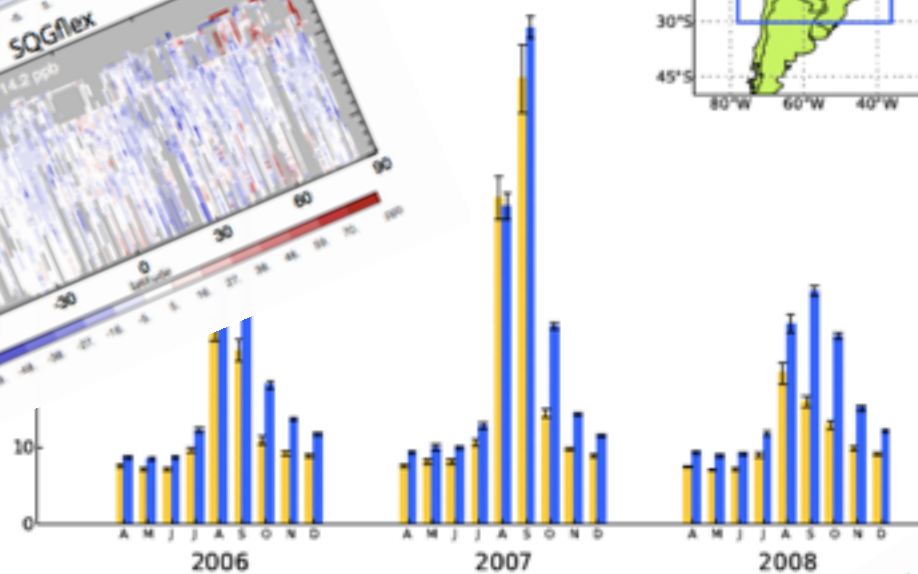
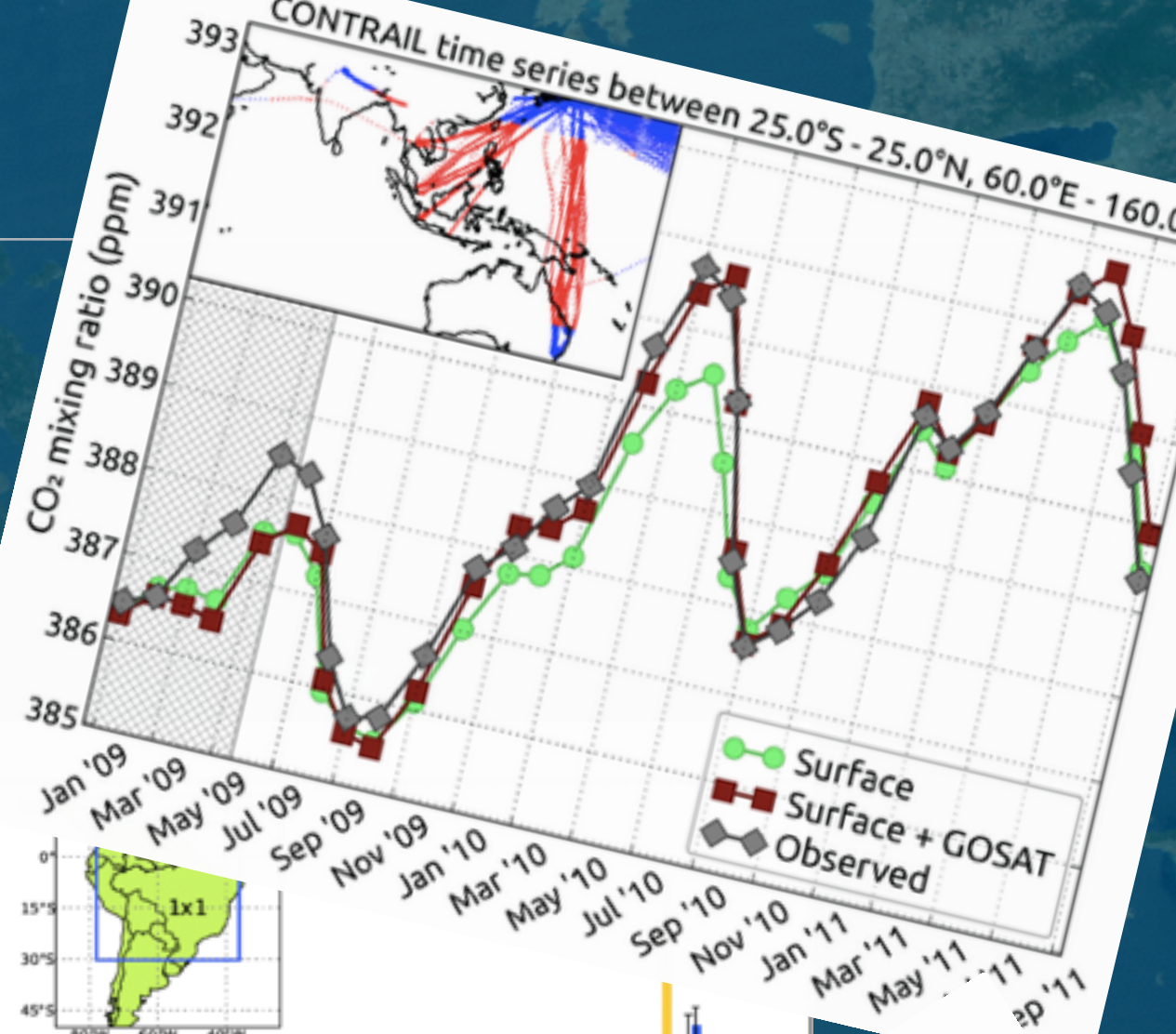
