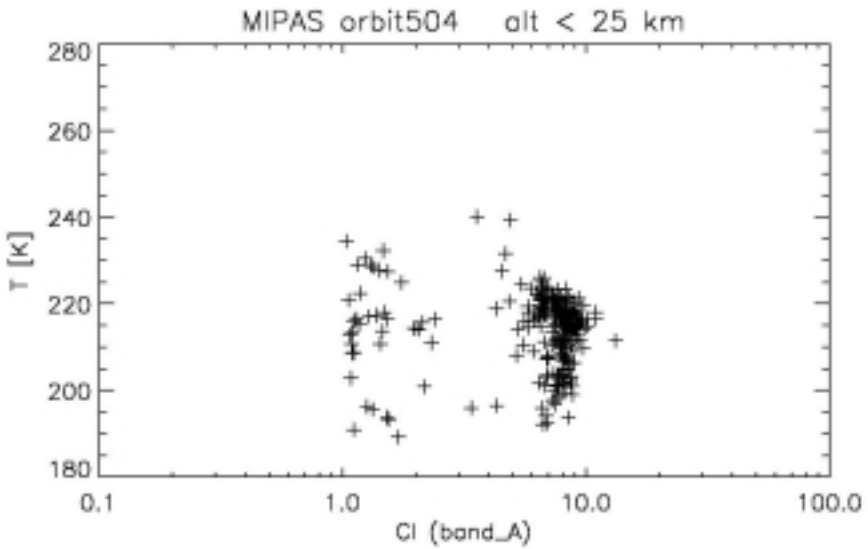
Cloud top heights

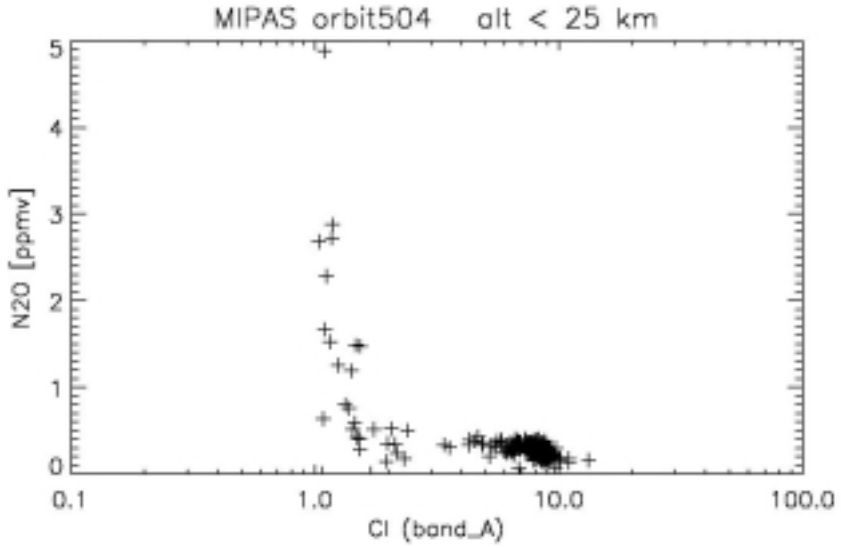
- **“Cloud top heights” have been calculated for each profile and are plotted here as a function of latitude and profile number.**
- **These data can also be provided as a fn. of profile no.**



Cloud influences on level 2 retrievals of T/p, vmr data

- **Cloud influences on retrieved data have been examined by a) using scatter plots and b) examining contour maps.**

