1 IMK Retrievals

Document version: April 6, 2002

1.1 Data

- Microwindow data supplied by A. Linden, email 10 Jan 02, MWs for joint CH_4 & N_2O retrieval email 7 Mar 02.
- Averaging kernels supplied by A. Linden, 5 Apr 02
- Residuals supplied by A. Linden, email 7 Mar 02 (unmasked points only).

1.2 Notes

- The IMK retrieval state vector is already high resolution ($1km$) so the retrieval grid averaging kernel is plotted directly $\mathbf{A}_x \simeq \mathbf{A}_z$ ('method 2')
- Line-of-sight pointing (LOS) is retrieved rather than pressure, so the LOS averaging kernel is on the tangent height grid
- Retrieval sequence: pT, O_3, H_2O, HNO_3, joint CH_4 & N_2O, then NO_2

1.3 REC Analysis

Table 1: REC analysis for IMK retrievals

error source	BT1 Residuals c	BT1 Residuals σ	BT2 Residuals c	BT2 Residuals σ
o3	0.10	0.01	0.03	0.01
h2o_06	0.03	0.01	0.02	0.01
n2o	0.13	0.01	0.13	0.01
no2	−0.05	0.01	−0.05	0.01
hno3	0.10	0.01	0.10	0.01
h2o_09	−0.14	0.01	−0.16	0.01
ch4	0.26	0.02	0.29	0.02
so2	−0.06	0.03	−0.09	0.03
h2o_12	0.01	0.03	−0.01	0.03
nonlte	1.00	0.04	0.86	0.03
h2o_st	−0.67	0.04	−0.53	0.04
n2o5	0.02	0.05	0.07	0.04
co2mix	0.27	0.05	0.23	0.05
pre	−0.74	0.10	−0.28	0.08
clono2	−0.08	0.10	0.20	0.09

