MIPAS Microwindow Selection

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Microwindows

Microwindows are small subsets of the complete spectrum selected to

- Maximise the information on the target molecule for the retrieval
- Minimise the contribution of other sources of error

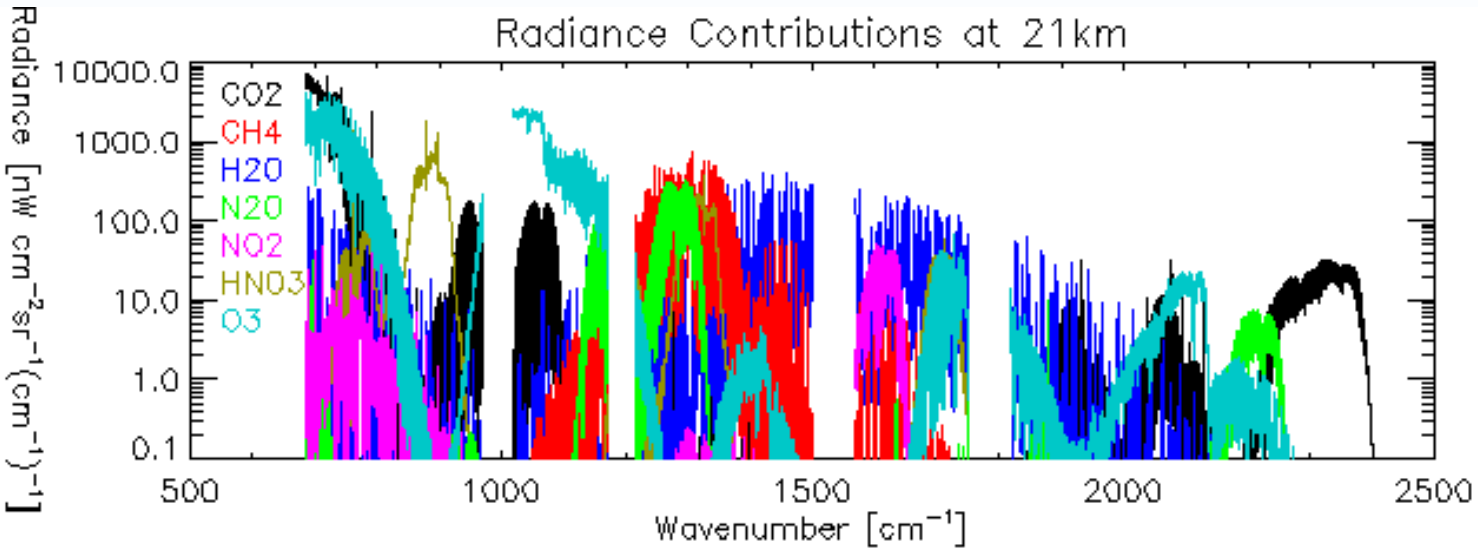
Traditionally, microwindows have been selected subjectively, but for MIPAS an objective selection has been used based on minimising the *total error covariance* S^{tot} of the retrieved profile

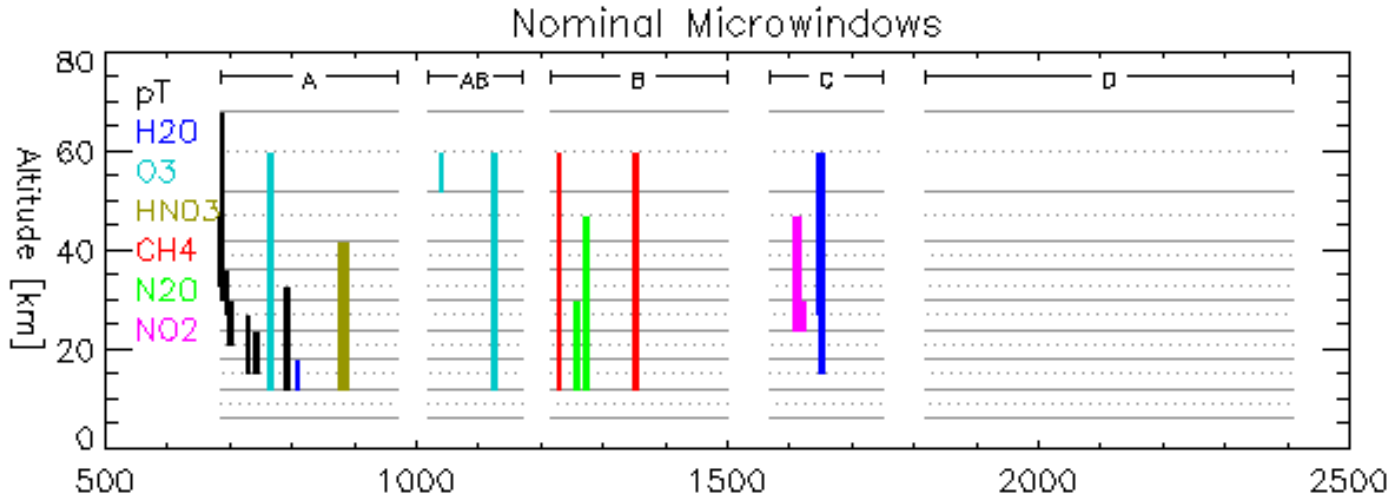
$$S^{tot} = S^{rnd} + S^{sys}$$

where

S^{rnd} is the contribution from (random) noise and

S^{sys} is the sum of other (systematic) error contributions from either the forward model or instrument characterisation


