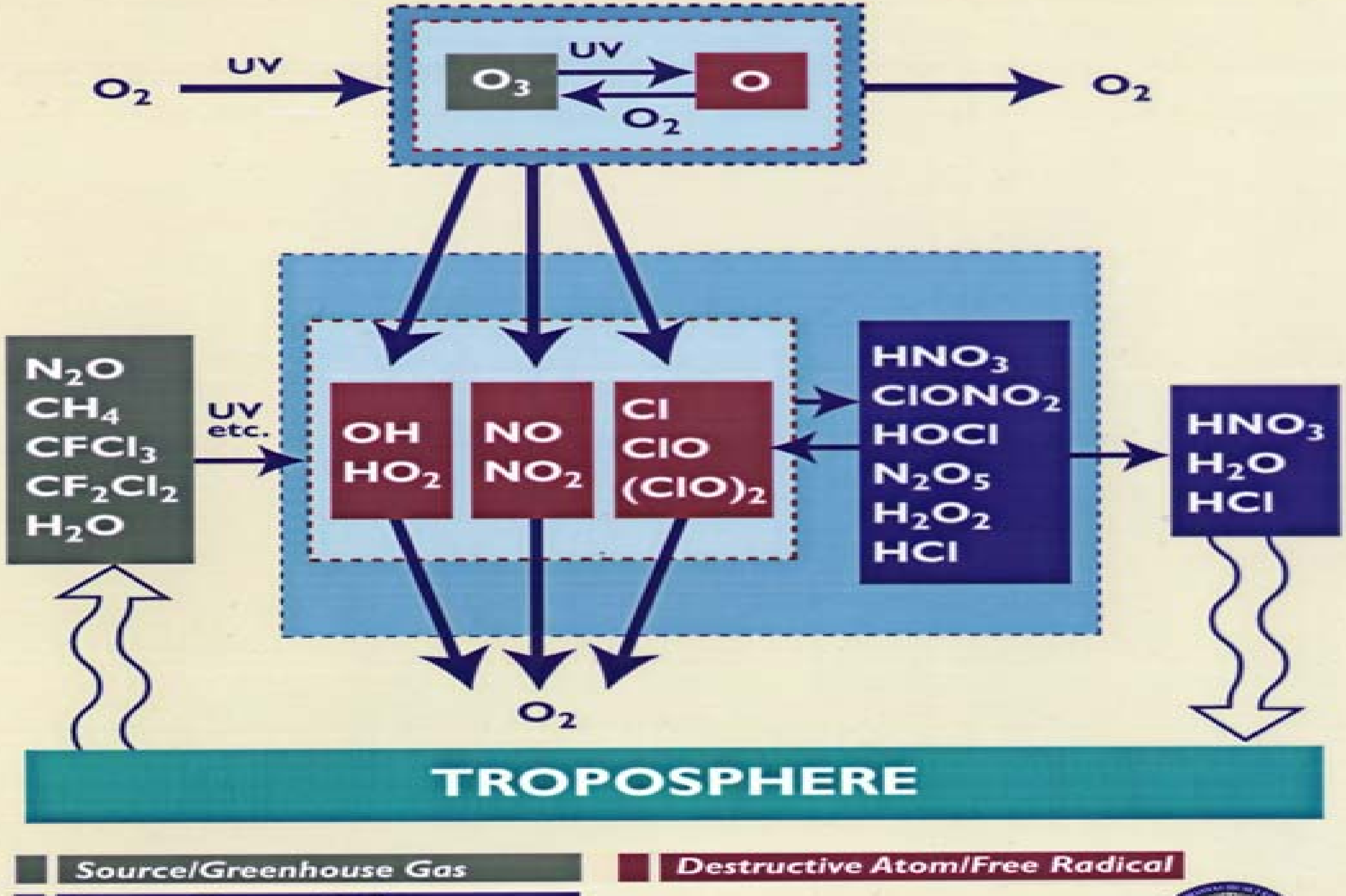
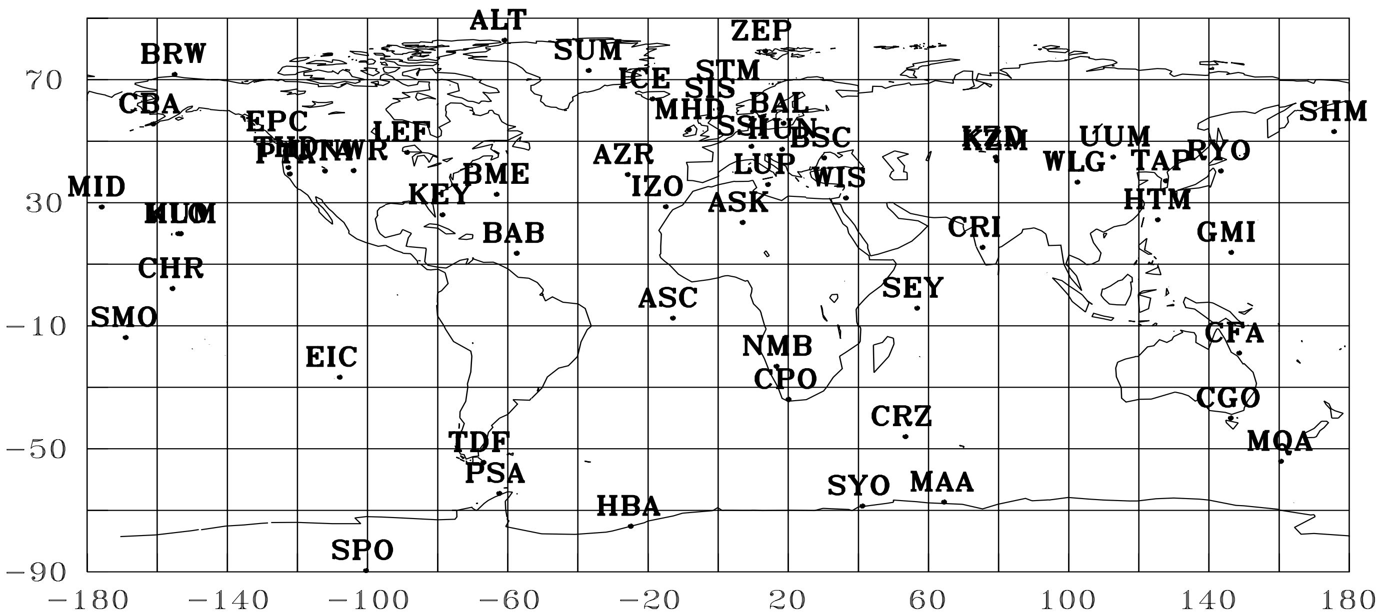
Optimal estimation of regional N_2O emissions using a three-dimensional global model

