

Oxford Work Packages

WP1400: Survey of existing algorithms

Draft report delivered 24 Feb 2003 contains

1. Survey of microwindow selection algorithms including updated error sources (new)
2. Survey of LUT/IG algorithms
3. Initial comments on additional species

At this meeting

- Updated error sources (AD)
- Predicted retrieval errors for additional species (AD)
- Test cases with real data (AB)

WP2100: Trade-off Studies

Issue recommendation on retrieval strategy

1. Species to be retrieved (from WP1400)
2. Which species can be grouped together
3. Retrieval sequence

At this meeting

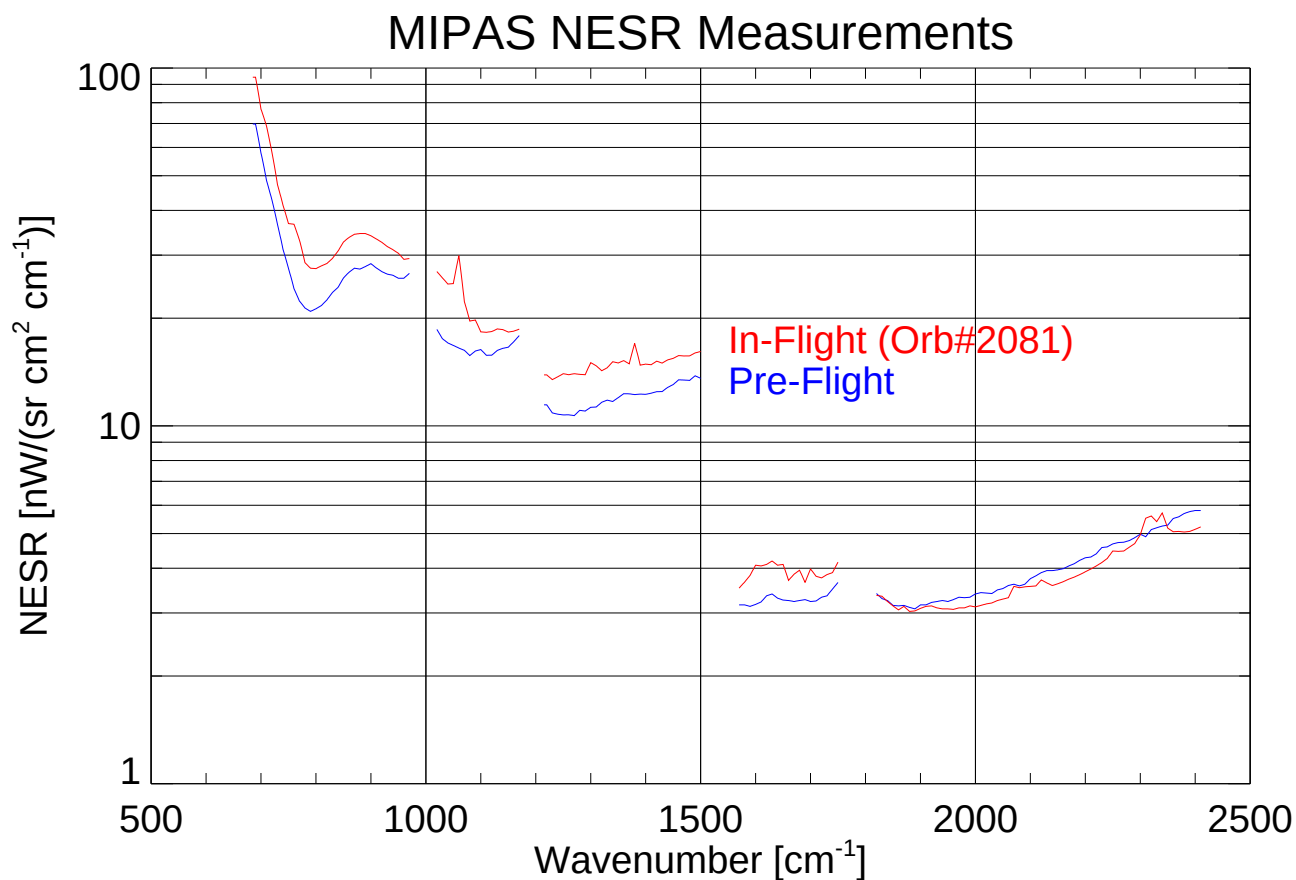
- Analysis of joint-retrievals of key species (CP)

