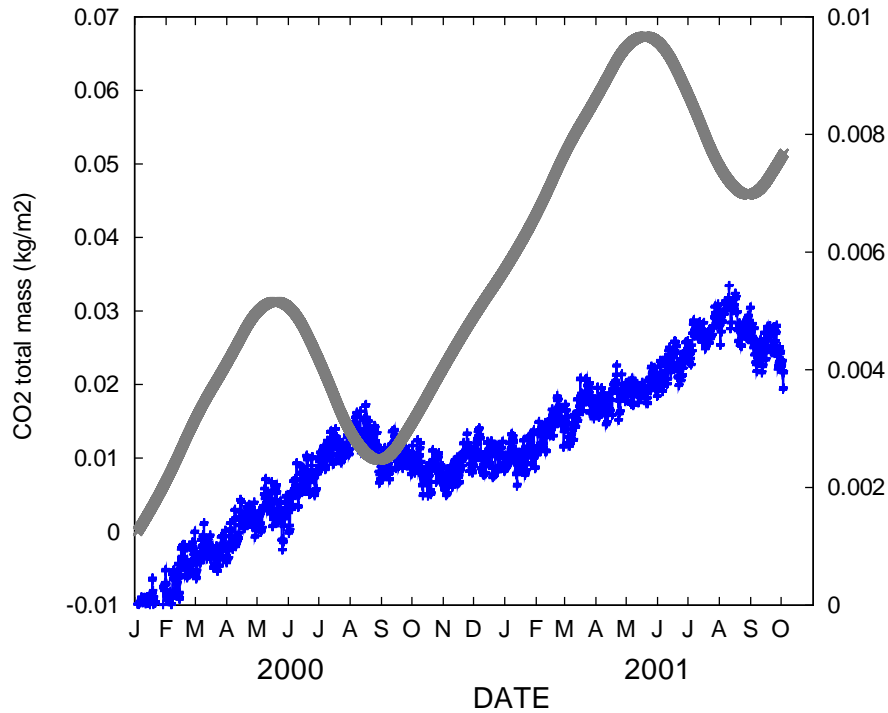


GHG : Summary of activity during the first 10 months

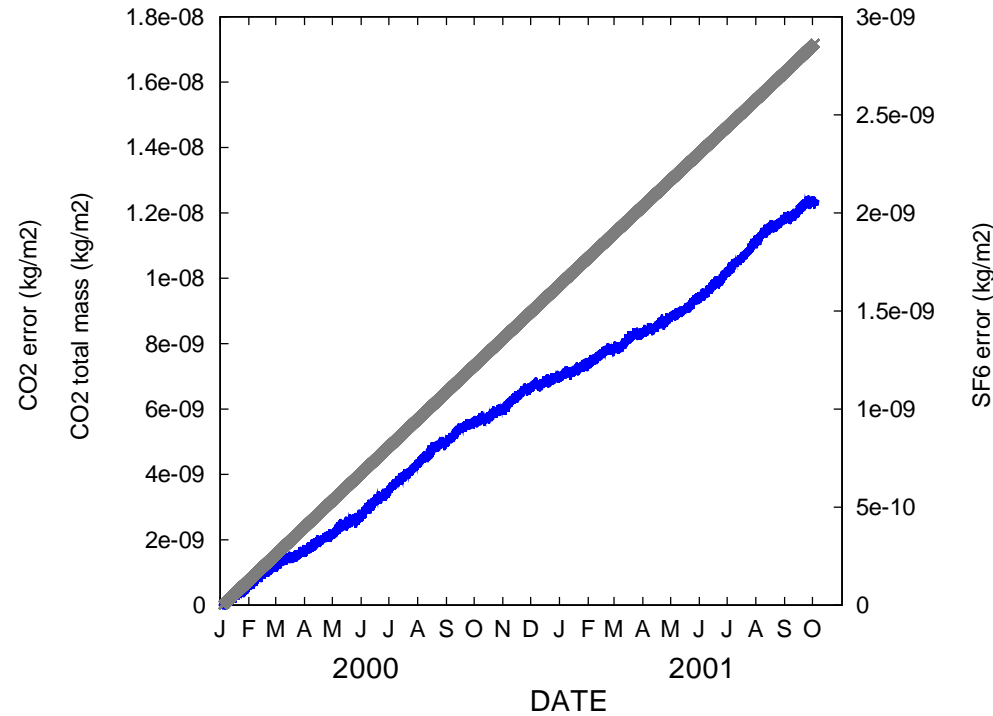
- ✓ Built the infrastructure of the CO_2 forecast model (WP_1.1 and 1.3)
- ✓ Analysis of the CO_2 forecast model outputs for the period 2002-2004 and comparison with in situ measurements (WP_1.1 and WP_1.4)
- ✓ First attempts to check the transport model by analyzing simulations of SF_6 concentrations (WP_1.4)
- ✓ Introduction of the diurnal cycle for the exchange with the natural biosphere (WP_1.3)
- ✓ Introduction of hemispheric tracers to check the inter-hemispheric transport in the model (WP_1.4)

The interpolation used in the advection scheme induces a mass gain

Mass conservation test for CO₂



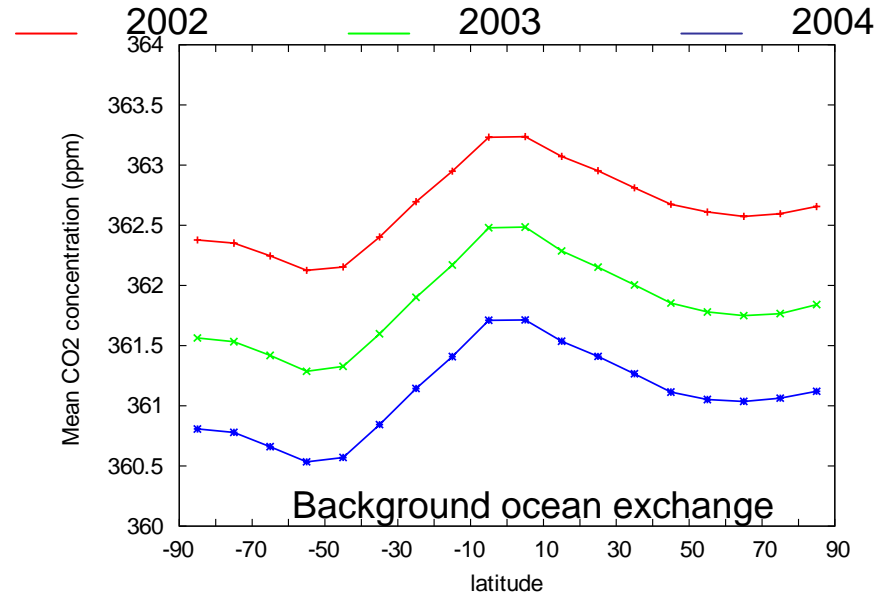
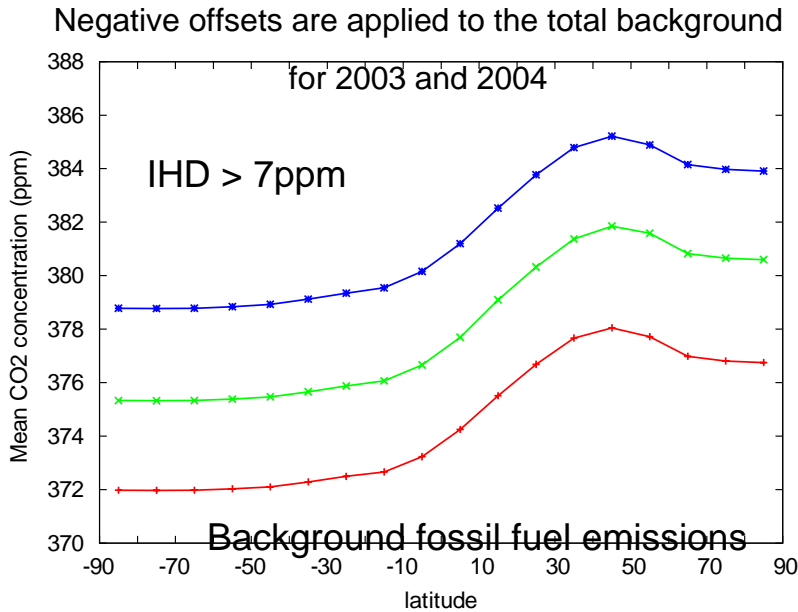
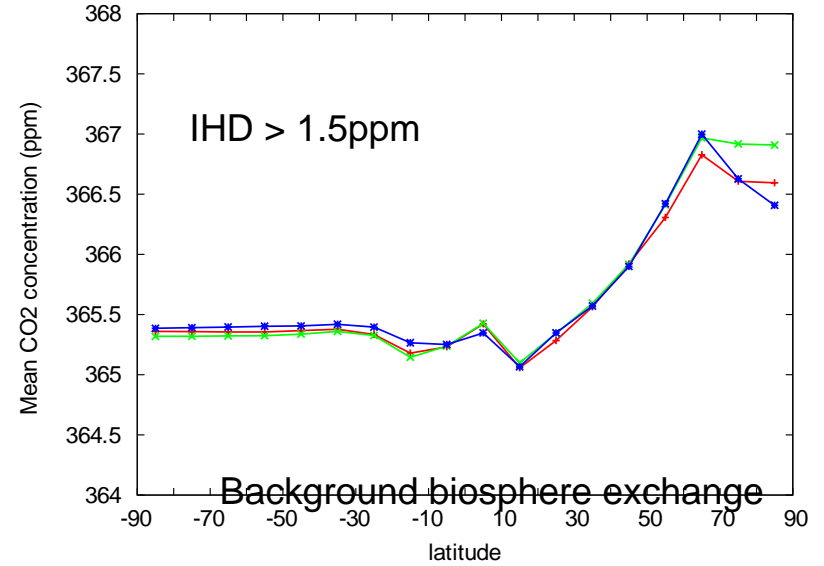
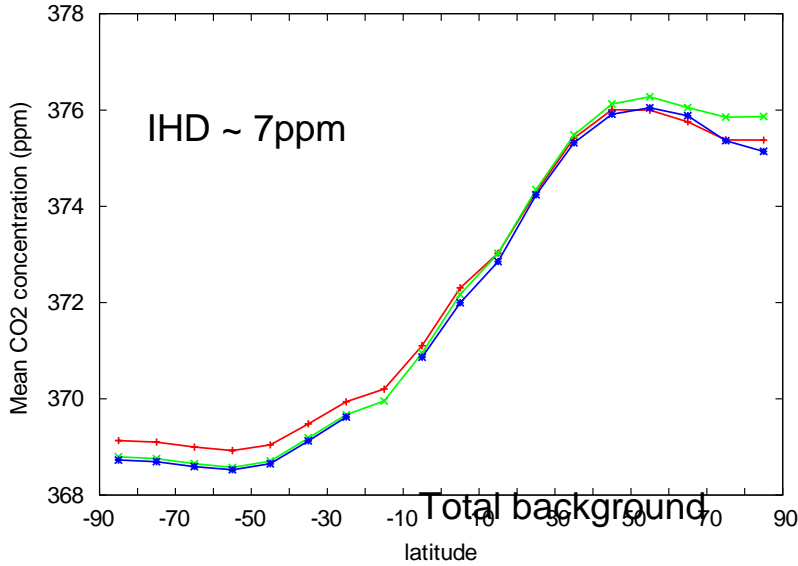
Mass conservation test for SF₆