Ref: J. Huang, R. Prinn, A.Golombek, et al, 2006

Stratospheric Chemistry of Climatically Important Species



Data:



AGAGE : (MHD) = Mace Head, Ireland; (THD) = Trinidad Head, California, USA; (SMO) = American Samoa; (CGO) = Cape Grim, Tasmania, Australia; real time measurements

CMDL (HATS): (ALT) = Alert, Northwest Territories, Canada; (BRW) = Point Barrow, Alaska, USA; (CGO) = Cape Grim, Tasmania, Australia; (KUM) = Kumukahi, Hawaii, USA; (MLO) = Mauna Loa, Hawaii, USA; (NWR) = Niwot Ridge, Colorado, USA; (SPO) = South Pole, Antarctica; (SMO) = American Samoa; flask measurements

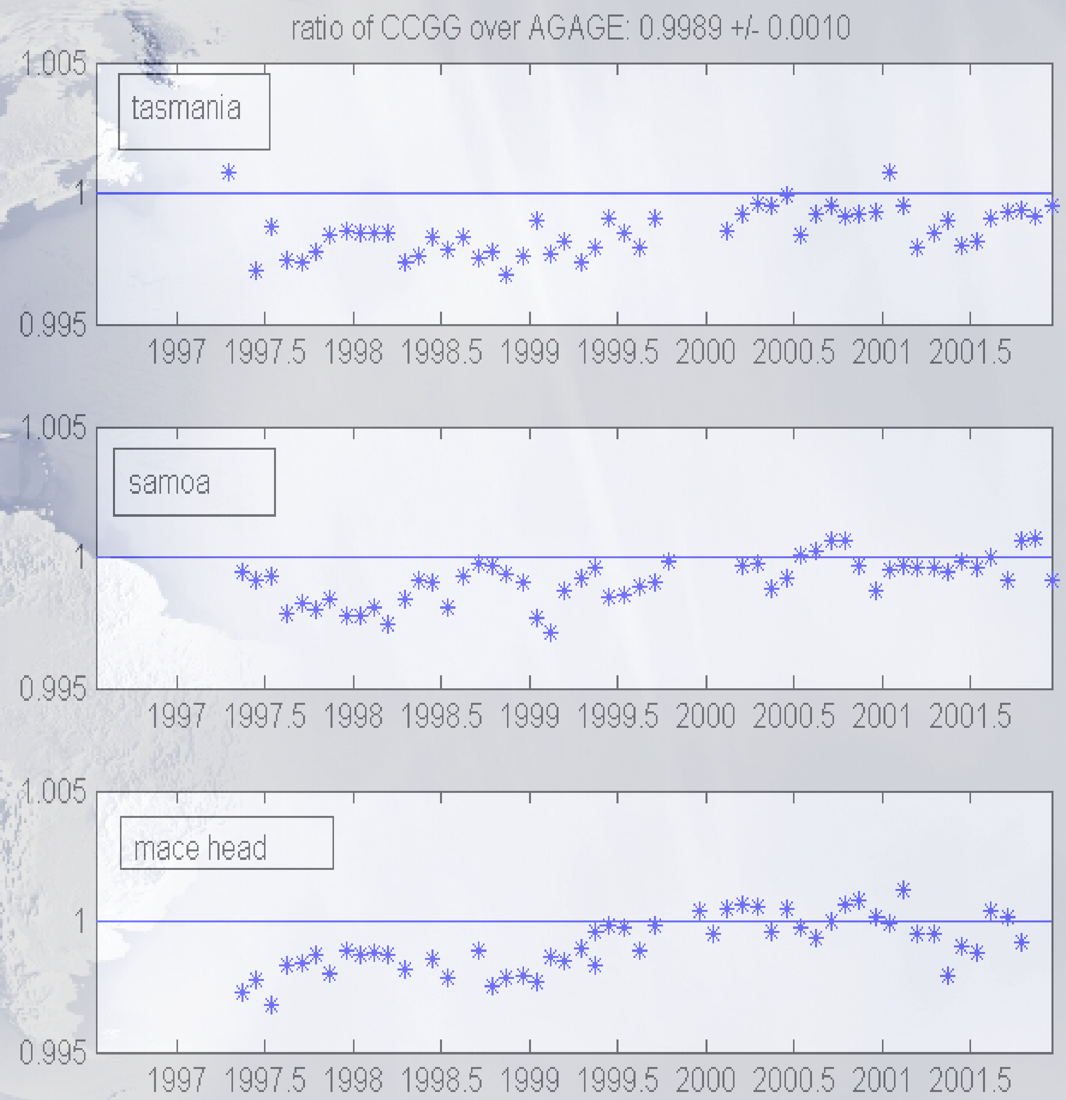
CMDL (CCGG): 35 sites over the globe, flask measurements

NIES: Hateruma, Japan., flask measurements

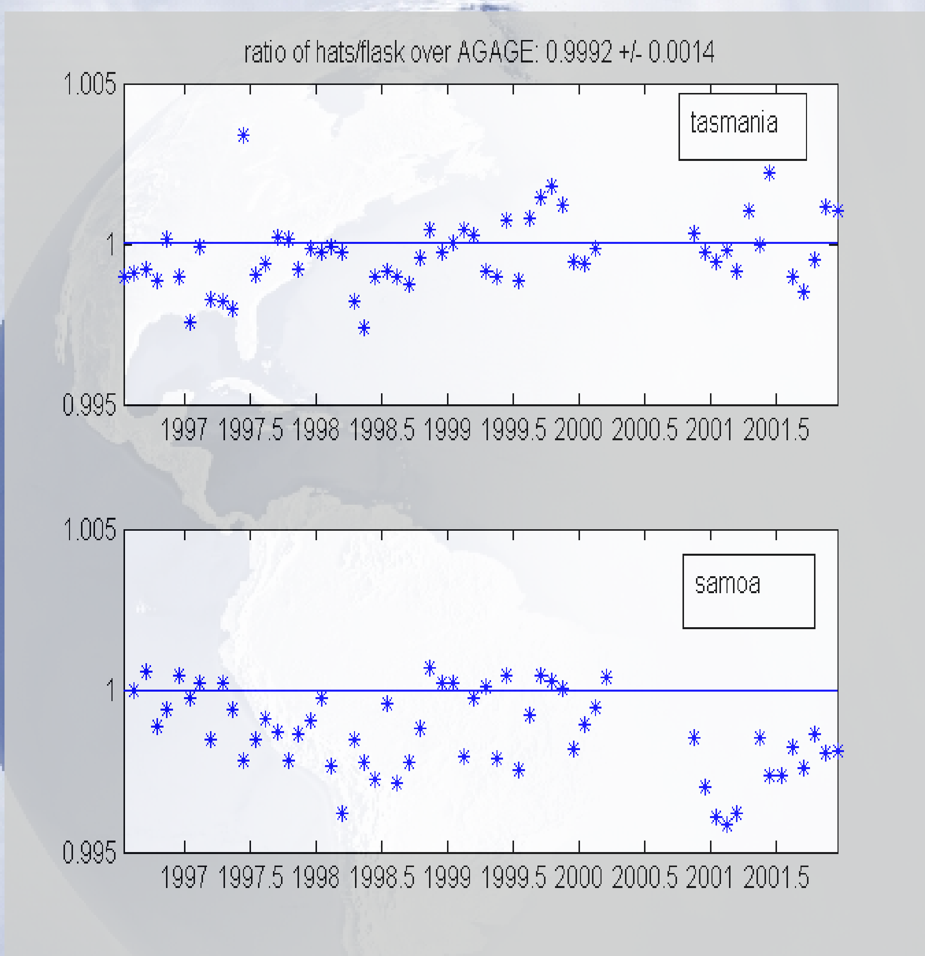
CSIRO: India (CRI), Australia (CFA), flasks