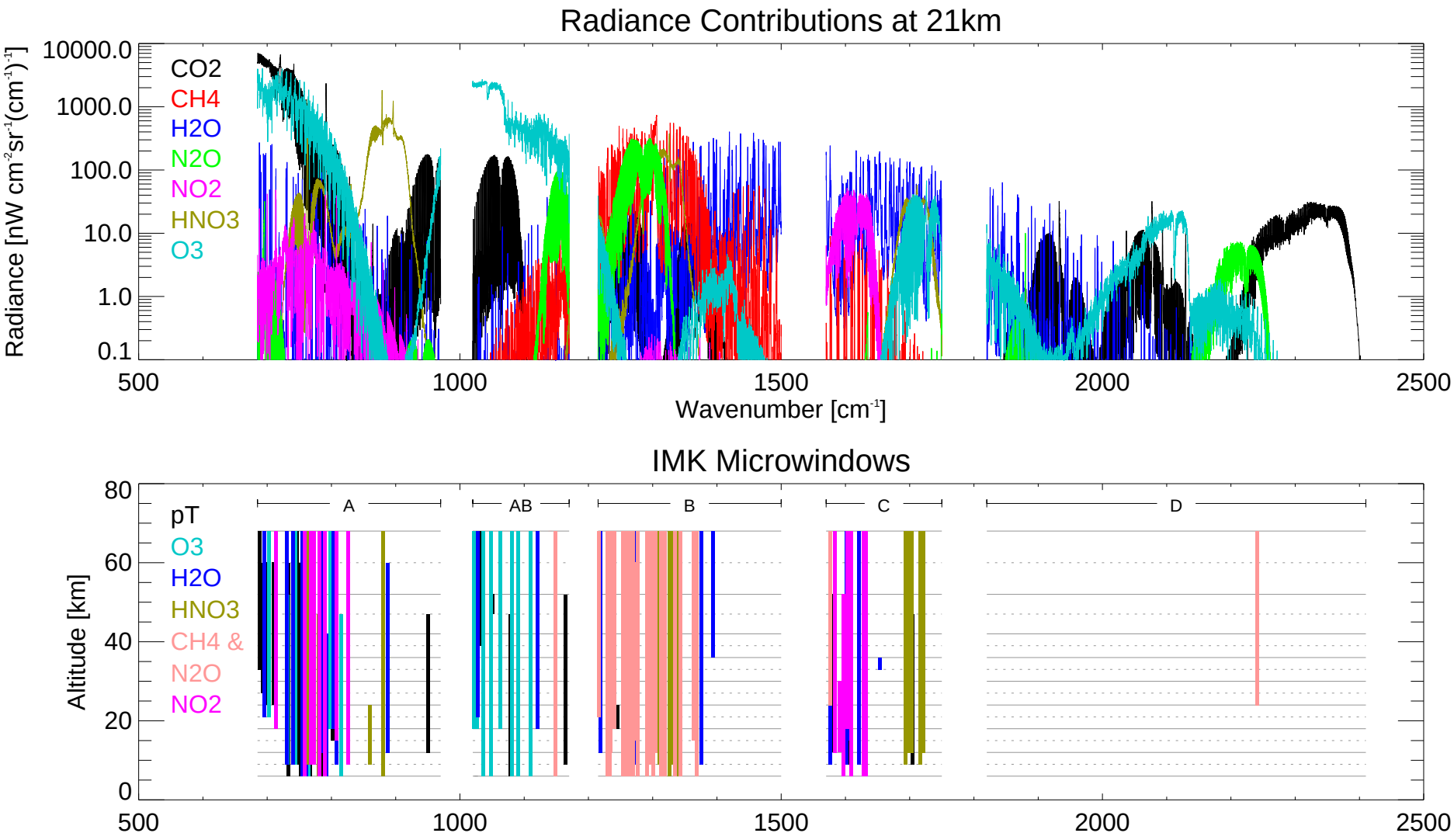


Figure 1: IMK microwindows

1.4 Pressure-Temperature

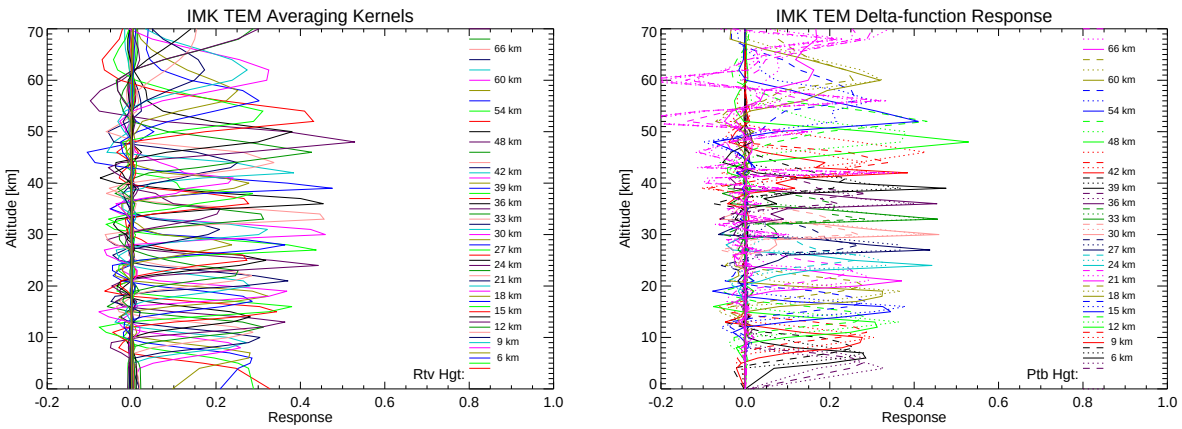
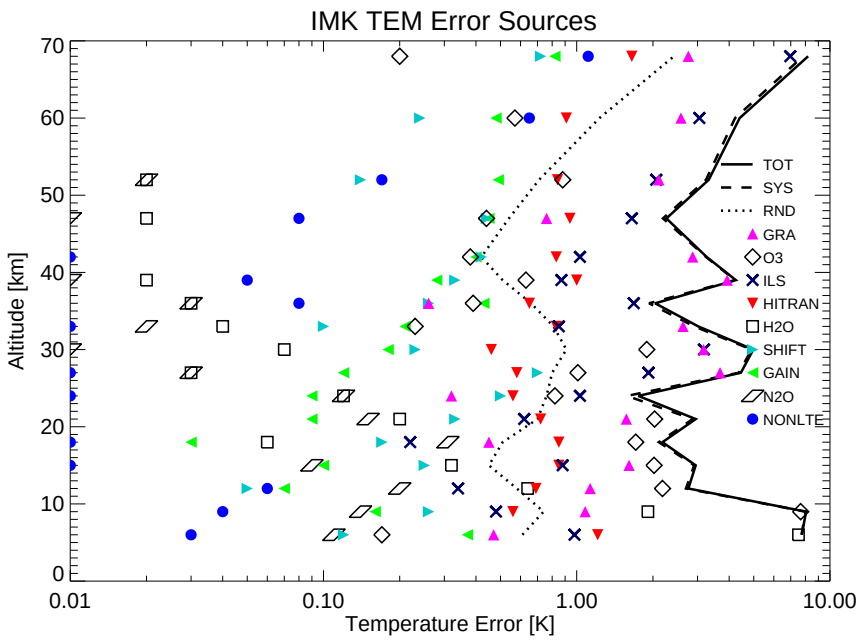


Figure 2: IMK temperature averaging kernel matrix



REC Analysis

source	c	σ
h2o_06	0.02	0.02
o3	−0.26	0.02
h2o_09	0.03	0.03
no2	−0.71	0.07
nonlte	0.24	0.08
n2o5	0.01	0.11
n2o	1.02	0.12
pre	−0.61	0.15
h2o_12	0.47	0.19
so2	0.04	0.22
ch4	0.62	0.25
hno3	0.98	0.25
clono2	0.58	0.26