Time cumulated mass (injected at the surface)

Tracer mass error (~7% for CO₂ and >10% for SF₆)

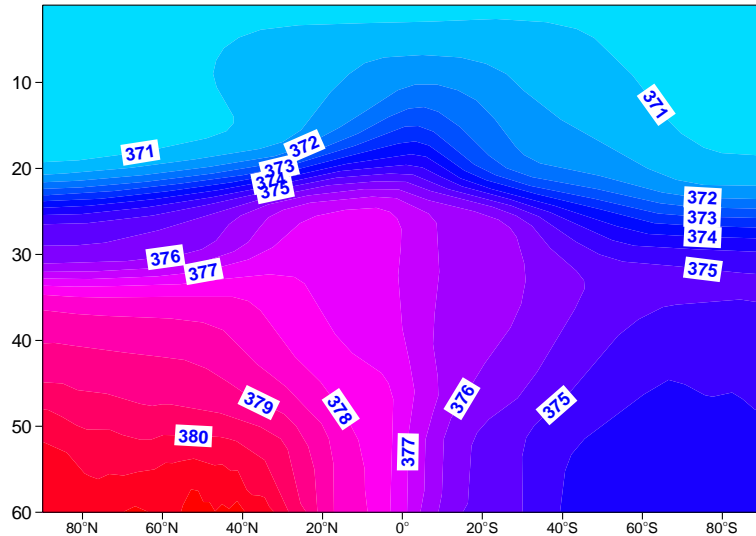
Meridional profiles of simulated annual surface CO₂ concentration