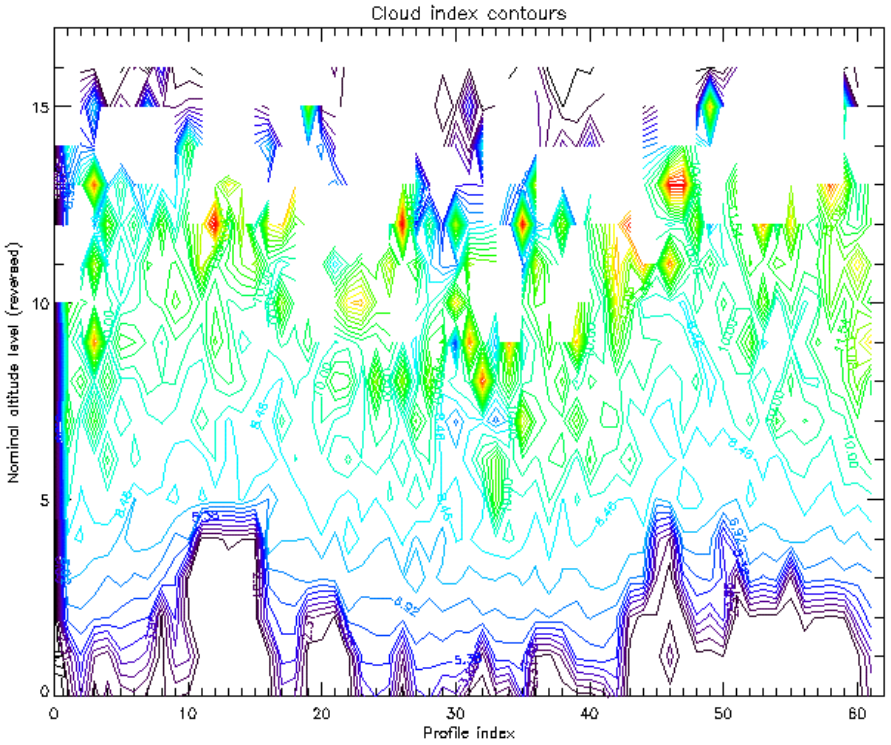


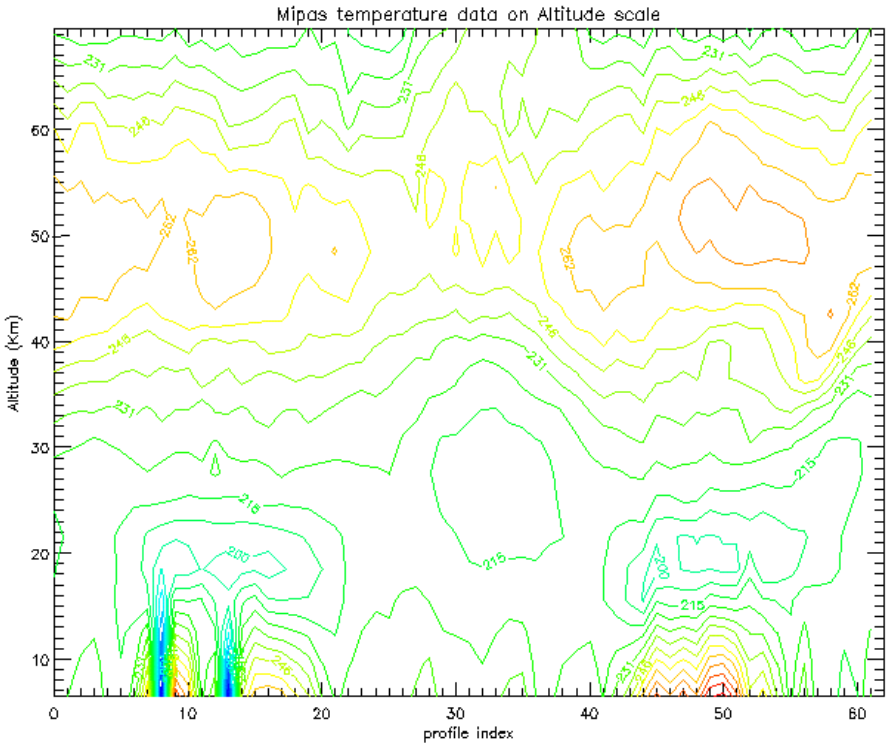


- **Cloud influences on N_2O are obvious from these plots although further work is needed on the critical region near the threshold value. We have found similar results for O_3.**
- **Cloud influences on T are also important but are less easy to see from these plots (see next plots).**