Figure 3: IMK temperature retrieval errors

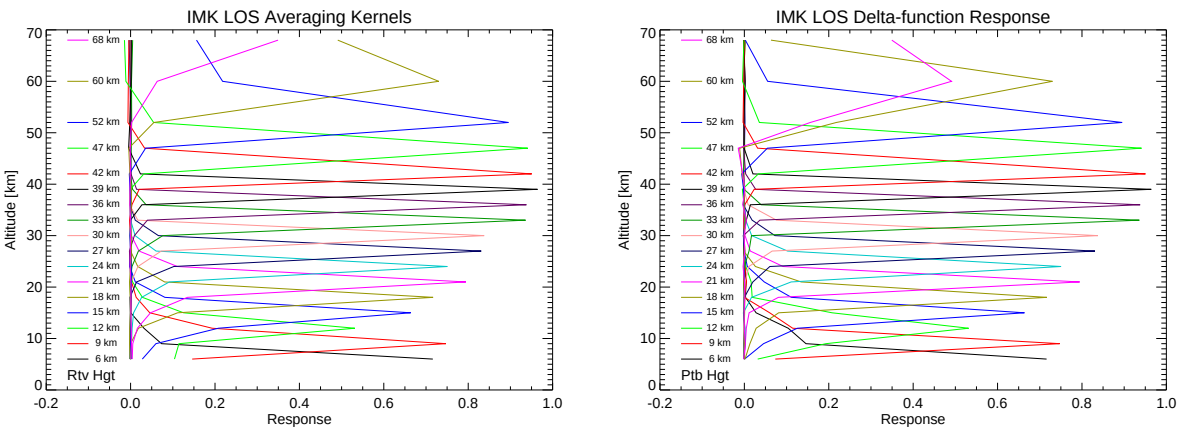
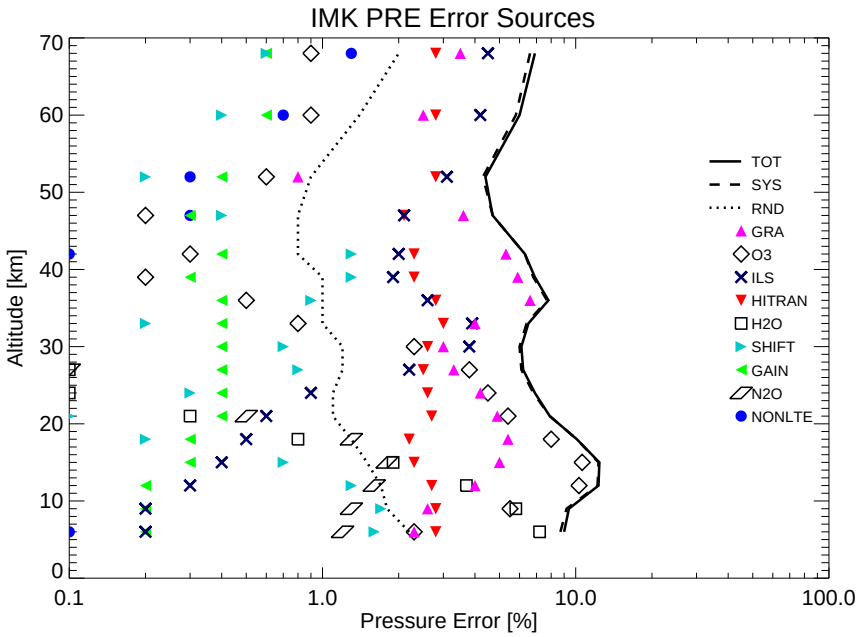


Figure 4: IMK LOS-pointing averaging kernel matrix



REC Analysis

source	c	σ
h2o_06	0.02	0.02
o3	−0.26	0.02
h2o_09	0.03	0.03
no2	−0.71	0.07
nonlte	0.24	0.08
n2o5	0.01	0.11
n2o	1.02	0.12
pre	−0.61	0.15
h2o_12	0.47	0.19
so2	0.04	0.22
ch4	0.62	0.25
hno3	0.98	0.25
clono2	0.58	0.26