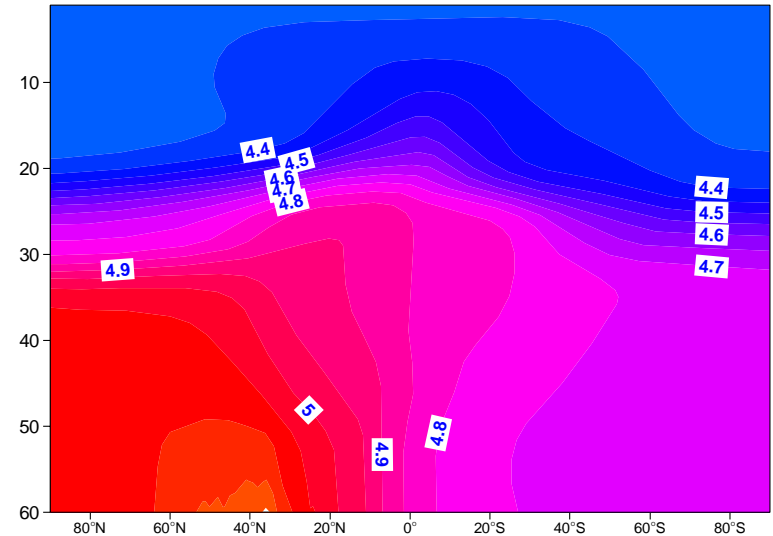
IHD= Inter-Hemispheric Difference

Annual means of simulated tracers concentrations

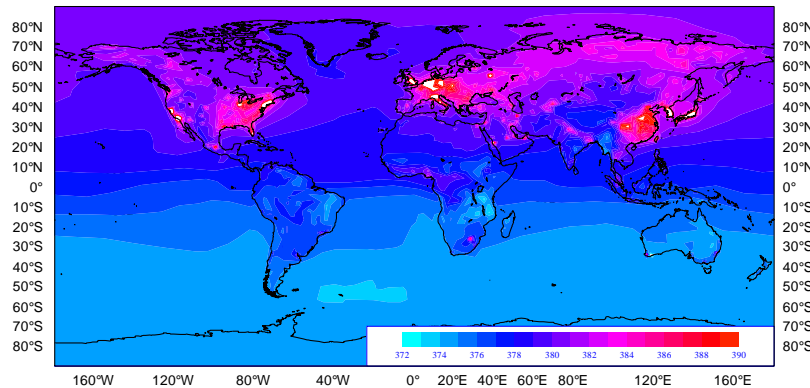
Latitudinal Gradient for CO₂ - 2002



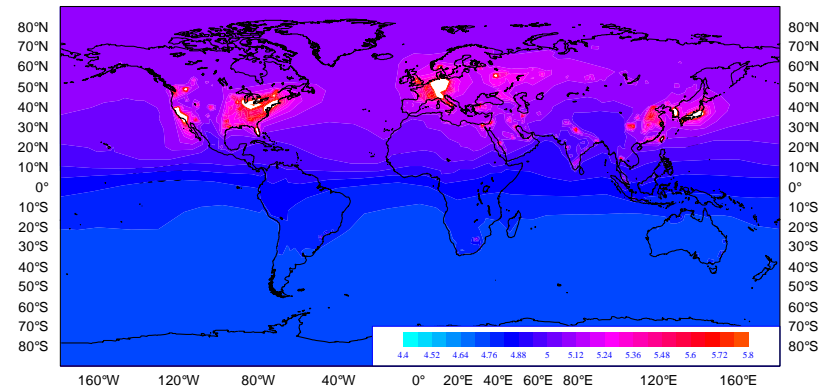
Latitudinal Gradient for SF₆ - 2002



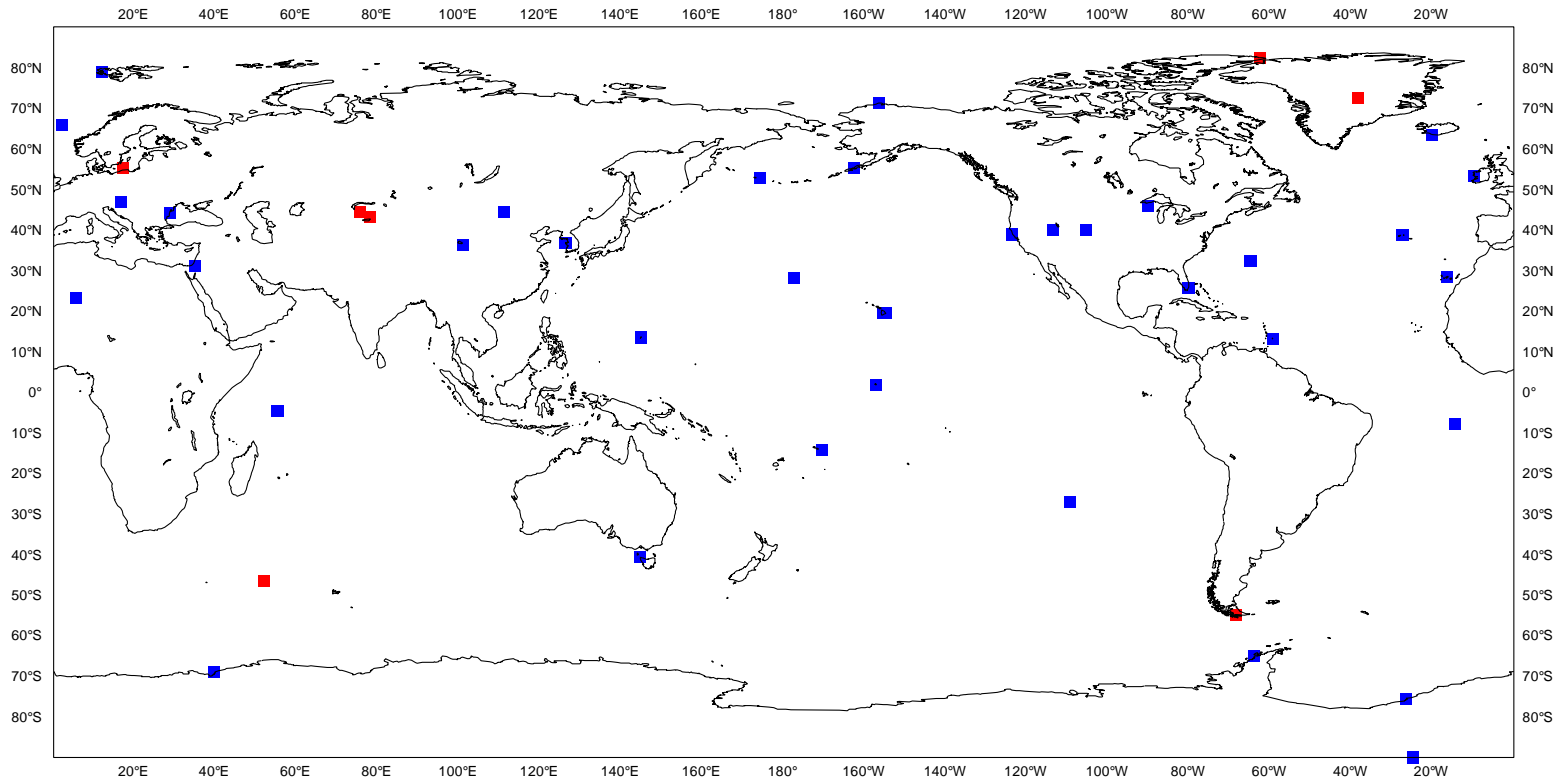
CO₂ concentration at the surface - 2002



SF₆ concentration at the surface - 2002



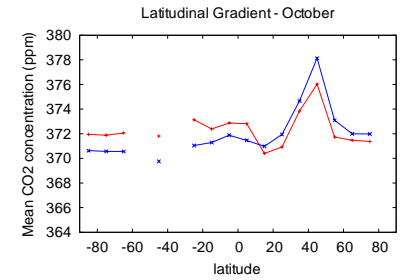
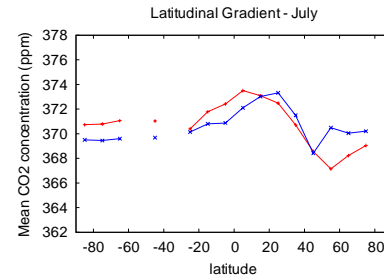
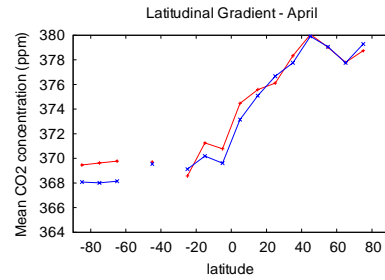
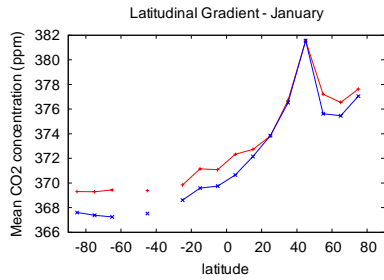
Location of CO₂ surface measurements used for model validation (from NOAA/CMDL sampling network)



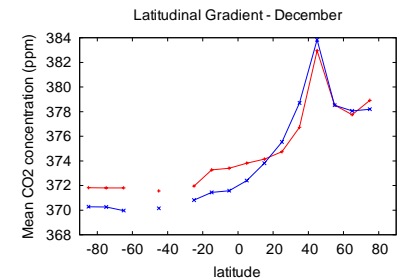
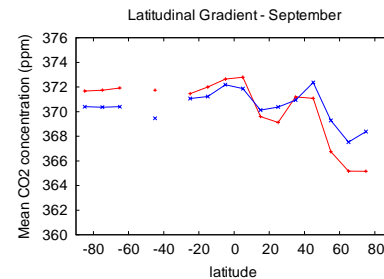
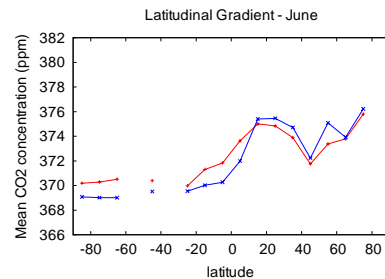
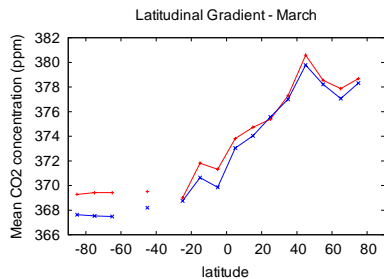
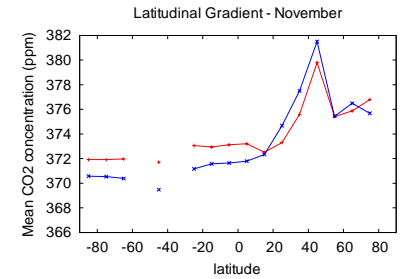
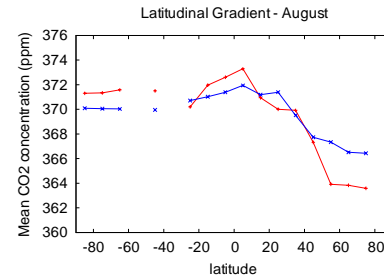
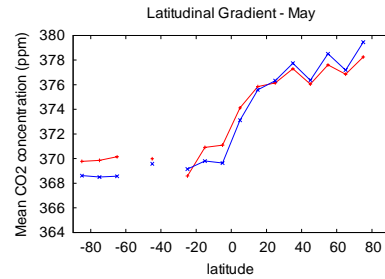
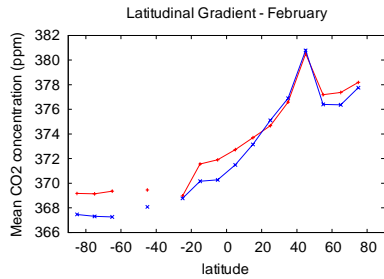
- complete data available for 2002-2004 period (37 stations)
- data rejected for 2002-2003-2004 inter-comparisons because incomplete