Radiance Contributions at 21km
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
10000.0
1000.0
100.0
10.0
1.0
0.1
CO2
CH4
H2O
N2O
NO2
HNO3
O3
500
1000
1500
2000
2500
Wavenumber [cm^{-1}]


Nominal Microwindows
Altitude [km]
80
60
40
20
0
pT
H2O
O3
HNO3
CH4
N2O
NO2
A
AB
B
C
D
500
1000
1500
2000
2500

Error Budget

In order to quantify the contribution of each error source it is necessary to

1. Decide which parameters are likely to contribute an error
2. Define a '1 sigma' uncertainty in that parameter
3. Compute error spectra representing the 1 sigma perturbation
4. Map the error spectra into a retrieval error covariance

An advantage of this approach is that it allows the contribution of each error source to the retrieval to be quantified – the *total error budget*

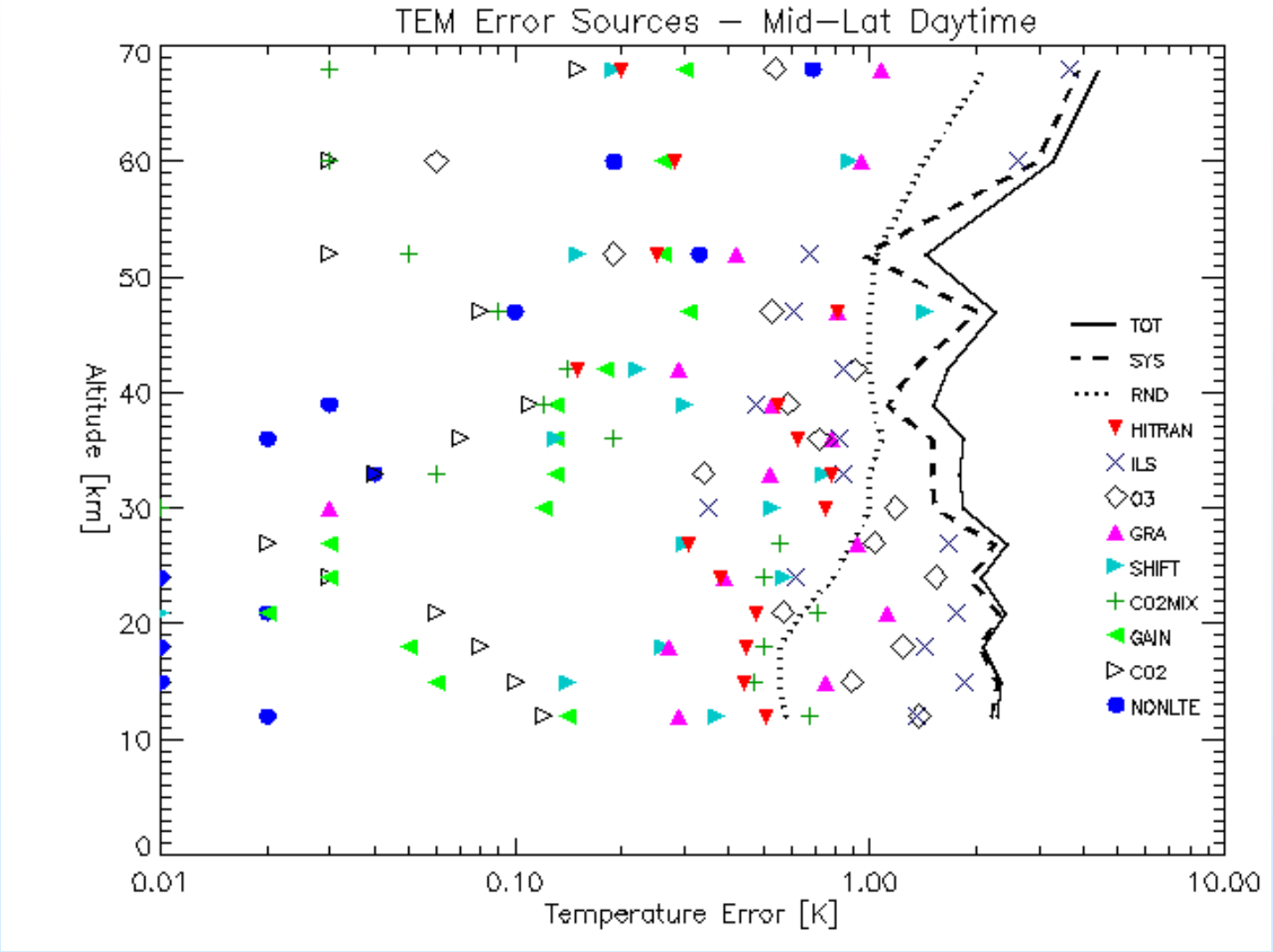
List of errors considered

Instrument characterisation

- Spectral calibration uncertainty +/-0.001 cm-1 (SHIFT)
- Radiometric gain uncertainty +/-1% (GAIN)
- Instrument lineshape uncertainty (ILS)
- Noise for instrument at temperature 205K (RND)

Forward model assumptions

- Climatological variability of 28 species
- Non-LTE effects (NONLTE)
- Spectroscopic database uncertainties (HITRAN)
- CO2 line mixing (CO2MIX)
- Horizontal temperature gradients +/-1K/100 km (GRA)
- (constituent retrievals) pT retrieval uncertainties of +/-2%, +/-1K respectively


TEM Error Sources – Mid–Lat Daytime
Altitude [km]
Temperature Error [K]
0
10
20
30
40
50
60
70
0.01
0.10
1.00
10.00
TOT
SYS
RND
HITRAN
ILS
O3
GRA
SHIFT
CO2MIX
GAIN
CO2
NONLTE