Figure 5: IMK pressure retrieval errors

1.5 Ozone

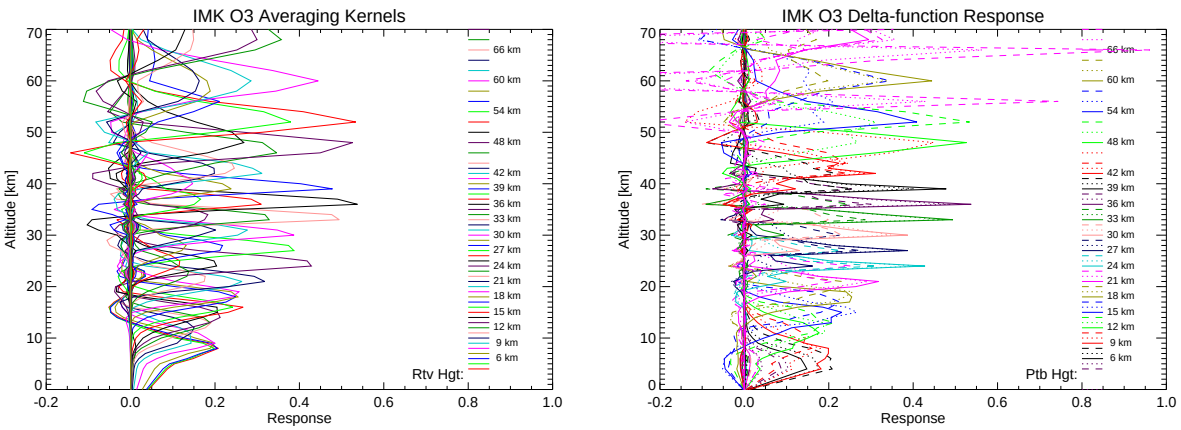
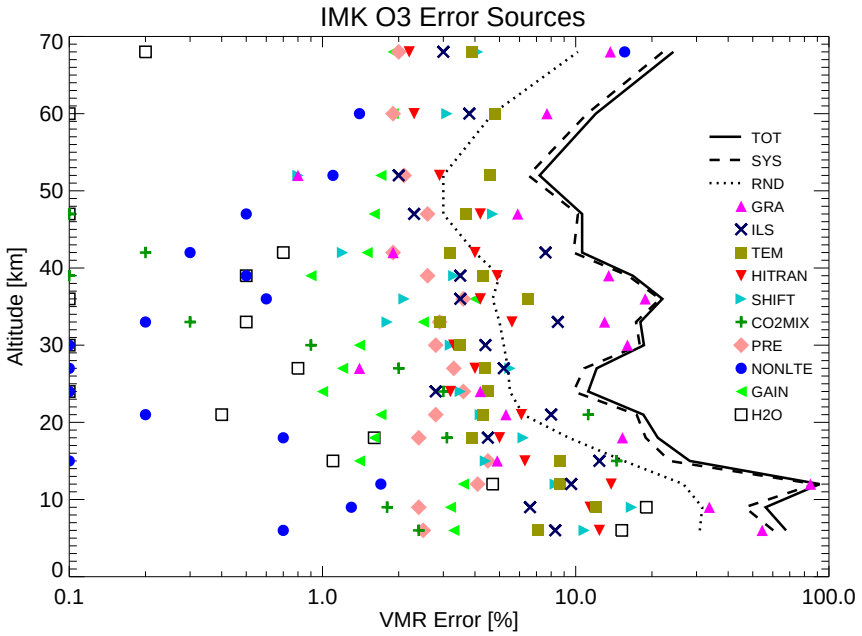


Figure 6: IMK ozone averaging kernel matrix



REC Analysis

source	c	σ
o3	0.02	0.02
h2o_06	0.01	0.02
co2mix	0.85	0.06
n2o5	−0.20	0.06
h2o_09	0.03	0.09
nonlte	0.91	0.16
pre	0.65	0.20
h2o_st	−0.92	0.24