Forward modelling verification - 2002

Comparisons to in situ measurements at the surface



—+— observations
—x— model

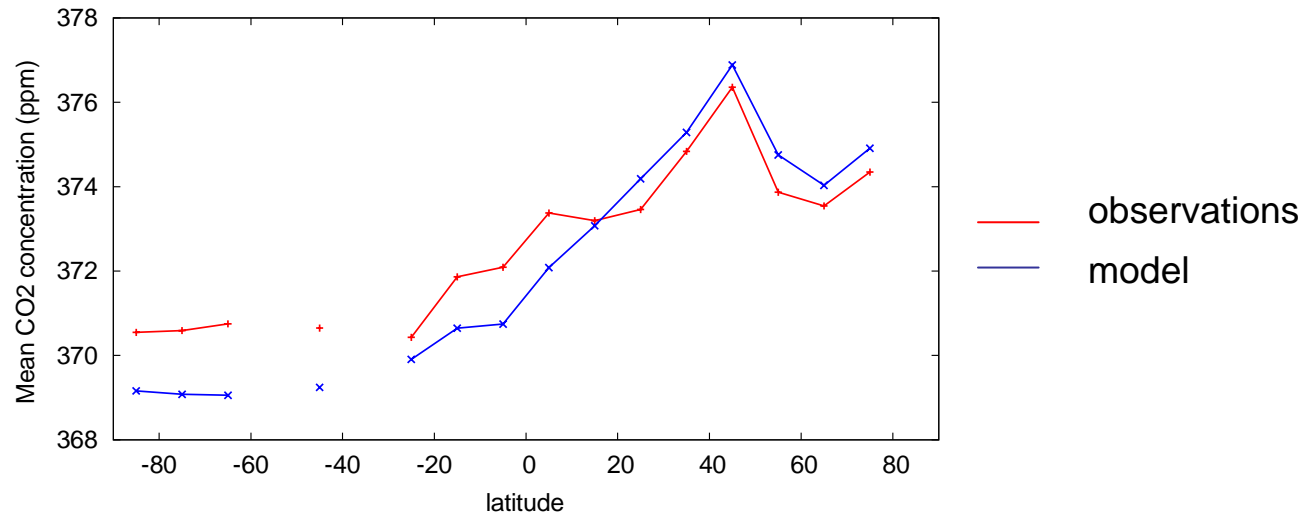


Comparisons to in situ measurements at the surface

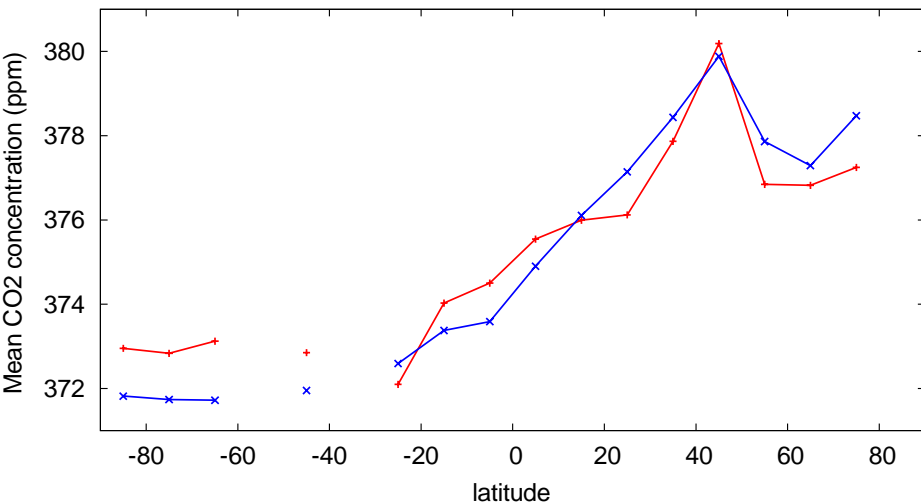
Meridional profiles of annual means

Same fluxes are used for 2002, 2003 and 2004 but different meteorology

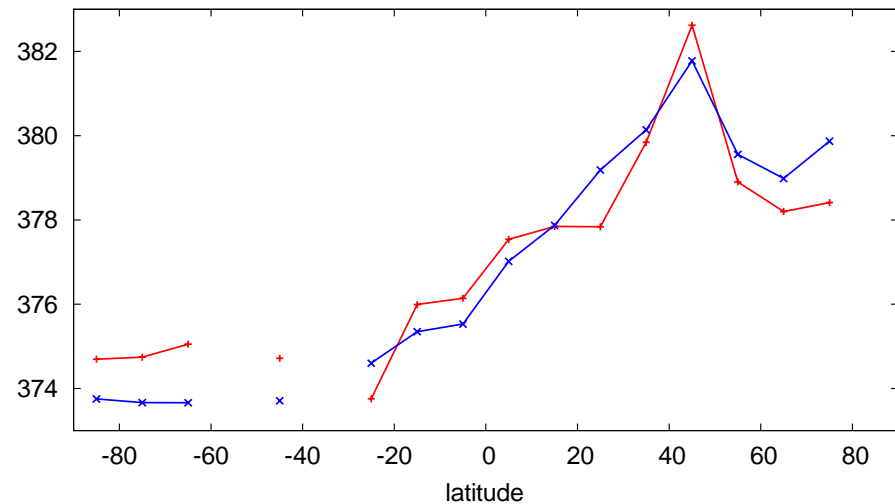
Annual Latitudinal Gradient - 2002



Annual Latitudinal Gradient - 2003



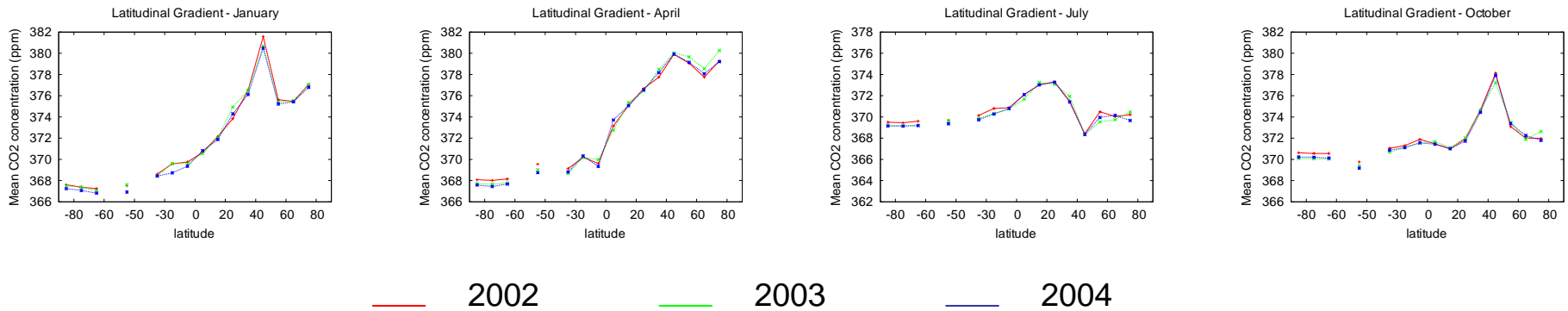
Annual Latitudinal Gradient - 2004



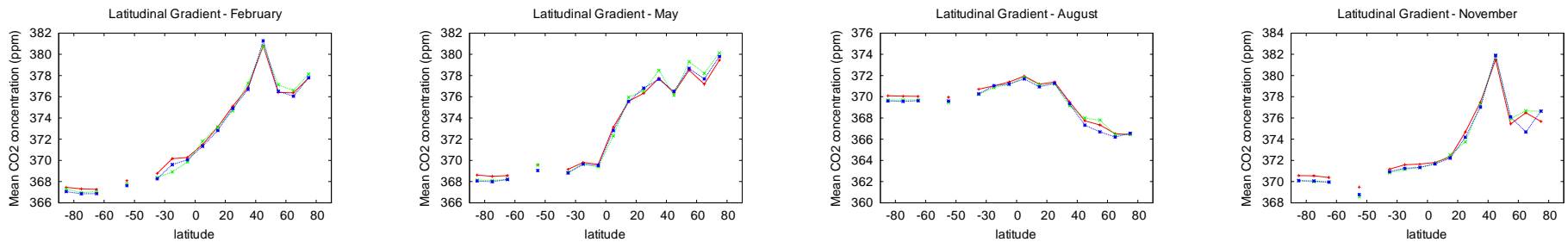
Observations show lower IHD for 2002

Background monthly mean - Zonal mean surface CO₂ concentration

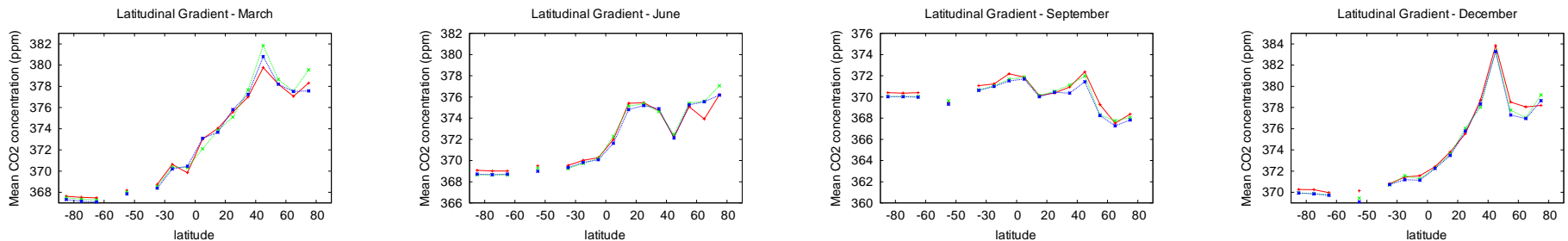
A negative offset is applied to 2003 and 2004 for comparisons with 2002



The model doesn't show high inter-annual variability

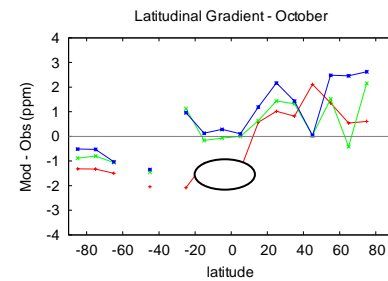
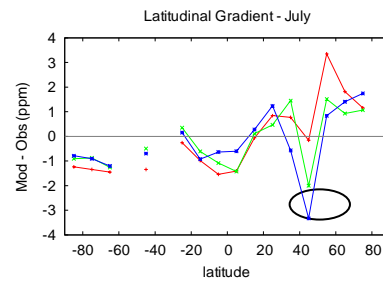
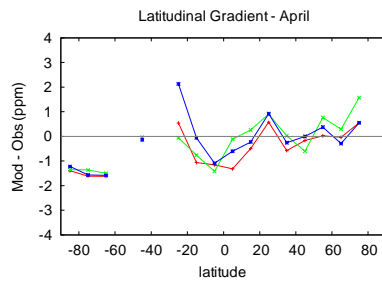
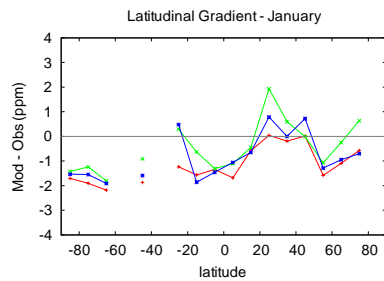


A steady state seems to be achieved after two years spin-up (2000-2001)

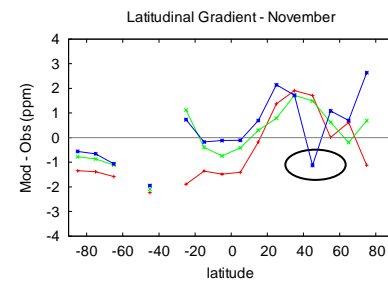
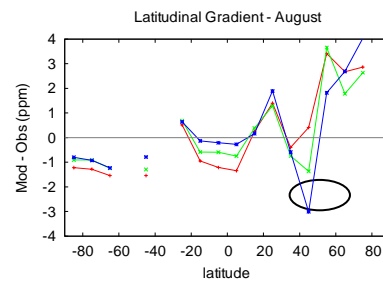
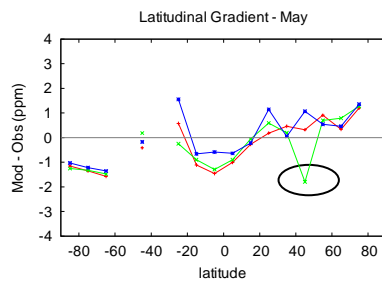
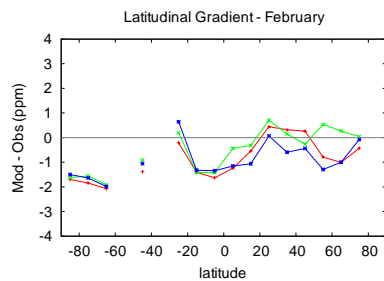


Model-Observation at the surface - Monthly zonal means

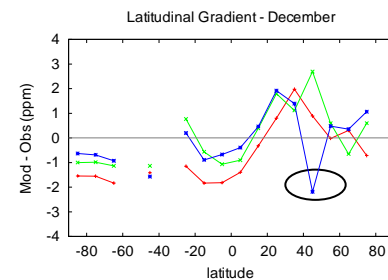
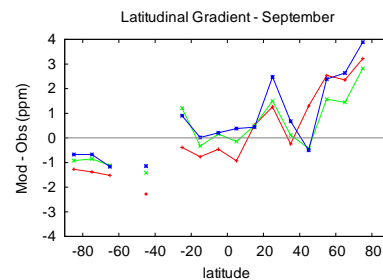
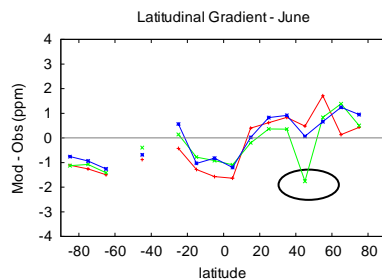
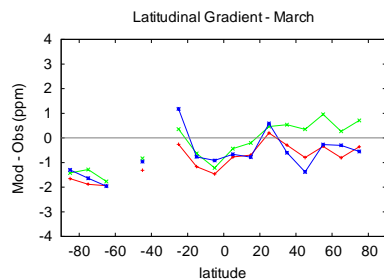
But some inter-annual variability is visible in observations