Cloud errors in retrieved temperature

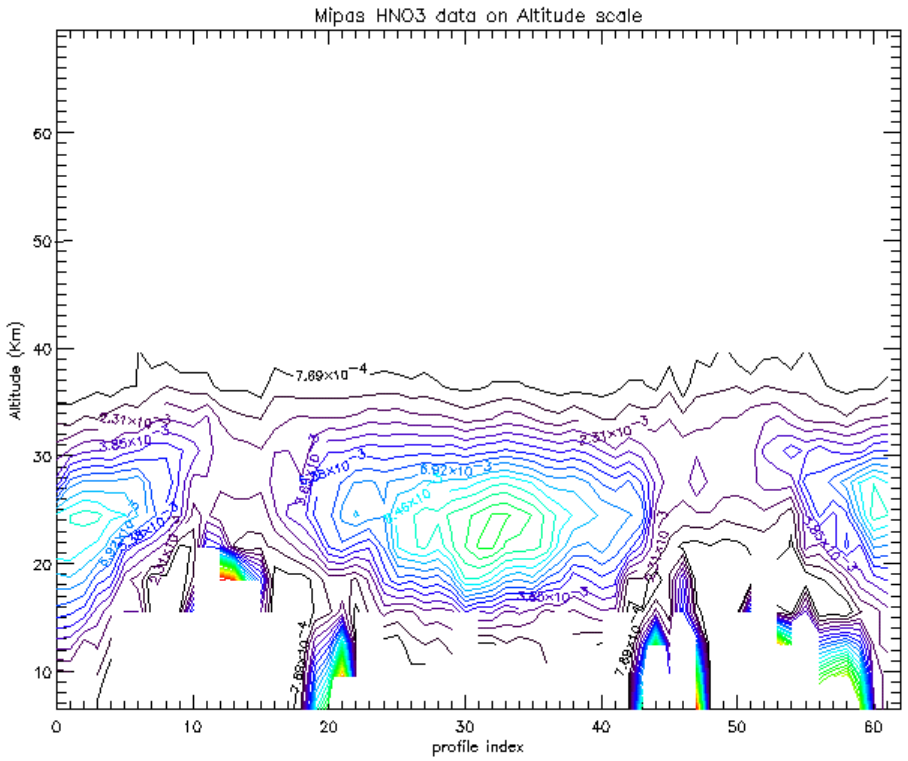
- **The steep gradients in the cloud index plot (left hand side) show clouds at the bottom of the atmosphere.**
- **Associated temperature anomalies are shown in the right hand plots. Errors in T due to clouds are now much more obvious.**