Figure 7: IMK ozone retrieval errors

1.6 Water Vapour

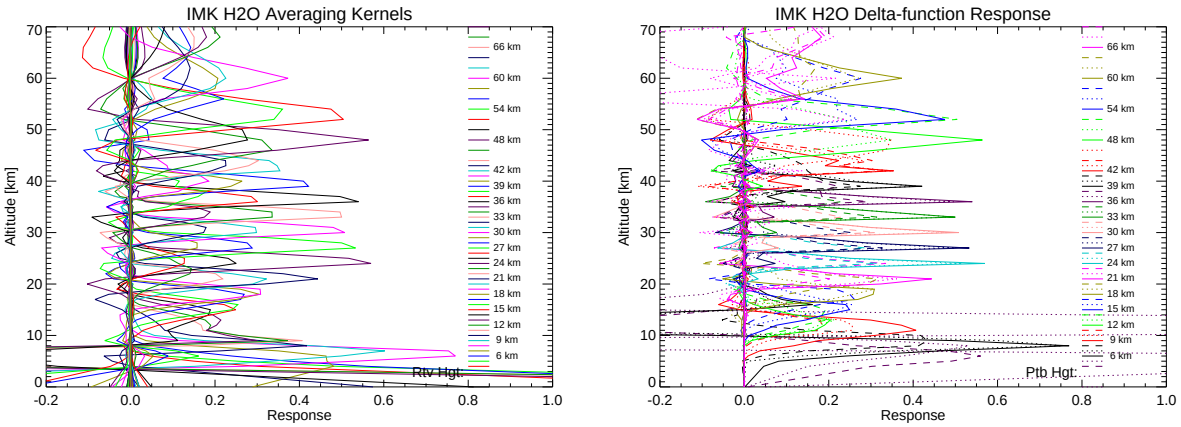
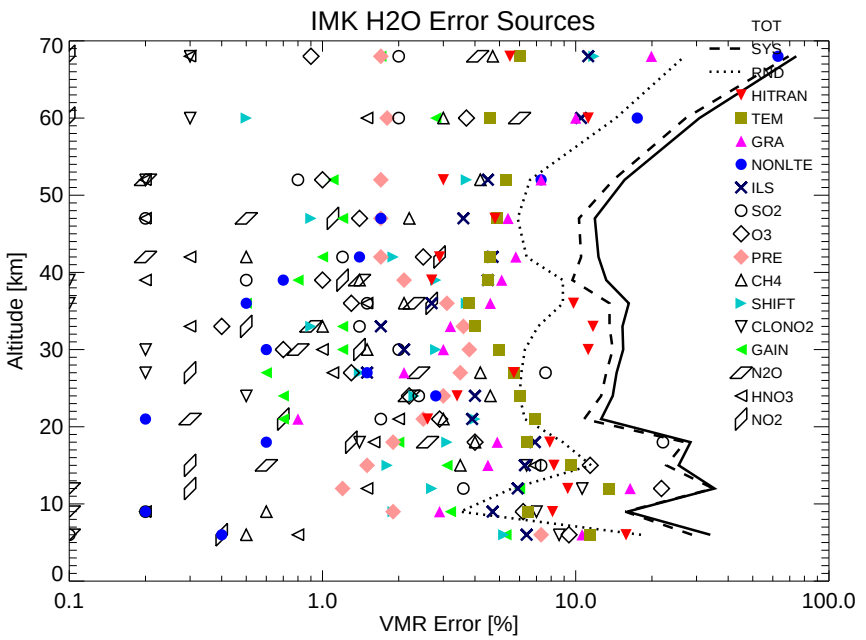


Figure 8: IMK water vapour averaging kernel matrix



REC Analysis

source	c	σ
o3	0.03	0.01
h2o_09	0.05	0.02
so2	0.15	0.03
h2o_06	−0.07	0.04
h2o_12	0.22	0.04
ch4	1.77	0.04
n2o	0.39	0.05
hno3	2.15	0.06
h2o_st	−1.07	0.06
nonlte	0.88	0.07
no2	0.16	0.08
n2o5	0.30	0.13
pre	−0.91	0.16
clono2	−1.29	0.23

Figure 9: IMK water vapour retrieval errors

1.7 Nitric Acid

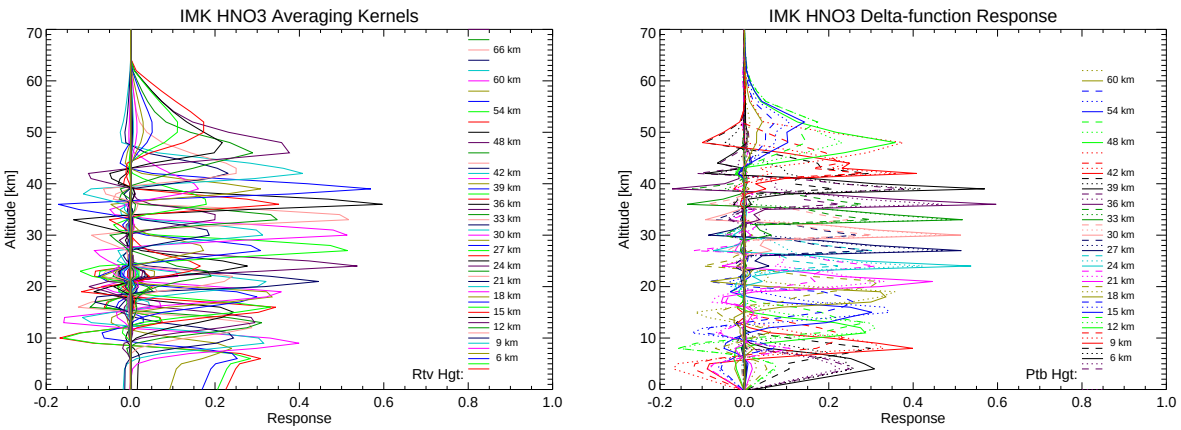
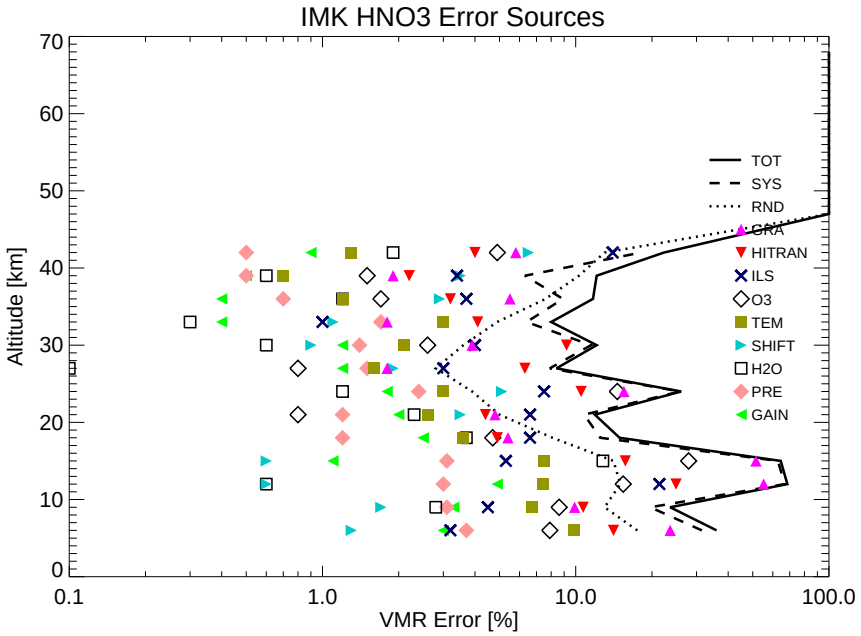