— 2002 — 2003 — 2004

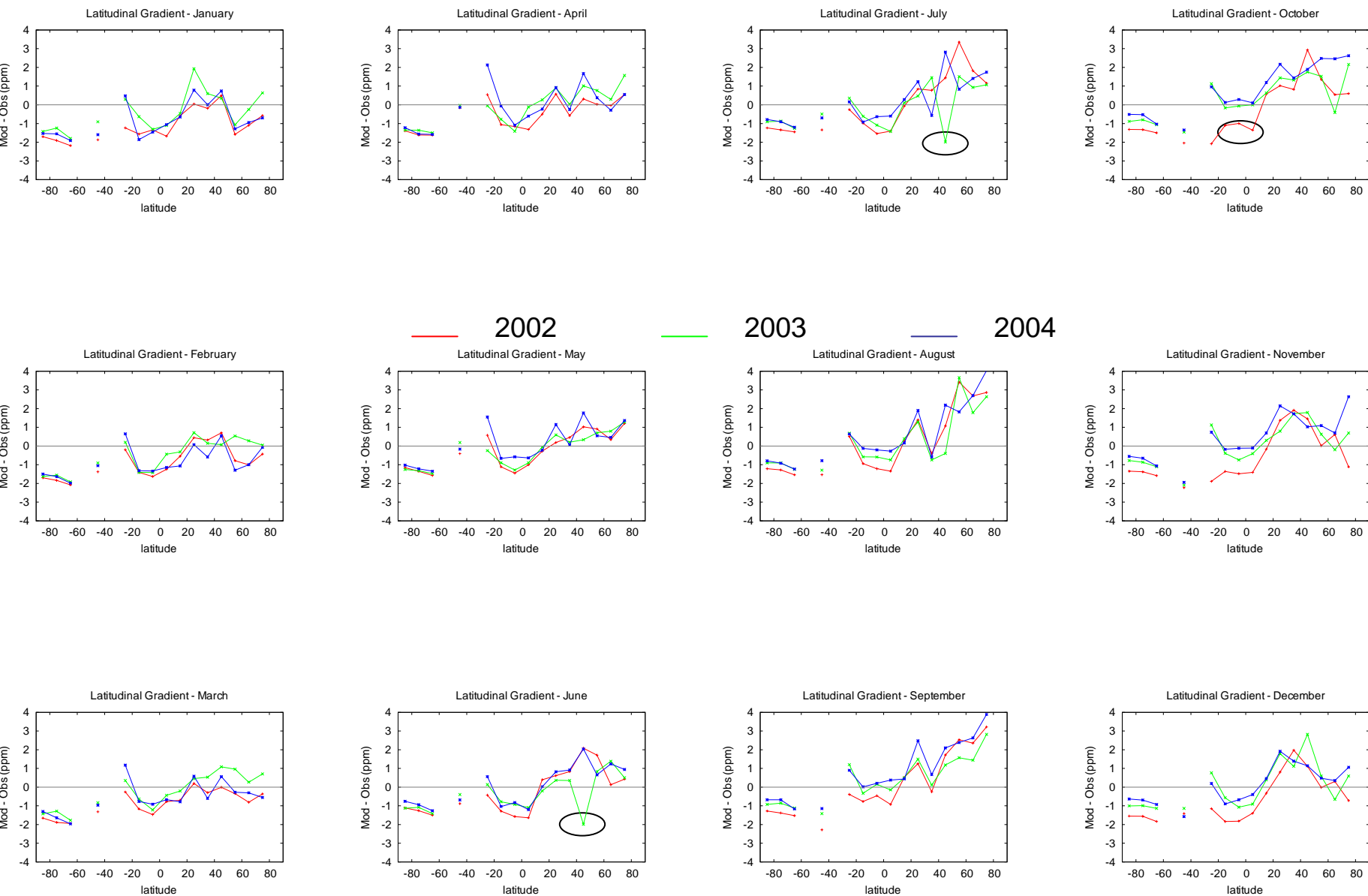


Residuals result from sources or sinks misrepresented in the model or possible deficiency in the transport model



Model-Observation at the surface - Monthly zonal means

Same as before but excluding data from the Black Sea station



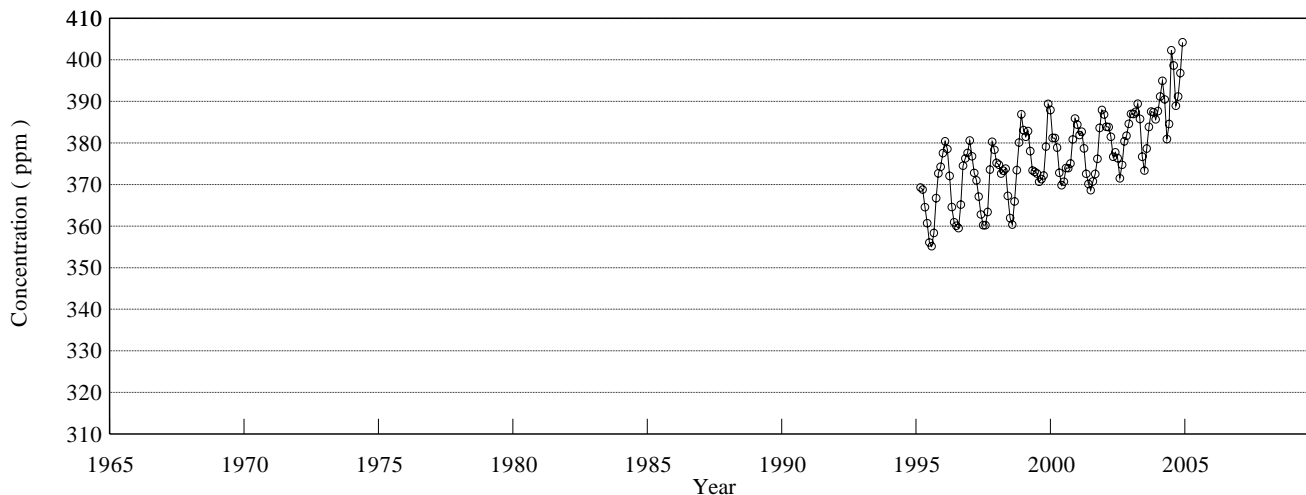
CO₂ Black Sea

Country/Territory : Romania
Location : 44 10' N, 28 41' E, elevation 3 meters above mean sea-level.
Organization : NOAA/ESRL Global Monitoring Division (the former CMDL)
Contact person : Mr. T. J. Conway
Analysis : NDIR
Time Interval : Weekly
Calibration : WMO CO₂ mole fraction scale

(unit: ppm)

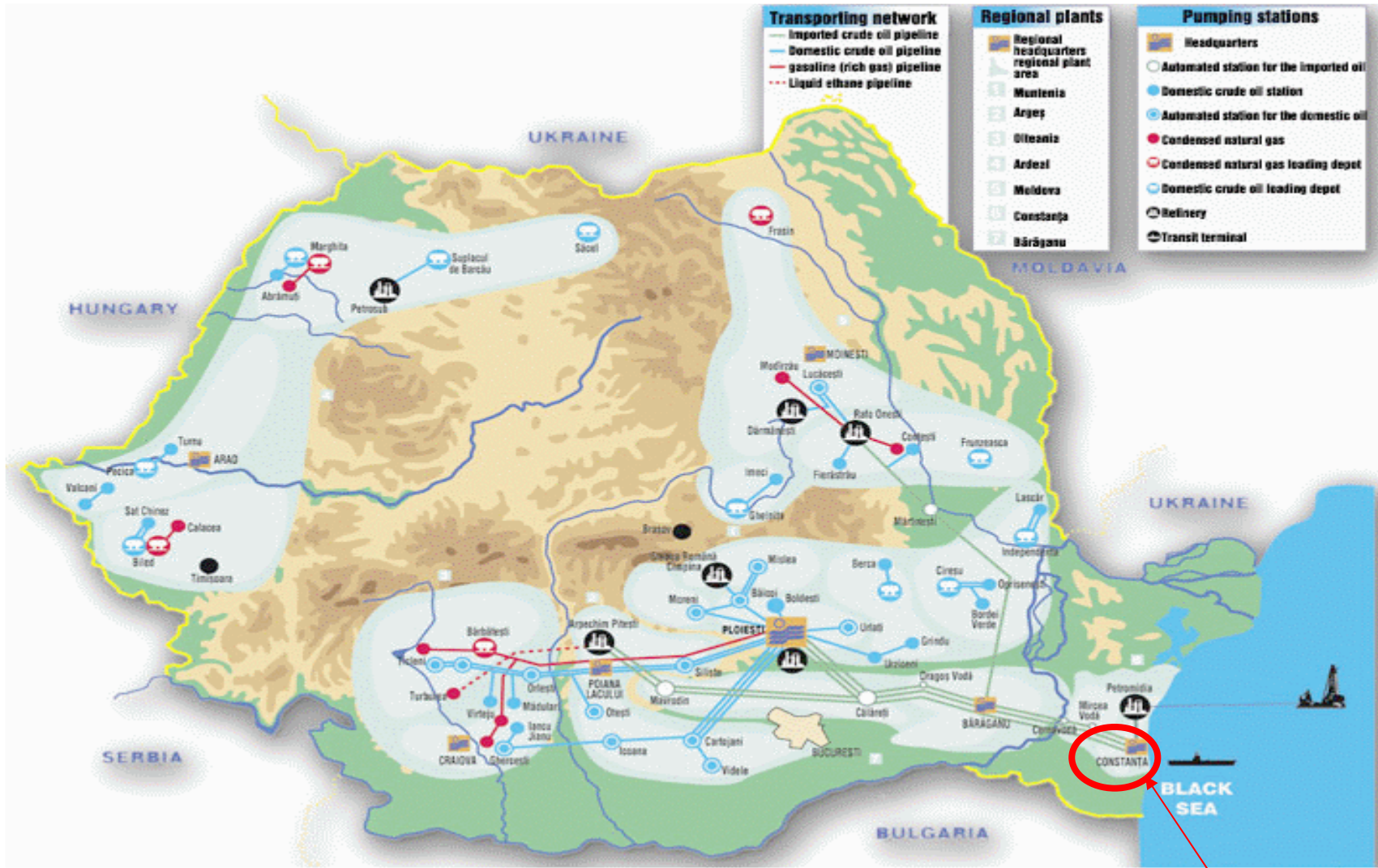
year	January	February	March	April	May	June	July	August	September	October	November	December	Annual*
1995			369.30	368.80	364.57	360.72	356.08	355.16	358.36	366.74	372.70	374.29	-
1996	377.58	380.41	378.56	372.10	364.59	360.95	360.07	359.50	365.18	374.54	376.29	377.61	370.62
1997	380.60	376.81	372.83	371.01	367.11	362.81	360.22	360.23	363.41	373.61	380.31	378.36	370.61
1998	375.21	374.78	372.65	373.34	373.82	367.27	361.92	360.36	365.92	373.47	380.12	386.90	372.15
1999	383.09	381.52	382.88	378.05	373.40	373.06	372.67	370.66	371.33	372.20	379.14	389.40	377.28
2000	387.95	381.20	381.20	378.89	372.84	369.85	370.70	374.00	373.95	375.09	380.88	385.91	377.71
2001	384.43	381.92	382.70	378.72	372.60	370.16	368.62	370.76	372.55	376.19	383.64	387.94	377.52
2002	386.85	383.90	383.84	381.50	376.69	377.75	376.35	371.52	374.76	380.40	381.74	384.62	379.99
2003	387.02	386.97	387.49	389.45	385.80	376.71	373.35	378.68	383.86	387.57	387.39	385.67	384.16
2004	387.68	391.17	394.97	390.48	380.95	384.58	402.30	398.65	388.94	391.17	396.82	404.23	392.66