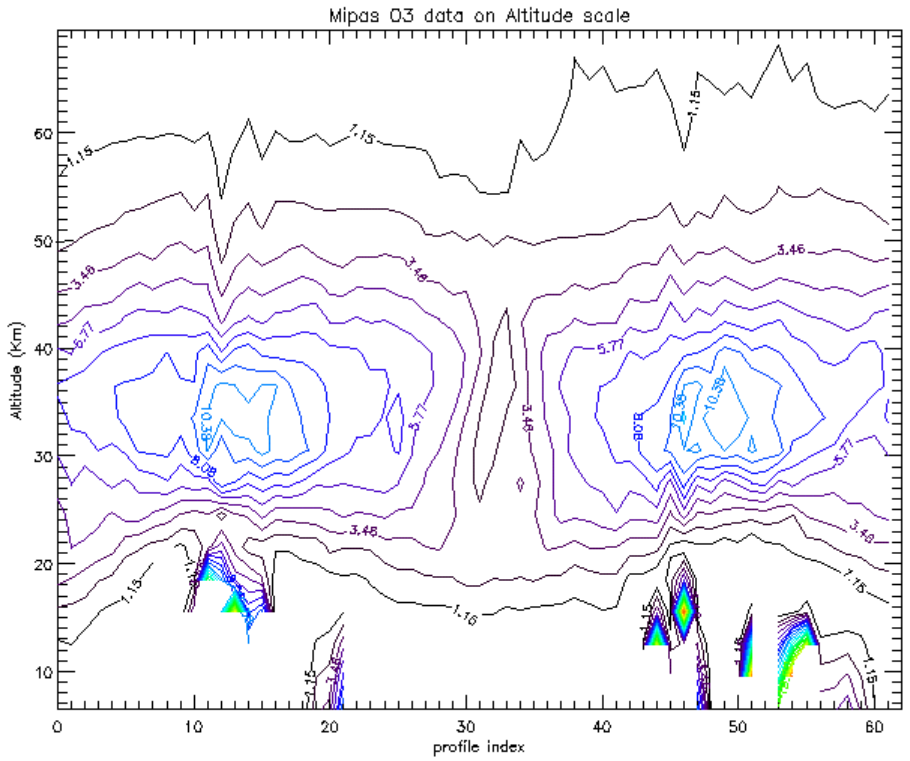




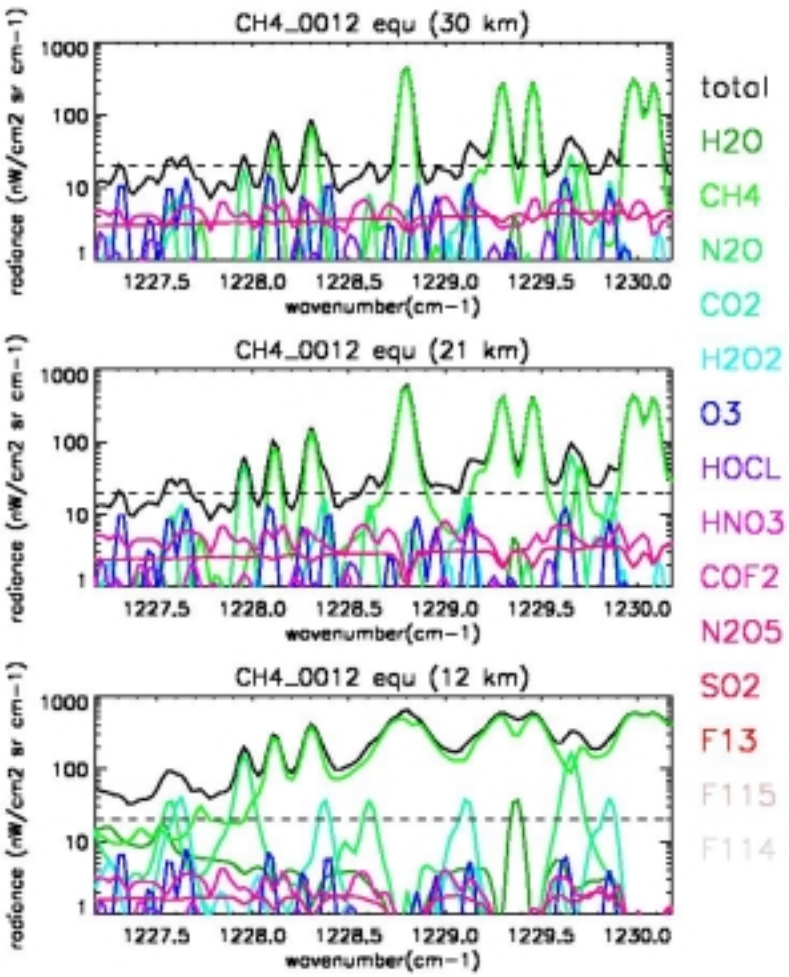
Cloud errors in retrieved VMR

- **Errors at low altitudes are also obvious in these plots for HNO_3 and O_3. Clouds are the most likely explanation.**