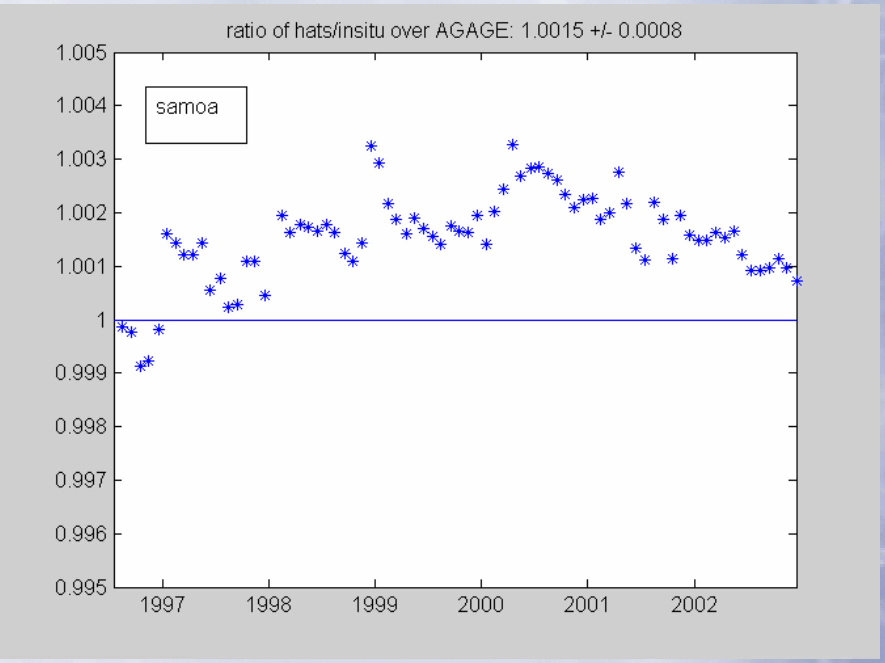
CSIR: South Africa (CPT), flasks

Data comparison

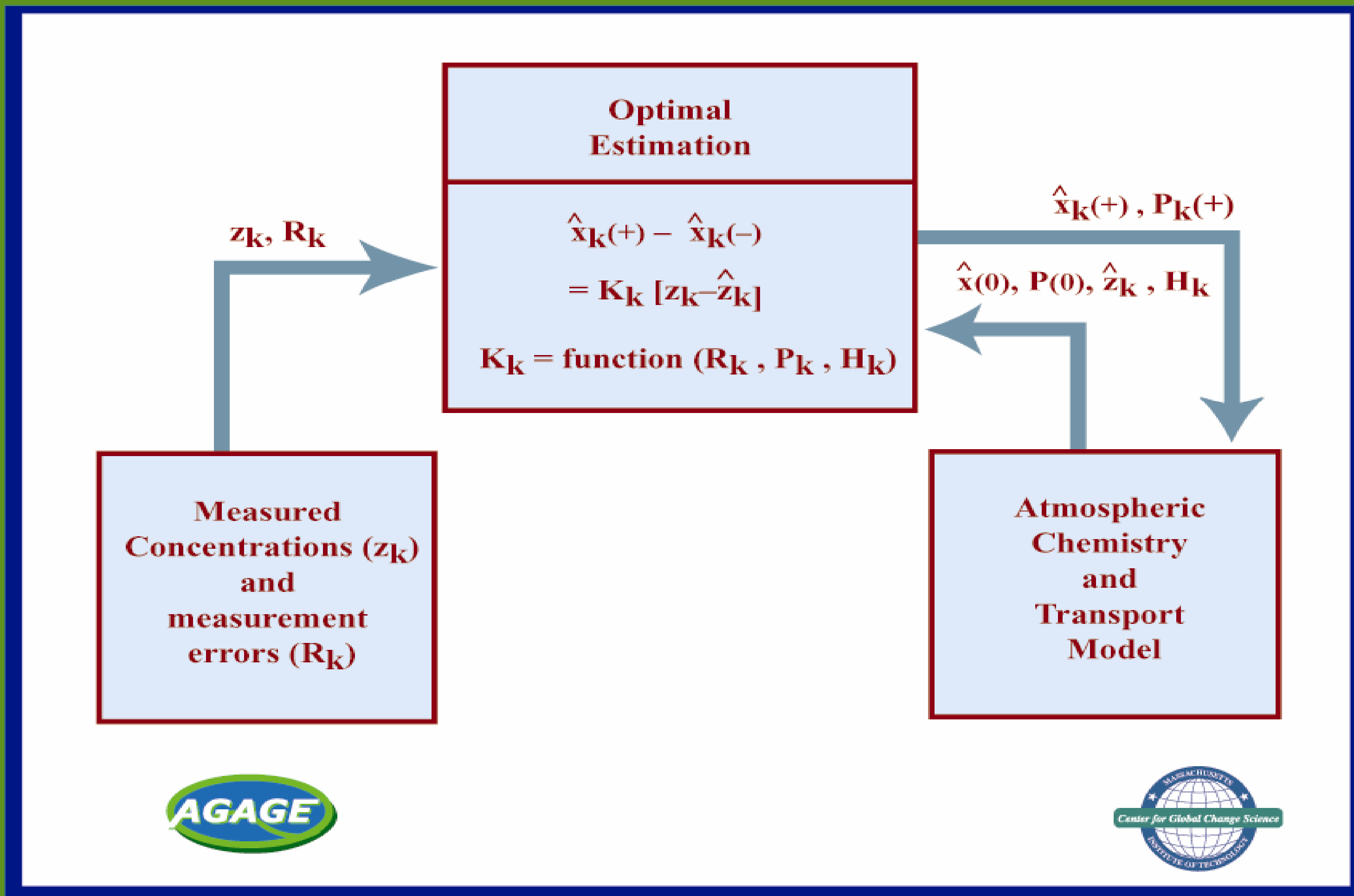


Data comparison, contd.