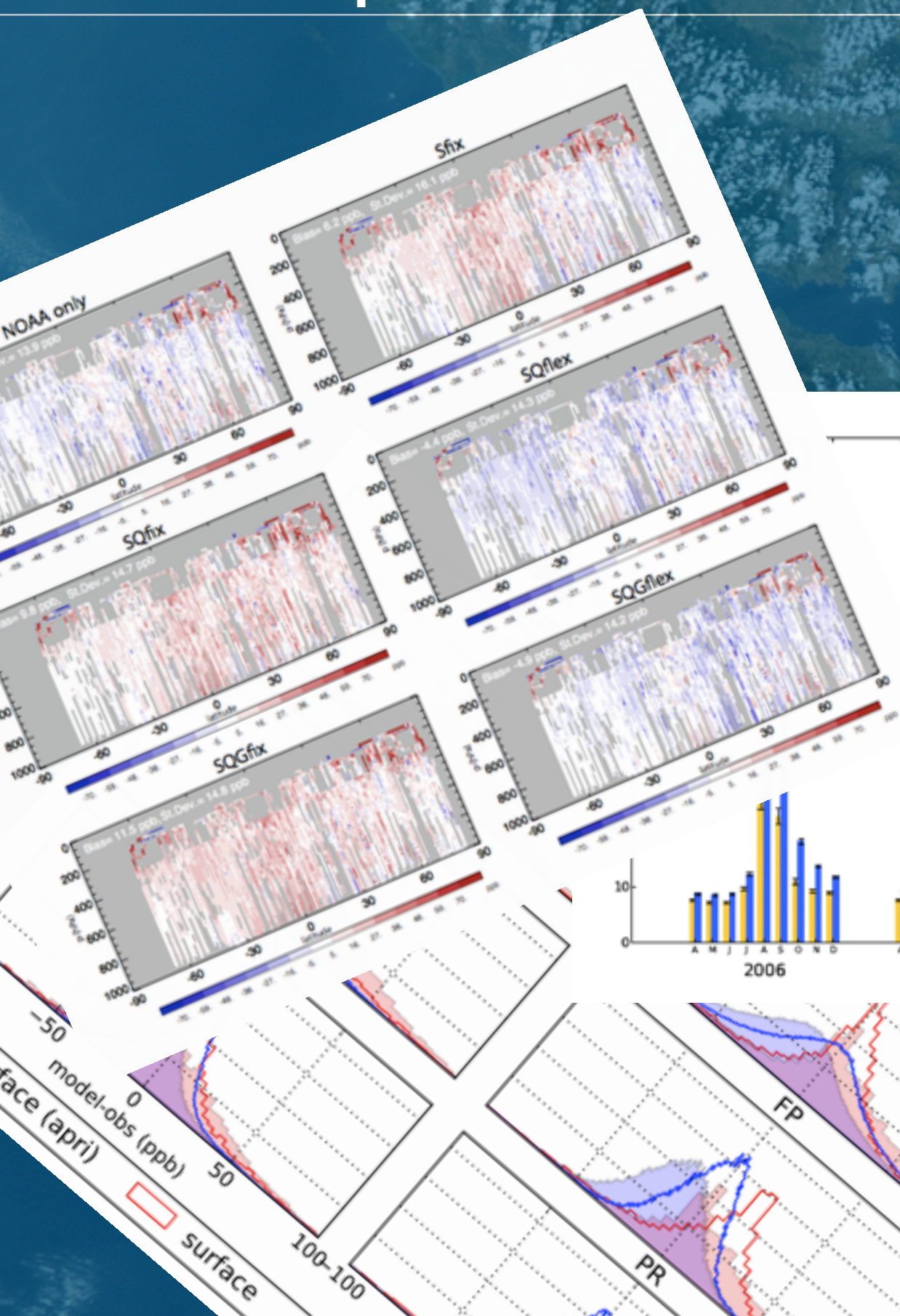