Error Sources

Changes from 'pre-launch' microwindow selection

Random Error Propagation of NESR - *changed*

- Pre-launch estimates based on 'cold' case (205 K)
- In-flight values taken from orbit 2081, warmer case



Difference between old and new assumptions of NESR

⇒ Random errors now approx 25% larger for all species

GAIN Uncertainty in Radiometric Gain - *changed*

- increased from 1% to 2%, mostly due to non-linearity correction in bands A, AB and B.

SPREAD Uncertainty in AILS width - *new*

- Value of 2% derived from observed 2nd derivative signatures in the residual spectra during the first 6 months of operation.
- Replaces previous **ILS** error.

HALT Uncertainty in high-altitude column - *new*

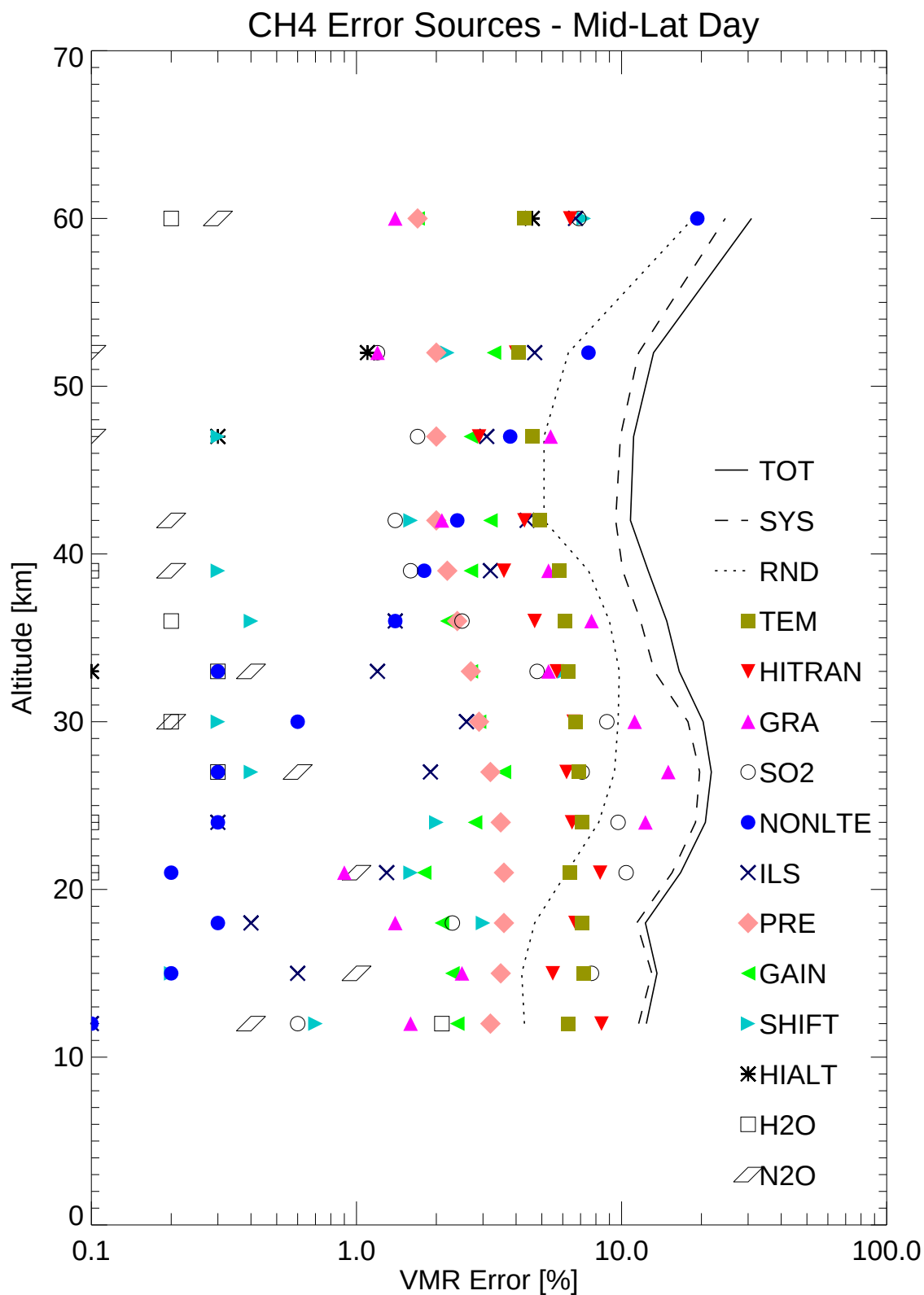
- Retrieval assumes a fixed-shape of atmospheric profile above the top retrieval level.
- Effect is calculated assuming 'true' profile can deviate by climatological variability.