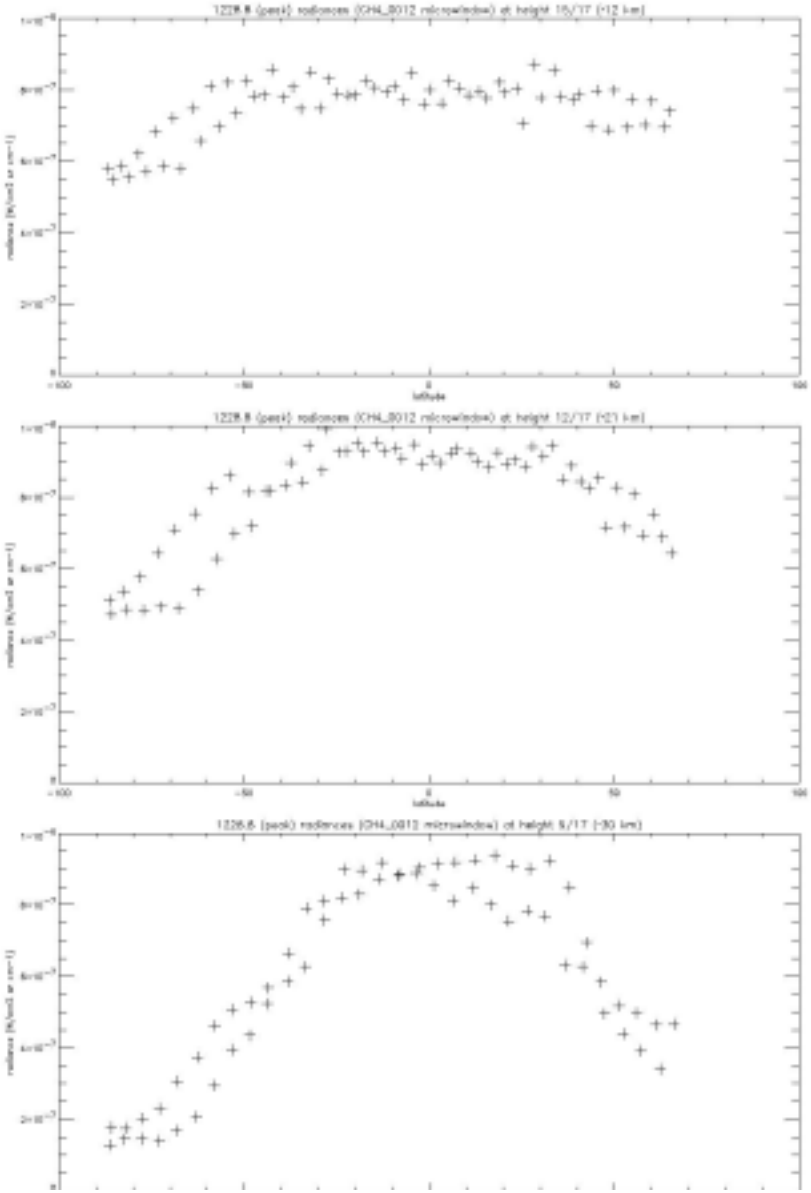


Clouds from microwindows I



- **It is also possible to look at cloud information from microwindows (MW) such as the CH4_0012 operational MW.**
- **The plots show the signatures of the CH_4 lines and other contributing gases.**
- **We have examined the peak of the CH_4 line at 1228.8 cm^{-1}.**
- **We have also examined the ratio of the signal at 1228.8 cm-1 to the average of the signals from 1227.175 cm^{-1} to 1228.0 cm^{-1}**

Clouds from microwindows II

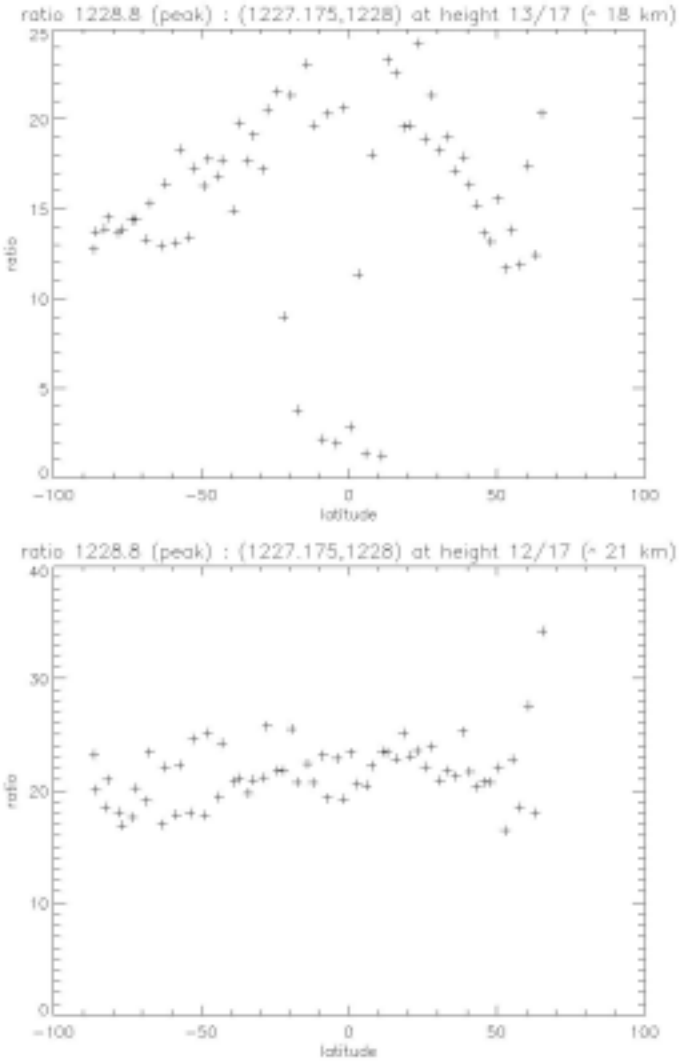


The figures show the radiance signal, as a fn. of latitude at

- **approx. 12km (top)**
- **approx. 21 km (middle)**
- **approx. 30 km (bottom)**

