

MIPAS REC Analysis

(Residuals and Error Correlation)

Anu Dudhia

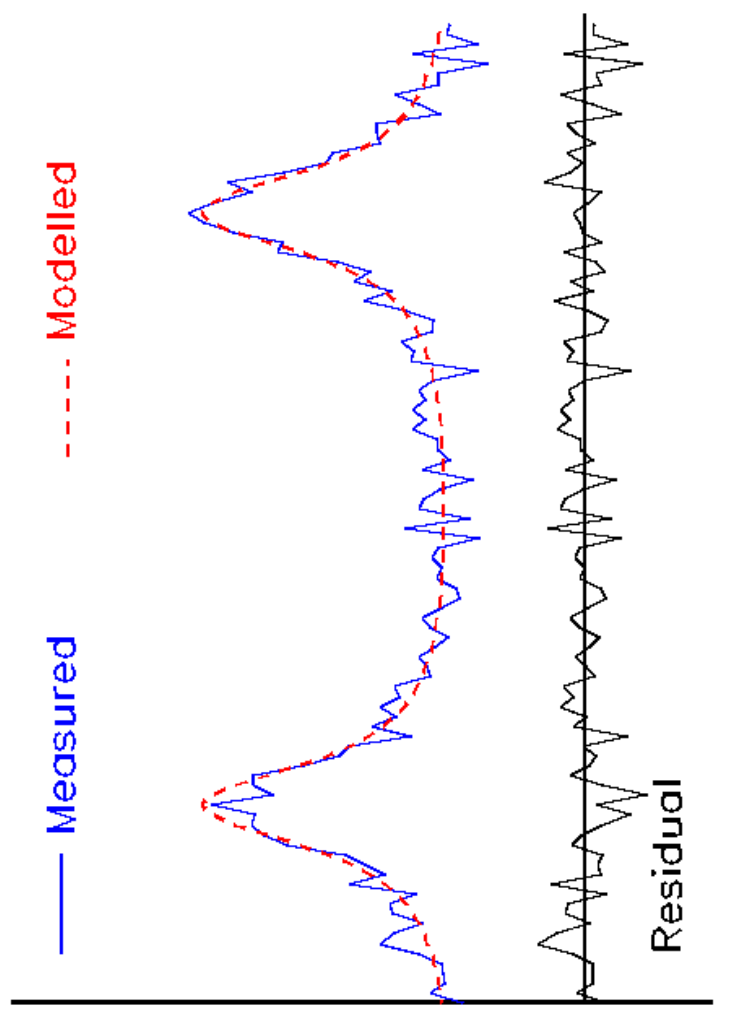
Atmospheric, Oceanic and Planetary Physics

University of Oxford

Residual Spectra

Ideally, the retrieval adjusts the profile until the *modelled* emission from the target species best matches the *measured* spectra.

The *residual* is the remaining difference, which should just be the random measurement noise.