SO2 Climatological variability - *changed*

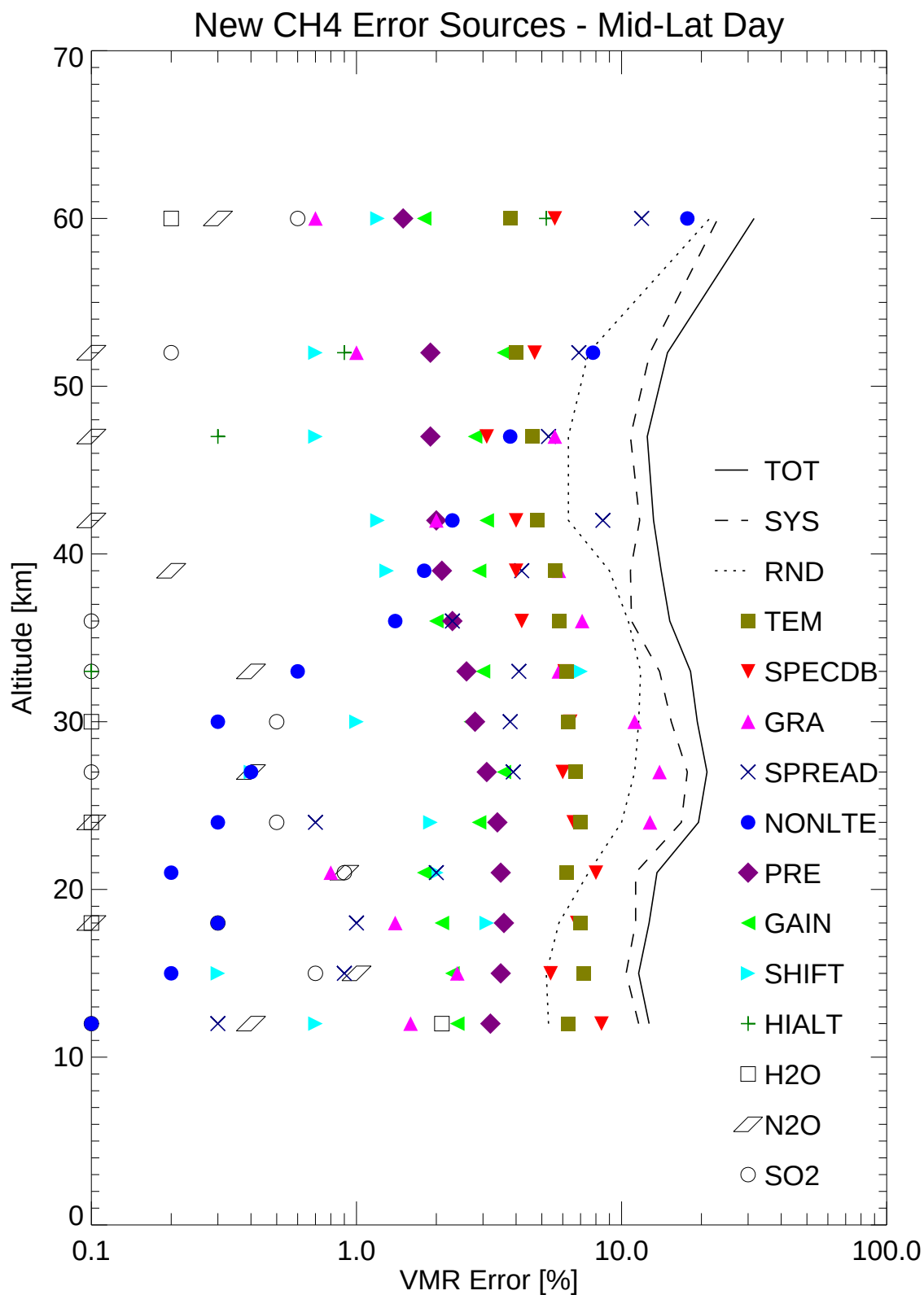
- Original value allowed for volcanic activity
- now reduced by factor 10.