Figure 10: IMK nitric acid averaging kernel matrix



REC Analysis

source	c	σ
hno3	0.05	0.01
h2o_06	0.01	0.02
h2o_09	−0.01	0.02
o3	0.02	0.03
n2o	1.16	0.03
h2o_12	−0.03	0.05
ch4	0.77	0.05
nonlte	0.93	0.07
h2o_st	0.75	0.10
so2	−0.67	0.18
n2o5	0.47	0.22
pre	−0.63	0.27

Figure 11: IMK nitric acid retrieval errors

1.8 Methane-Nitrous Oxide

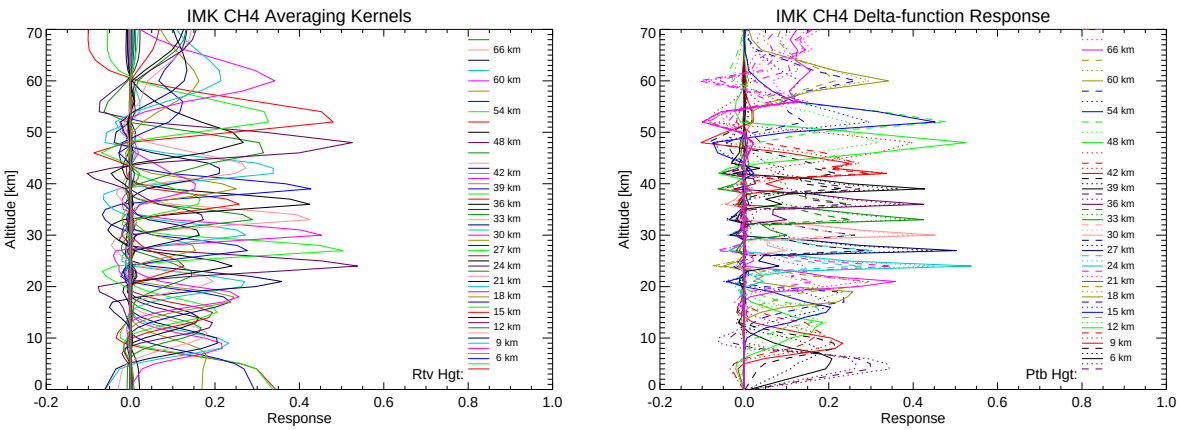
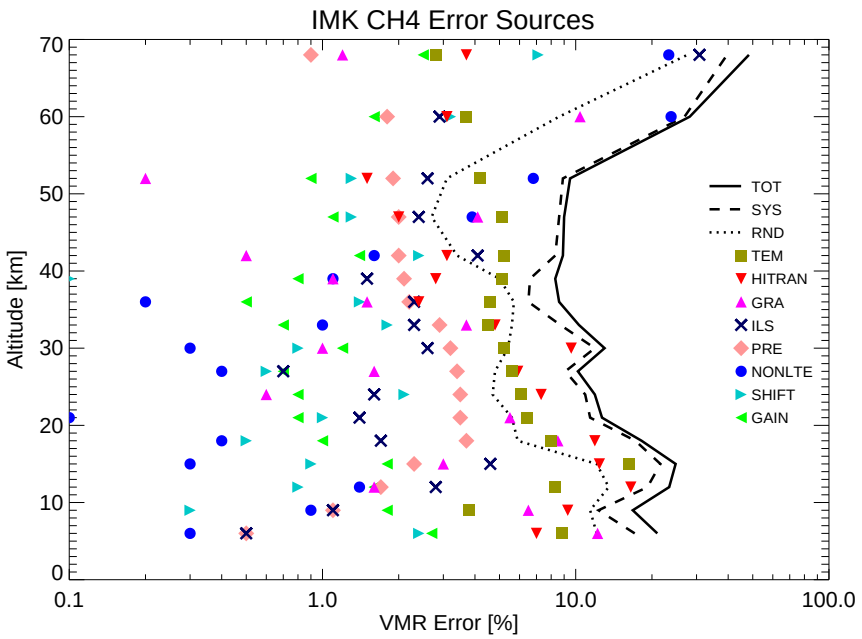