(*)Annual mean concentration are the arithmetic mean calculated with 12 monthly values by WDCGG.



An increase of measured CO₂ concentration is visible for the recent years

The Black Sea station is located at Constanta close to an oil refinery

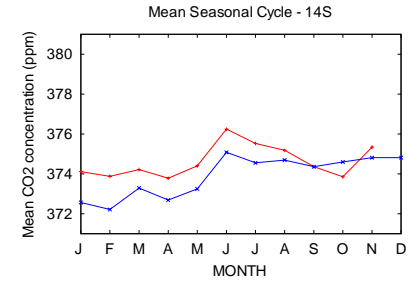
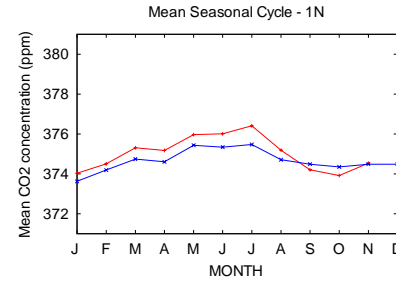
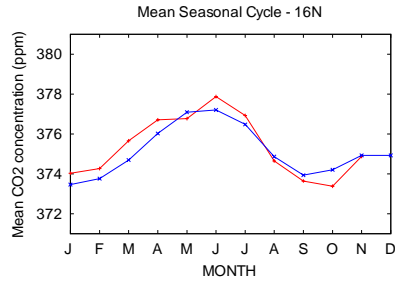
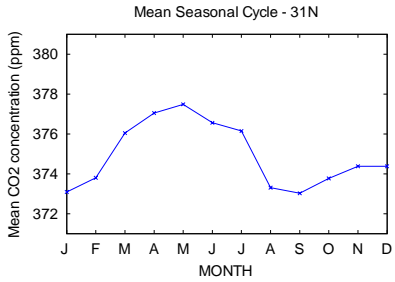


... this could be the source of the anomalies observed

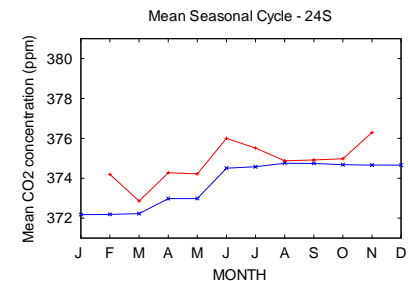
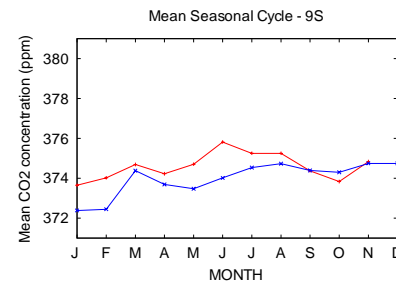
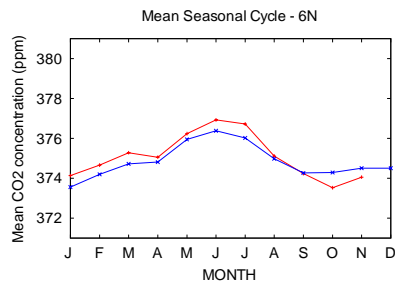
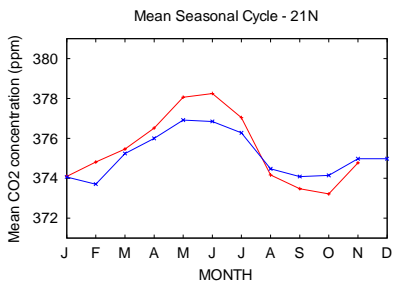
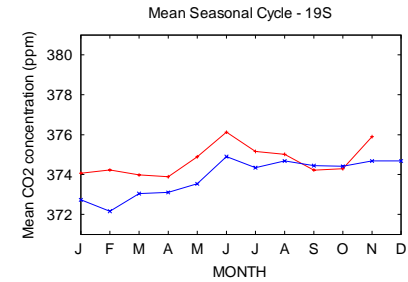
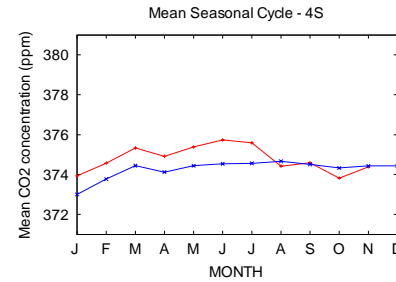
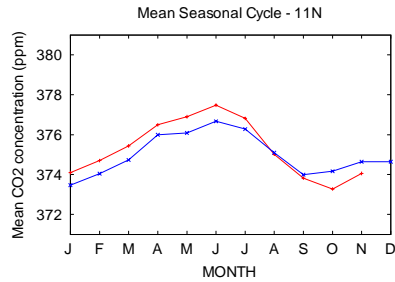
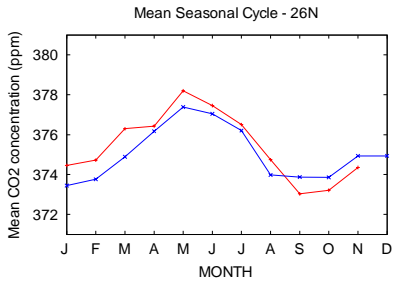
Location of Costanta station

Forward modelling verification

Comparisons to aircraft measurements from the JAL (2003)

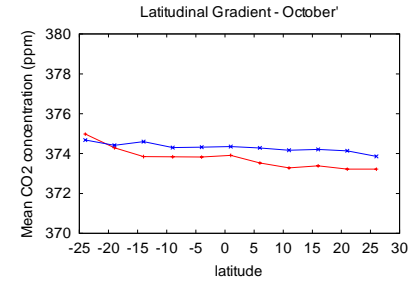
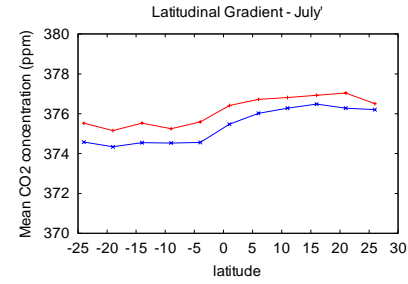
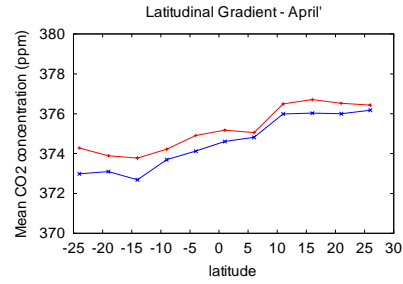
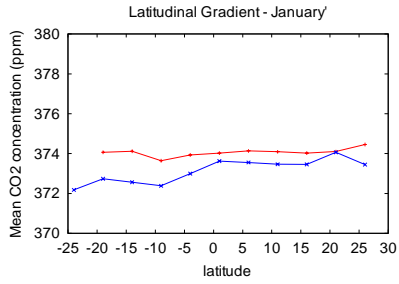