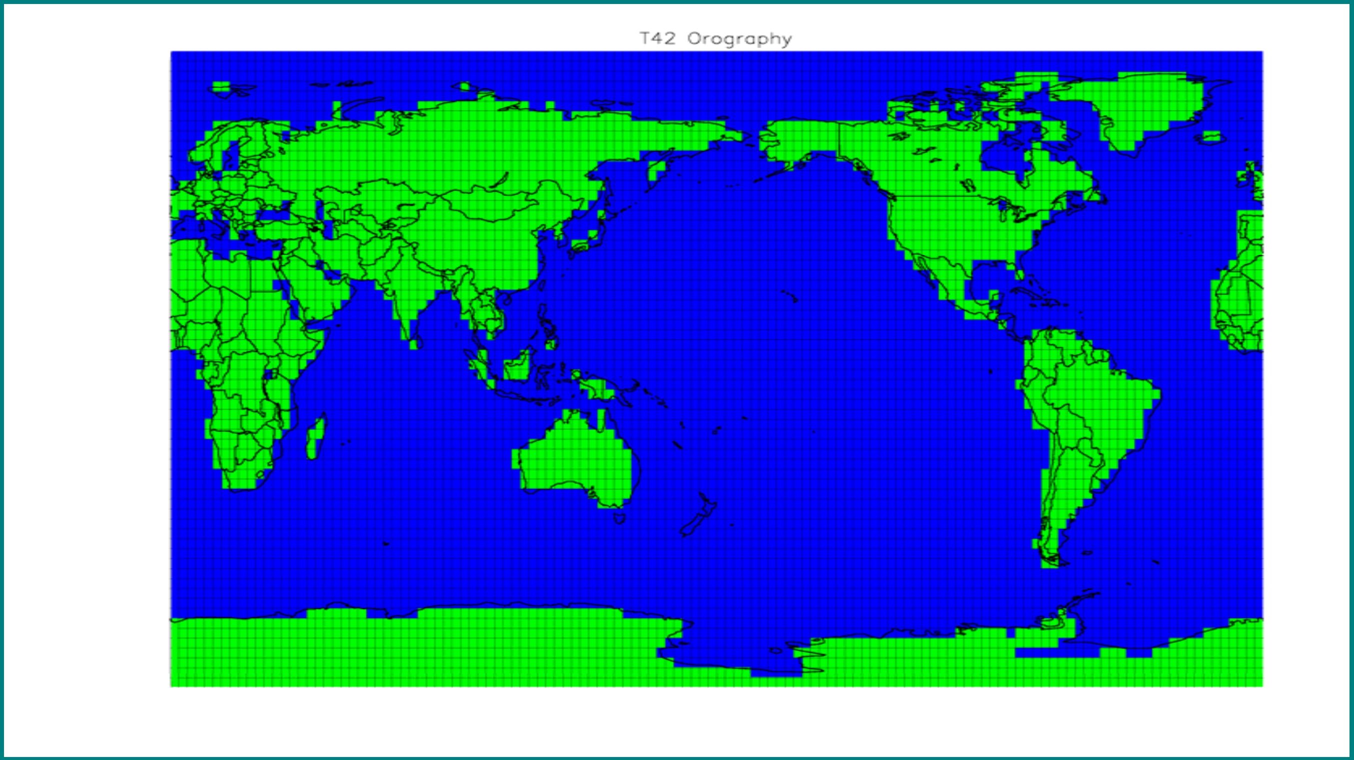




Kalman Filter



MATCH:



1.8º x 1.8º (T62)
28 Vertical (sigma) levels: 1000 to 2.9mb
30 minute time-step (Semi-Lagrangian or mass conserving SPITFIRE)

NCEP Reanalysis Meteorology

Chemical Studies Include: Rn, CCl3F, SF6,Ozone, Sulfur Chemistry, Aerosols, Dust

Conclusions

- Global oceanic sources decrease slightly from 26% (GEIA, 1995) to 22%;
- Southern oceanic sources decease substantially from 12% to 0.6% while the tropical oceans increases from 10% to 19%
- South Asia sources are almost doubled compared to the bottom up method (GEIA, 1995), could be due to the increased soil fertilization in this area and still on-going deforestation.
- By semi-hemisphere, southern extra-tropical sources decrease from 14% to 3% largely due to the big oceanic source reduction in this area; while the northern tropical N2O sources increase from 34 to 58%