Status TM5-4DVAR

Maarten Krol & other developers
TM meeting, May 2014, Wageningen

Great publications



Atmospheric CH₄ in the first decade of the 21st century: Inverse modeling analysis using SCIAMACHY satellite retrievals and NOAA surface measurements

P. Bergamaschi^{1*}, S. Houweling^{2,3}, A. Segers^{1,4,1}, M. Krol^{2,3,5}, C. Frankenberg⁶, A. Scheepmaker², E. Dlugokencky⁷, S. ...⁸, E. A. Kort⁶, C. Sweeney^{7,9}, T. Brenninkmeijer¹⁰, H. Chen ... and C. Gerbig¹²

1 JUL 2013

Issue

Journal of Geophysical Research: Atmospheres

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status various versions

- » multi tracer pyshell version
- » Ispra version MACC. CH₄. N₂O
- » various personal versions
 - Sander (bias correction)
 - Sudhanshu (ratio method)
 - Guillaume (GOSAT CH₄)
 - KIT version
- » how to get to 1 version?
- » We badly need an integration operation!

First step has been taken

Dear Arjo,

Maarten, Sourish, Sander, and myself discussed today in Noord-
TM5-4DVAR pyshell version. The main points from this discussion:

- (1) The basis should be Sourish's / Sander's multi-
- (2) The new common version should include m1qn3, optimization of initial fields, sum error for station observations)

will be good to have this combined in a single version.

Hallo Peter et al.,

seems a rather complete feature list, will be good to have this combined in a single version.

One thing that might be added:

- (9) off-line pre-conditioner (fortran code to do the forward/backward transformation, xc_to_x etc) ;

this is work in progress

On the hg server: the "RedMine" server "dev.knmi.nl" provides hg, there is a TM5 account already (used by Phillipe).


I'll forward a mail on this to Maarten (it is in Dutch).

- ('T38ps7', i.e
model representation

A common TM5–4DVAR

- » Multi-tracer (separated TM5 – Pyshell)
- » CONGRAD (linear) + M1QN3 (non-linear)
 - Optimize emissions, initial condition, (bias) parameters
- » Observations (including representation errors)
 - Flask
 - Satellites
 - Continuous
- » Emissions: PyShell, Time-factors
- » Merged User Output
- » Support of “old” & “new” convection
- » Available through “hg”, preferably on dev.knmi.nl

Time-line

An aerial photograph of a mountain range, likely the Alps, covered in snow. The image is overlaid with a semi-transparent blue filter. A white horizontal line is positioned near the top of the frame, just below the title.

» End of summer

Continued development

» 4D-var is sequential, not very suitable for massive parallel computing

- Split of the long time windows
 - “Saddle point 4DVAR”
 - “Chevallier” – idea
- Move to TM5-MP
 - But.....adjoint is not coded up yet
 - And.....6 hourly meteo is now the only option
 - Required time investment yet unclear

$$\delta \mathbf{c}(t) = \sum_{t'=T}^t \mathbf{H}_{t't}^{\varphi} \cdot \delta \boldsymbol{\varphi}(t') + \mathbf{H}_{t't}^c \cdot \delta \mathbf{c}(T),$$

$$\delta \mathbf{c}(t) = \sum_{t'=\tau}^t \mathbf{H}_{t't}^{\varphi} \cdot \delta \boldsymbol{\varphi}(t') + \delta b(\tau),$$

Continued development

» Multi-tracer inversions

- CO – CO₂ coupled inversions (Sourish, GO-proposal)
 - Emissions are coupled through the B-matrix
 - Observations ($Hx - y$) are correlated
 - Chemical CO₂ production from CO
- CO₂ – CH₄ system (ratio method GOSAT)
- ...NO₂, CH₂O, ..., chemistry (?)

» Large data-streams of satellite data

- Coding up stuff with f2py
- Share code with other users (e.g. Carbontracker)?

Summary

» TM5–4DVAR–version is in good shape

- Excellent scientific papers

» Future

- Merge existing frameworks
- Continue to develop the system
- Discuss (later) the synergism with TM5(–MP)