— observations
— model

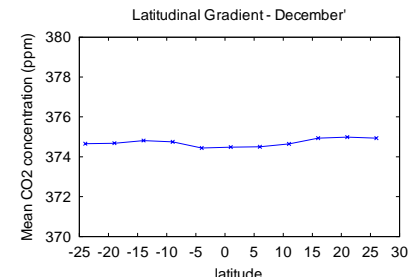
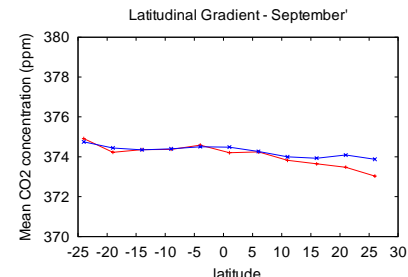
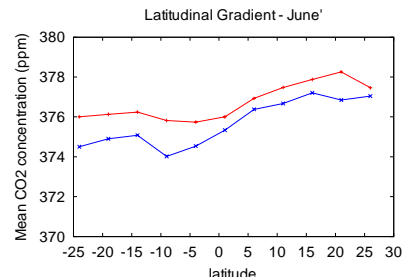
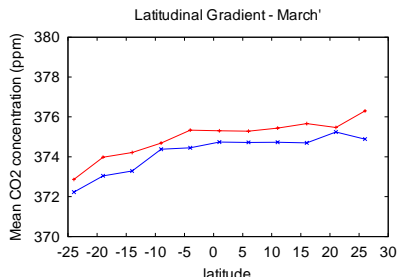
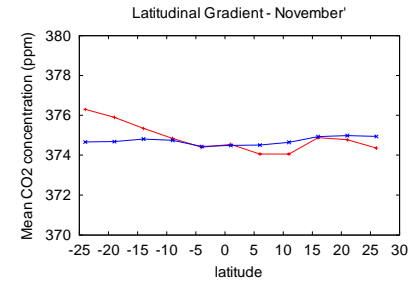
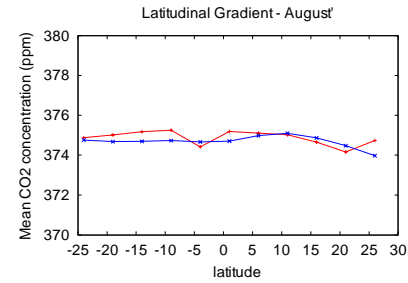
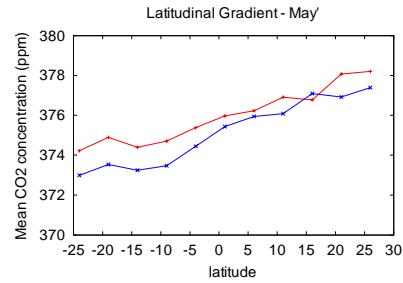
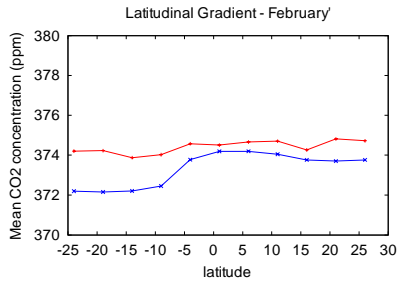


Forward modelling verification

Comparisons to aircraft measurements from the JAL (2003)

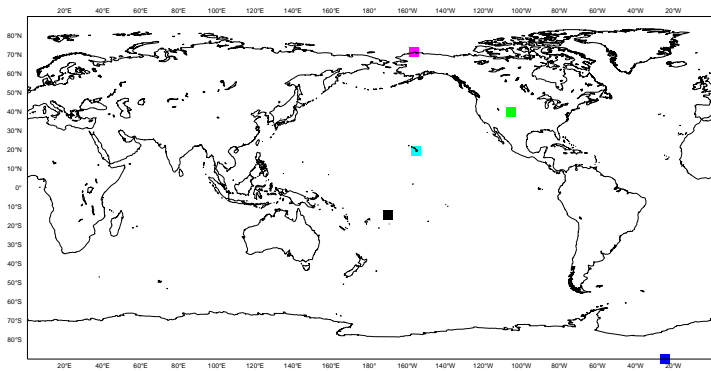
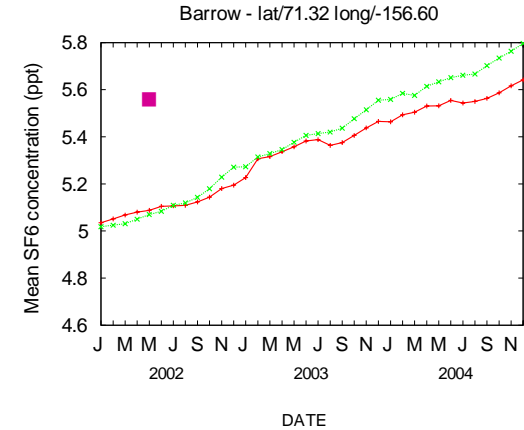
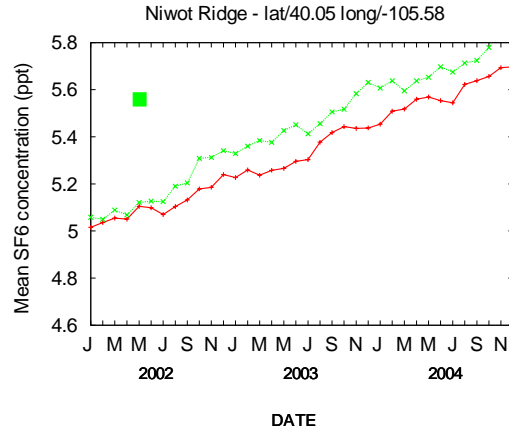
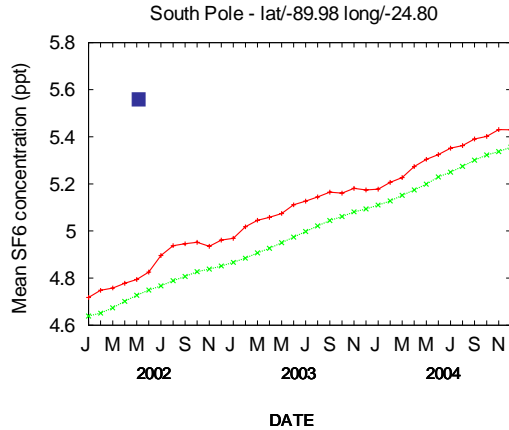


— observations
— model

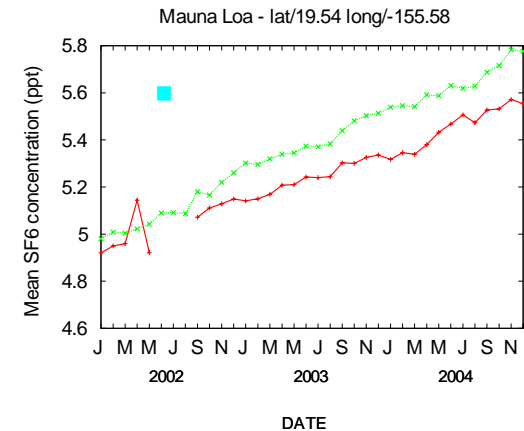
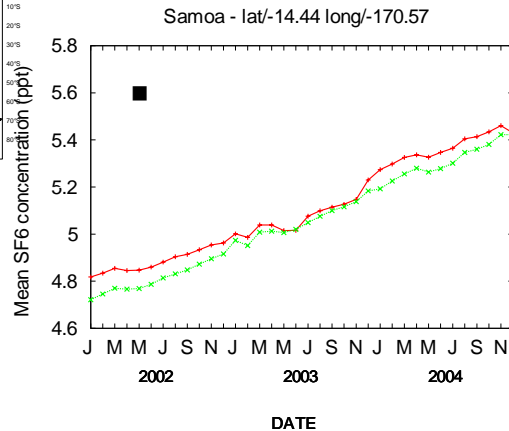


Comparisons of simulated SF6 concentrations to in situ measurements

Monthly-means data



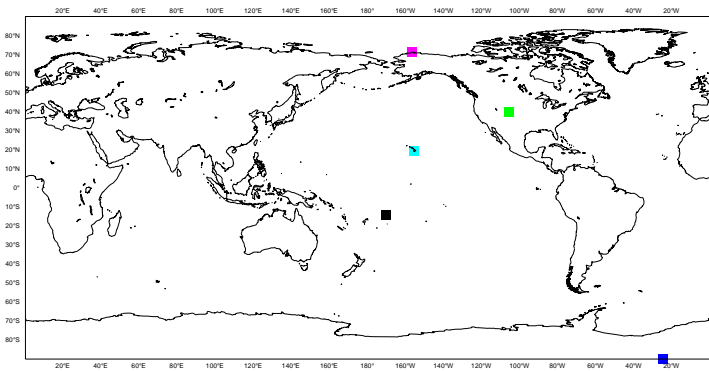
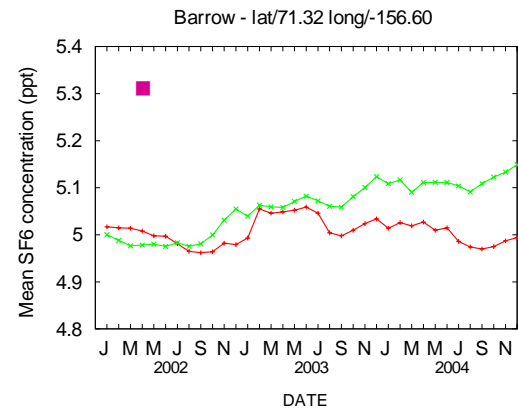
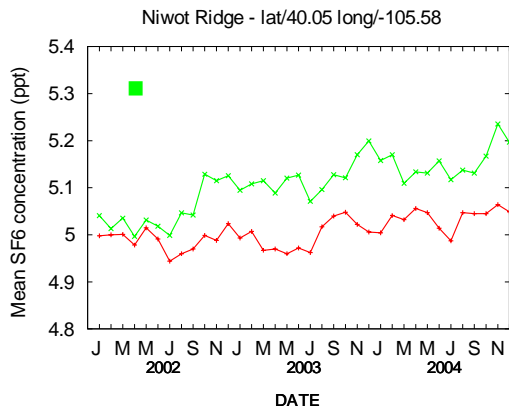
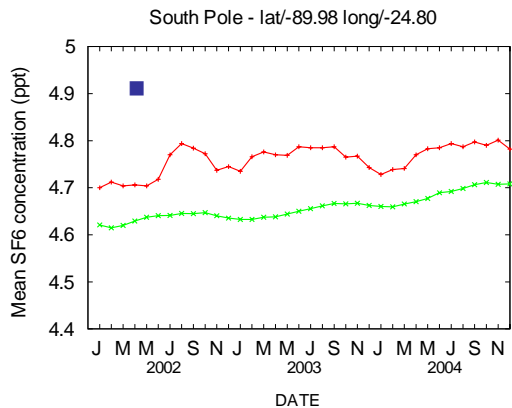
— observations
— model