SPECDB Uncertainty in spectroscopic parameters - *renamed*

- Error source originally known as **HITRAN**
- Renamed since we don't actually use standard HITRAN data



Old estimates of CH₄ retrieval error (plus HIALT)



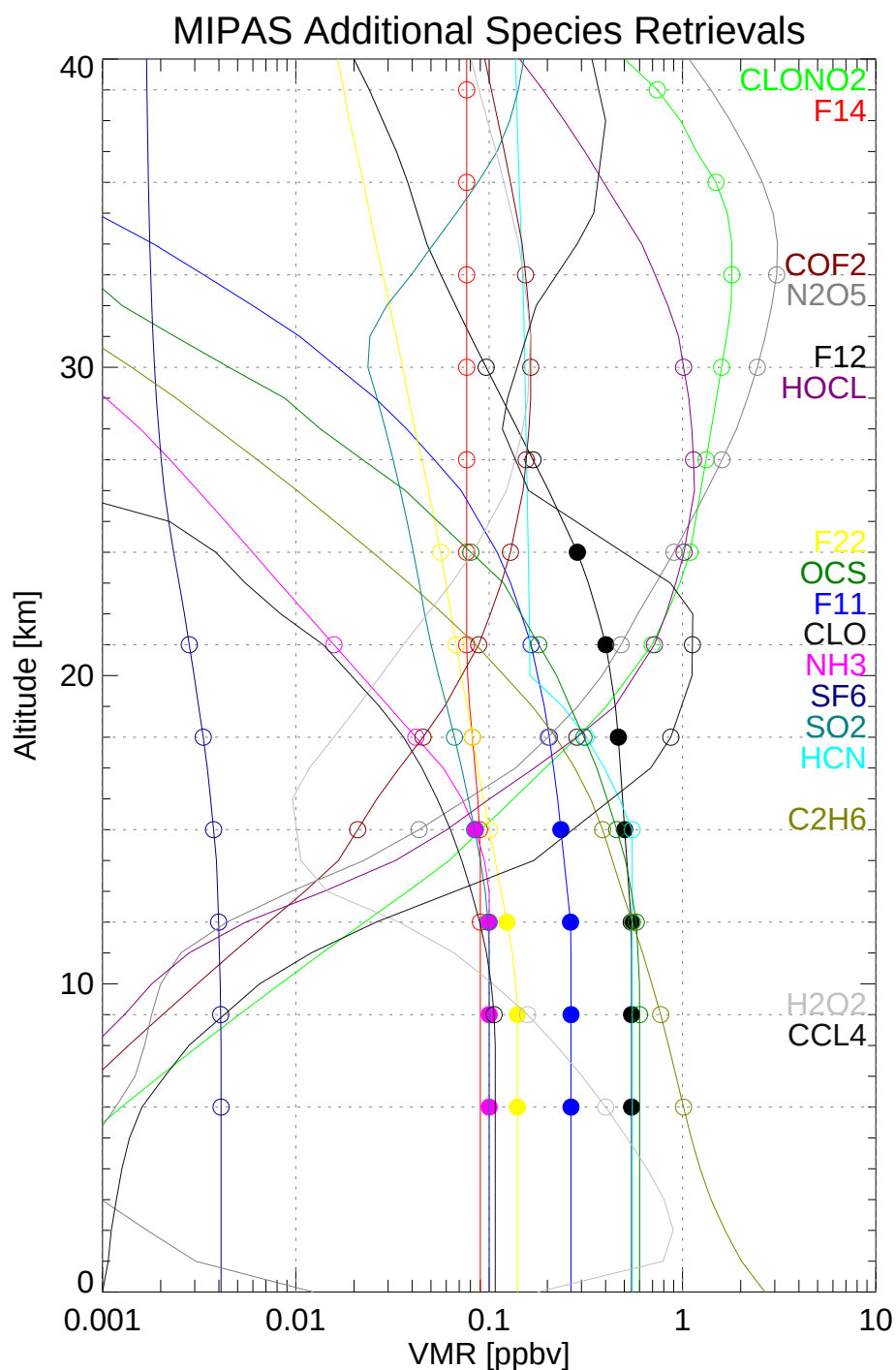
Additional Species

Microwindows have been selected for additional species up to a limit of 10 microwindows or 10000 measurements

NB: typically factor 2–3 higher than for operational microwindows

Species	Atmos	N.MWs	N.Meas	Alt.Rng	Info
CFC-12	day	6	>10000	6–30km	36.2
CFC-14	day	7	>10000	12–52(?)	33.1
ClONO ₂	ngt	7	>10000	18–39km	25.0
CFC-11	day	7	>10000	6–21km	23.7
CFC-22	day	7	>10000	6–24km	23.6
NH ₃	day	8	>10000	6–21km	20.2
HCN	day	10	4153	12–18km	19.2
COF ₂	day	10	7821	15–33km	18.7
OCS	day	10	9604	9–24km	15.2
SF ₆	day	6	7268	6–21km	15.0
N ₂ O ₅	ngt	6	>10000	15–33km	13.5
C ₂ H ₆	day	10	7947	6–15km	13.3
HOCl	win	6	>10000	18–30km	12.6
SO ₂	day	10	7045	12–18km	8.6
H ₂ O ₂	day	10	7502	6–9km	8.2
ClO	win	9	>10000	18–21km	5.3
CCl ₄	day	10	>10000	9km	3.8

Also looked at C₂H₂ and HNO₄ but no microwindows found.



Assumed profiles of additional species used for the microwindow selection. Open circles indicate where the retrieval random error is less than 30%, solid circles where it is less than 10%.

However ...

Information content only defined relative to uniform $\pm 100\%$ *a priori* uncertainty.

If we define information content relative to *climatological variability* for each species,

⇒ Different priority list

Species	Info	
NH ₃	28.3	(17.5)
OCS	12.2	(10.6)
ClONO ₂	11.6	
COF ₂	9.4	
CFC-12	8.6	
SO ₂	8.4	
HCN	6.5	
C ₂ H ₆	3.3	(0.2)
H ₂ O ₂	3.1	(0)
N ₂ O ₅	2.9	
HOCl	1.8	
CFC-11	0.4	
CFC-22	0.3	(0.1)
CFC-14	0	
SF ₆	0	
ClO	0	
CCl ₄	0	

Figures in brackets indicate information content if retrieval is restricted to 12 km and higher.

Conclusions

So far, only ORM-like retrievals have been considered, ie.

- (a) Use microwindows with simultaneous continuum retrieval
- (b) Microwindow maximum width = 3cm^{-1}
- (c) Climatological variability of all contaminants
- (d) Retrieve single profile from single scan
- (e) Local thermodynamic equilibrium