Figure 12: IMK methane averaging kernel matrix



REC Analysis

source	c	σ
n2o	0.00	0.01
ch4	−0.05	0.03
h2o_06	0.01	0.03
hno3	0.03	0.08
nonlte	0.52	0.11
h2o_09	−0.06	0.12
h2o_st	0.53	0.14
clono2	−0.39	0.16
n2o5	0.38	0.21
pre	0.12	0.25

Figure 13: IMK methane retrieval errors

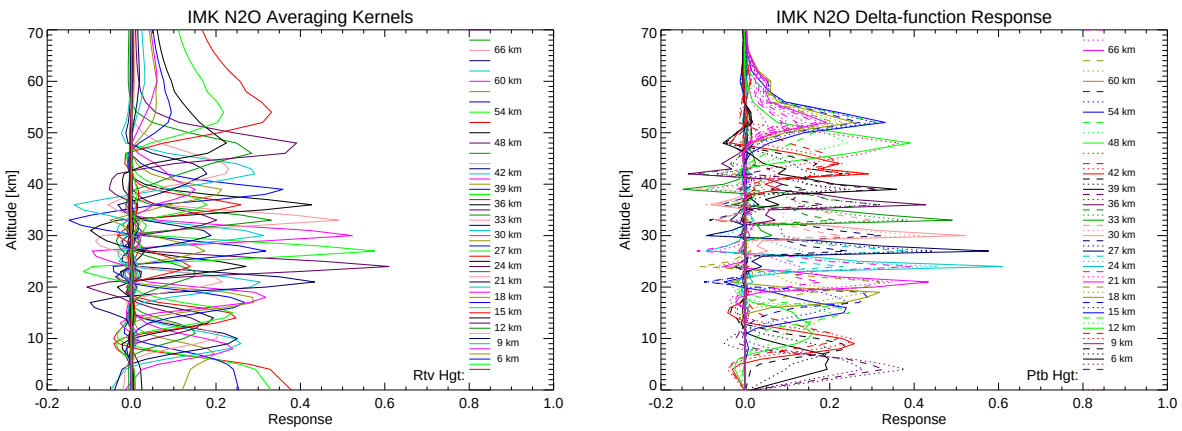
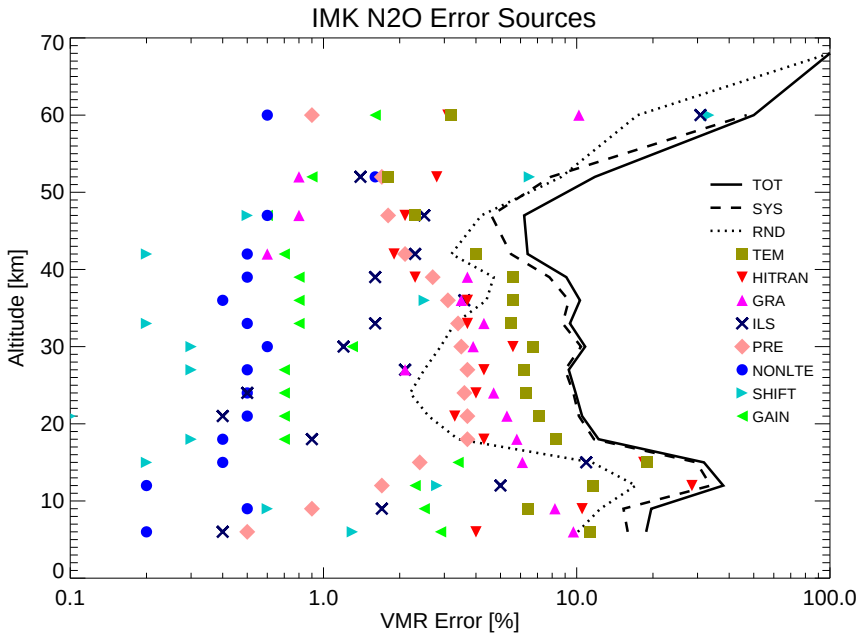