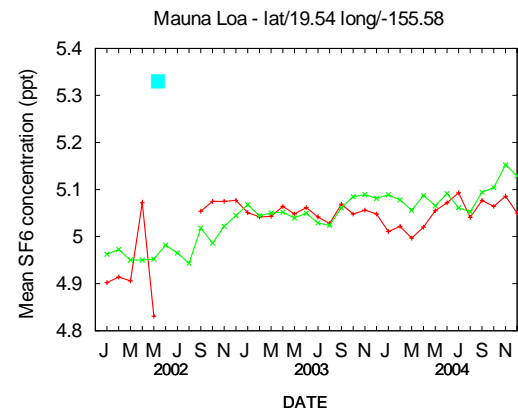
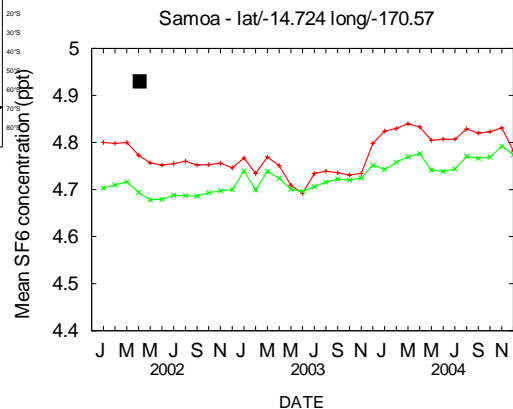
The signal is driven by the tendency but we are interested on the variations related to the transport

Comparisons of simulated SF6 concentrations to in situ measurements

Monthly-means data



— Observations (tendency removed)*
 — Model (tendency removed)*

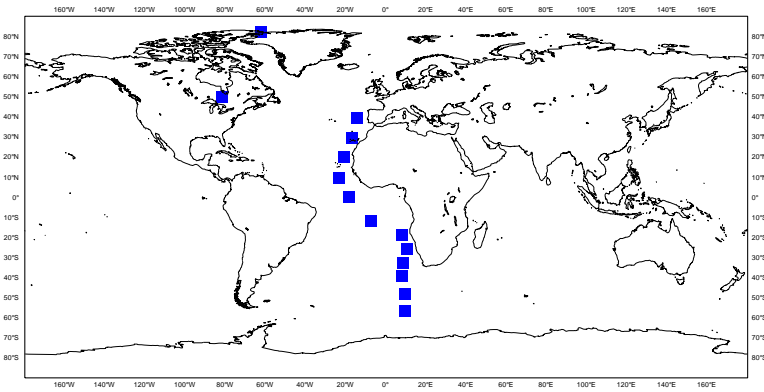


Observed biases indicate an over-estimation of the meridional gradient in the model in coherence with CO₂ simulations

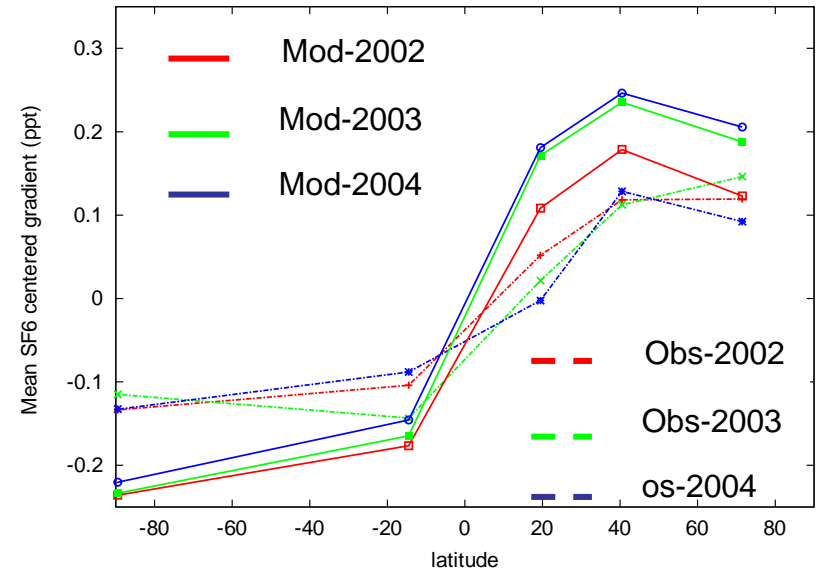
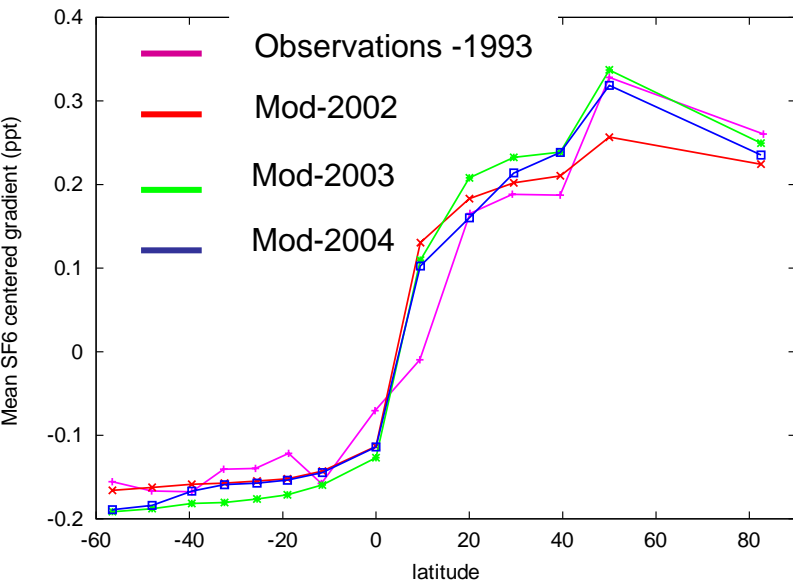
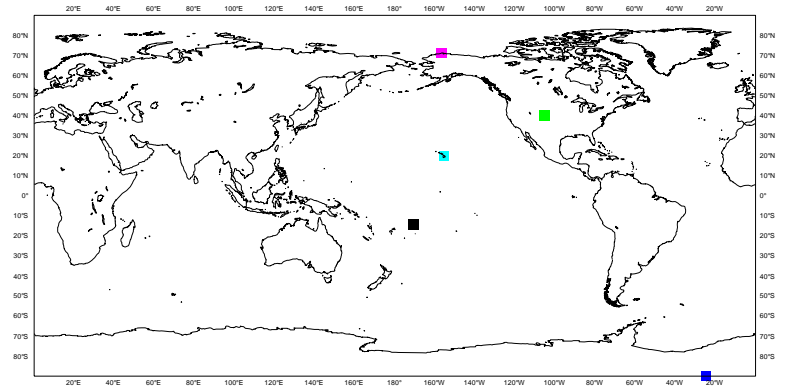
* A mean tendency based on all the observations

Meridional profiles of simulated and observed annual mean concentrations of SF₆

Comparisons with data Maiss et al.

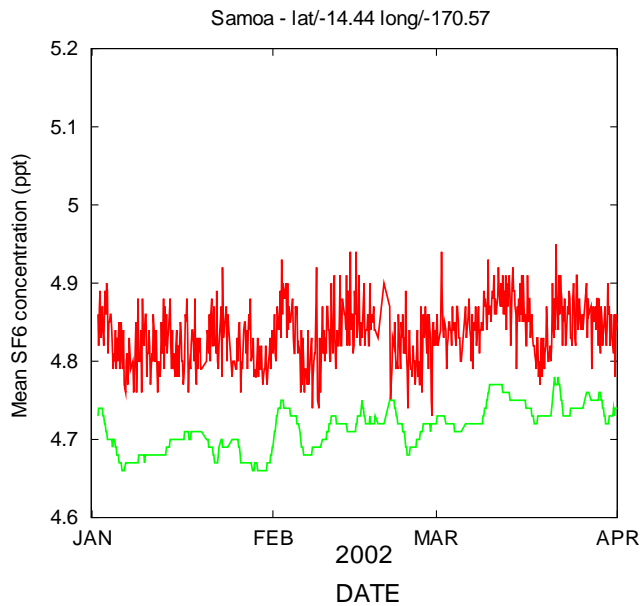


Comparisons with data from CMDL

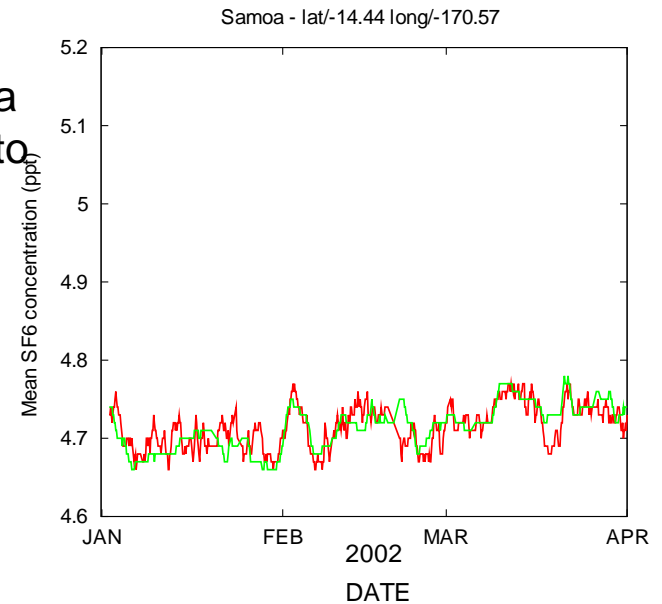
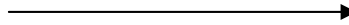


Inconsistency in conclusions between the two data sets

Example of comparisons with high frequency observations



A negative offset and a
15h filtering is applied to
observations



Samoa is an oceanic station remotely located from the sources, the comparisons here are mainly an indication of the quality of the winds

More work need to be done to relate the variations observed to the meteorology

— observations
— model