USING A LAGRANGIAN 3D MODEL TO CHECK INDUSTRY REPORTS OF EMISSIONS OF CFC REPLACEMENT GASES

(1) AGAGE high frequency GC-MS measurements in MaceHead, Ireland

(2) 3D U.K. Met. Office NAME Lagrangian Model

(3) Estimate European country and regional emissions

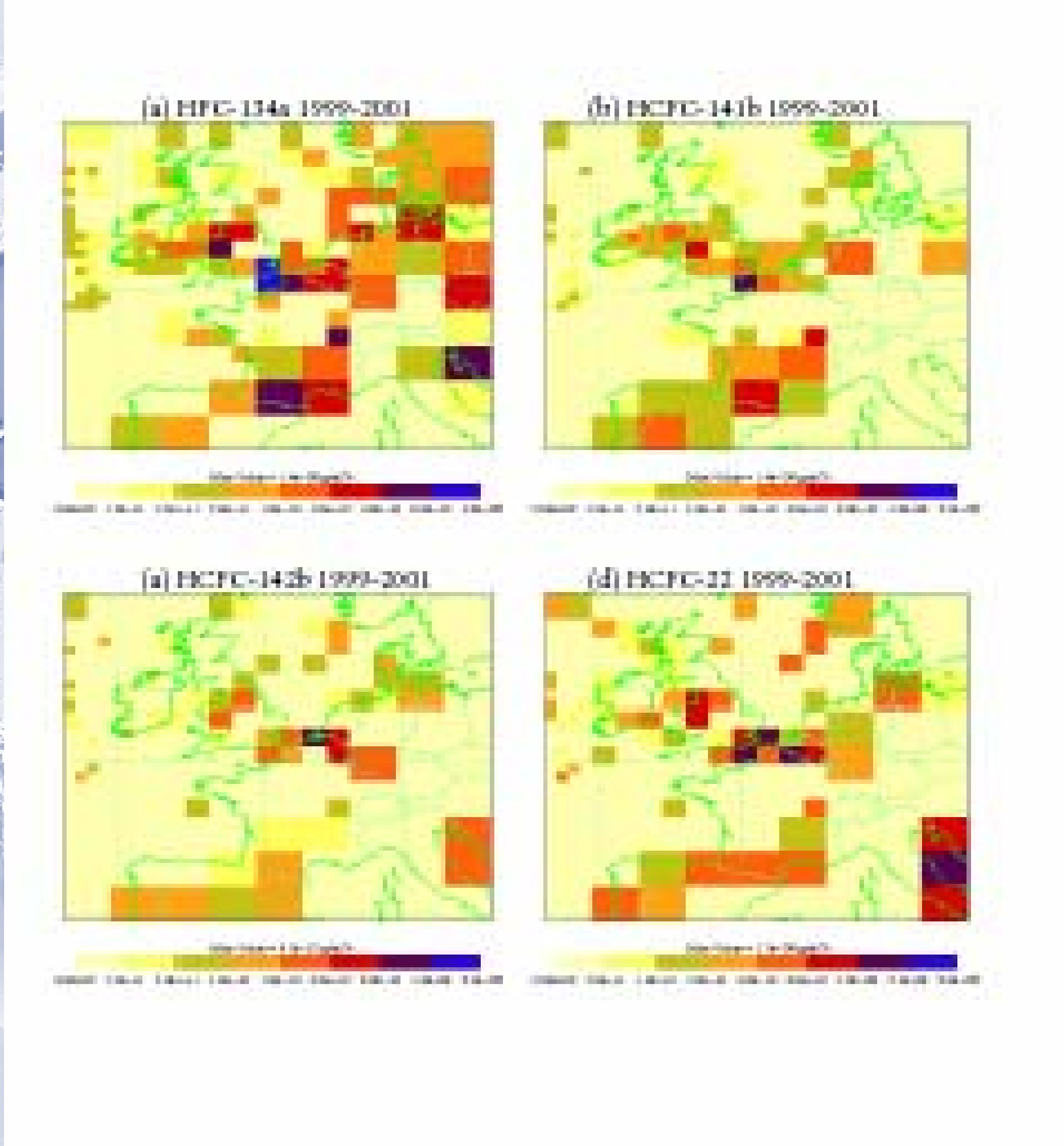
Estimated Concentrations of HFC-134a and HCFC-141b

Compared to observations (Ireland) using inverse (top down) emissions

Image removed due to copyright considerations.

See Figure 8. Simmonds, P. G., S. O'Doherty, J. Huang, R. Prinn, R. G. Derwent, D. Ryall, G. Nickless, and D. Cunnold (1998), Calculated trends and the atmospheric abundance of 1,1,1,2-tetrafluoroethane, 1,1-dichloro-1-fluoroethane, and 1-chloro-1,1-difluoroethane using automated in-situ gas chromatography-mass spectrometry measurements recorded at Mace Head, Ireland, from October 1994 to March 1997, J. Geophys. Res., 103 (D13), 16,029–16,038.

NAME MODEL: EUROPEAN HCFC & HFC EMISSIONS



Three year rolling average NAME-derived and industry estimates of European HCFC & HFC emissions in kilo-ton per year.

Gas	Data Source	1995-1997	1996-1998	1997-1999	1998-2000	1999-2001 (method 1)	1999-2001 (method 2)
HCFC-22	NAME	-	-	-	-	27	28
	Industry	38	40	41	41	41	-
HCFC-141b	NAME	8	9	12	13	8	7
	Industry	10	11	12	13	13	-
HCFC-142b	NAME	8	8	12	6	6	4
	Industry	10	11	11	11	11	-
HFC-134a	NAME	7	8	12	13	11	11
	Industry	7	11	15	19	23	-