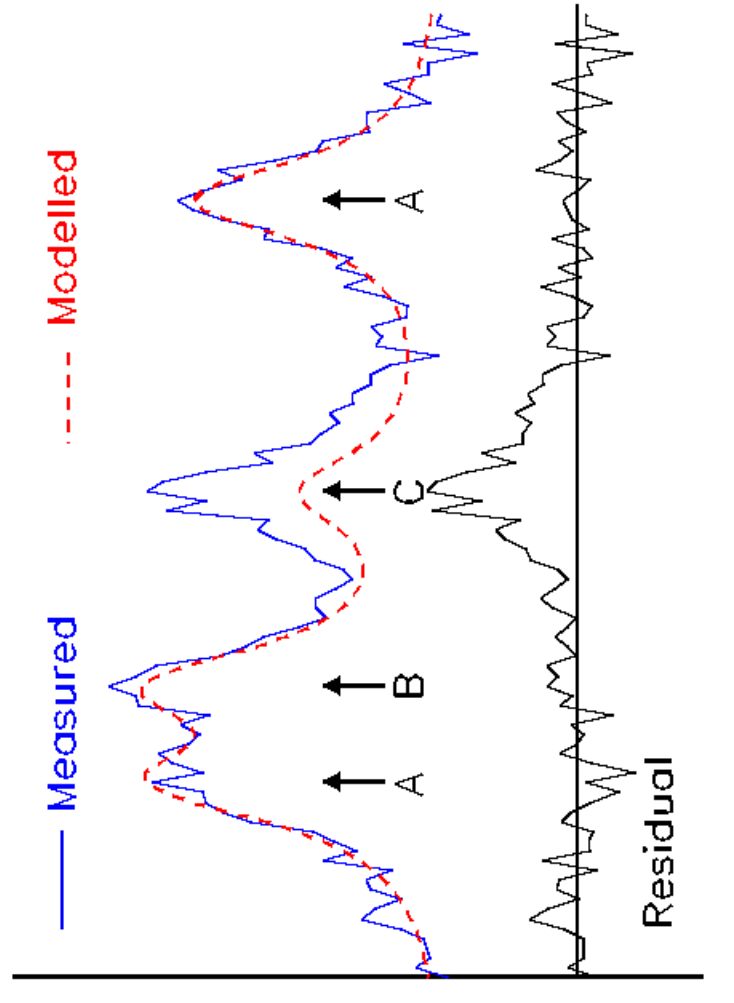


Residual Spectra - Foreign Lines

In practice, microwindows contain emission lines not only from the target species (A), but also foreign species (B,C) whose profiles have to be assumed.

If these are correctly modelled (B) there should be no signature in the residual.

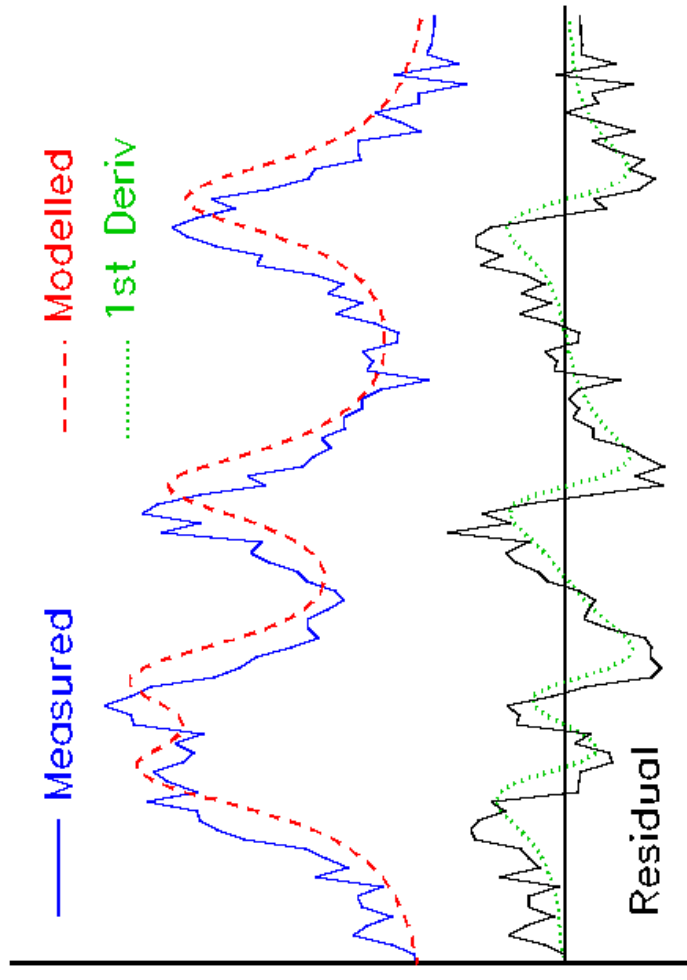
If the foreign species are over/underestimated (C), they will contribute a residual signature.



Residual Spectra - Instrumental effects

Instrumental effects may also show up as signatures in the residuals.

For example, a spectral shift due to calibration errors has a signature similar to the 1st derivative of the modelled spectrum.



Correlations With Error Spectra

- ◆ Identifying the source of residual signatures can be a time-consuming process
- ◆ 'Error spectra', representing the difference spectra due to 1-sigma perturbations of variety of error sources have already been computed as part of the microwindow selection
- ◆ REC analysis is simply a statistical correlation between the residuals and these error spectra - high correlation suggests probable source
- ◆ Primarily intended as part of validation of retrieved products, but clear 1st derivative signature has already been observed...

Example with actual MIPAS data

- ◆ Plot shows results of fitting 1st derivative spectra to residuals from each retrieval microwindow averaged over orbit 504
- ◆ Clear trend across spectrum, and possibly with tangent altitude (shown by different colours)
- ◆ Note, for comparison that the assumed calibration uncertainty is $\pm 0.001 \text{ cm}^{-1}$