Figure 14: IMK nitrous oxide averaging kernel matrix



REC Analysis

source	c	σ
n2o	0.00	0.01
ch4	−0.05	0.03
h2o_06	0.01	0.03
hno3	0.03	0.08
nonlte	0.52	0.11
h2o_09	−0.06	0.12
h2o_st	0.53	0.14
clono2	−0.39	0.16
n2o5	0.38	0.21
pre	0.12	0.25

Figure 15: IMK nitrous oxide retrieval errors

1.9 Nitrogen Dioxide

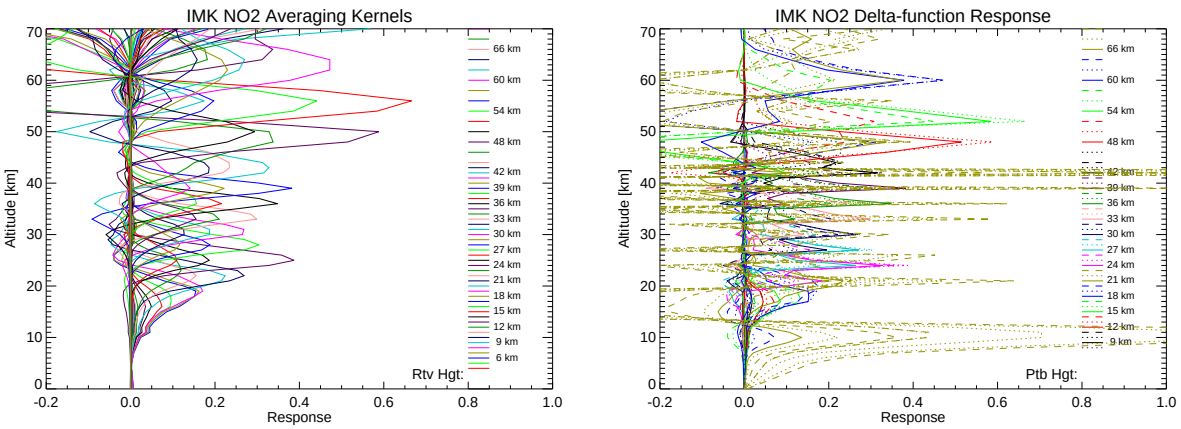
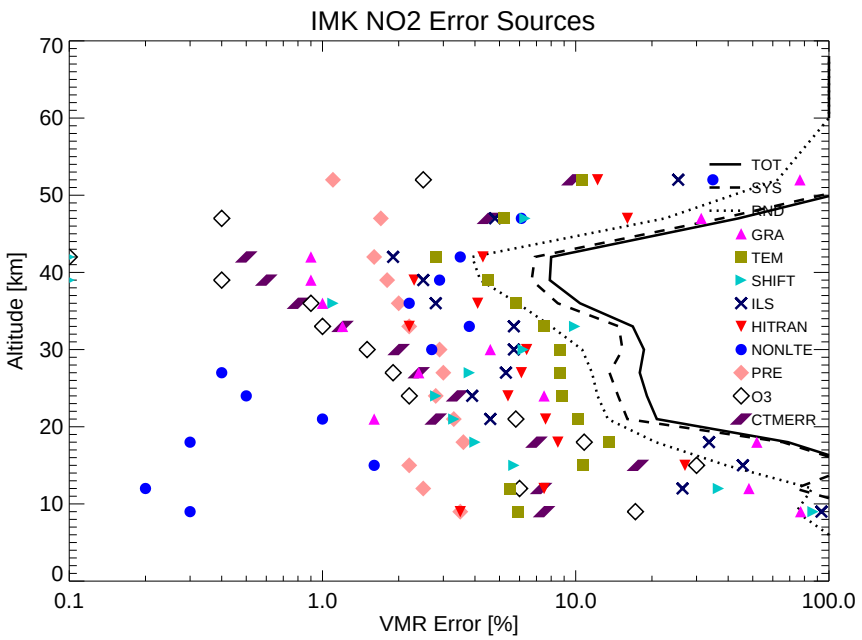


Figure 16: IMK nitrogen dioxide averaging kernel matrix



REC Analysis

source	c	σ
no2	−0.04	0.01
o3	0.13	0.01
h2o_06	0.04	0.02
h2o_09	−0.52	0.02
nonlte	0.88	0.10
co2mix	−1.86	0.11
h2o_st	0.06	0.14
ch4	−0.12	0.15
hno3	1.44	0.18
clono2	0.69	0.18
h2o_12	0.52	0.21
pre	−0.02	0.26
n2o5	0.75	0.28

Figure 17: IMK nitrogen dioxide retrieval errors