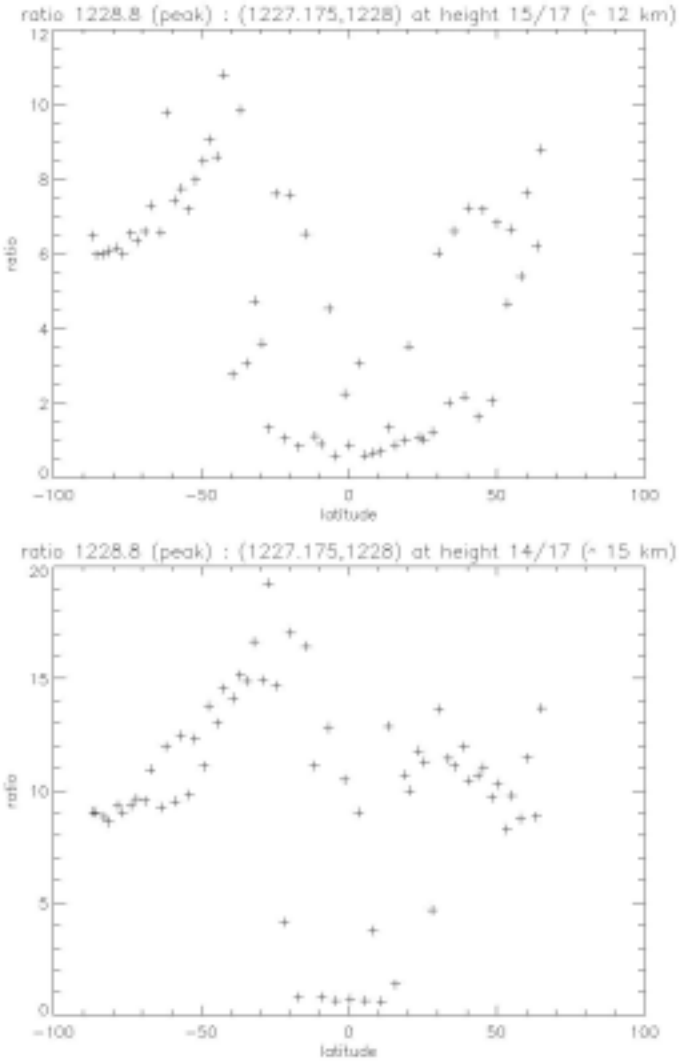
The general behaviour is quite smooth. There are some offsets in signal level between the ascending and descending parts of the orbit.

Clouds from microwindows III



- **The ratio of the signal at 1228.8 cm-1 and average(1227.175 to 1228 cm-1) is plotted:**
  - **approx. 18 km (top)**
  - **approx. 21 km (bottom)**
- **At 21 km, no values close to UNITY are seen.**
- **At 18 km, a number of events with ratios less than 5 are seen and in fact there are two events close to 10. A strong reduction in the ratio towards unity is expected when clouds are present.**

Clouds from microwindows IV



- **The ratio of the signal at 1228.8 cm-1 and average(1227.175 to 1228 cm-1) is plotted again:**
  - **approx. 12 km (top)**
  - **approx. 15 km (bottom)**
- **With decreasing altitude, the ratios become closer to unity for some profiles and there is an increase in the number of profiles which are affected.**
- **Therefore, it seems possible to indicate cloud locations from information within a particular MW (at least for some MW).**

SUMMARY

- **Tests have been performed on the 1st pair of cloud microwindows and these indicate good performance with only a small adjustment of the height range for the cloud tests.**
- **Cloud locations can be provided from analyses at Leicester.**
- **The influence of clouds on the level 2 T/VMR can be seen through plotting the retrieved products versus cloud index. Further investigations will be performed.**
- **The clouds can also be detected using data within a PT/VMR microwindow, at least for some MW (in this case, tests were performed on CH4_0012).**