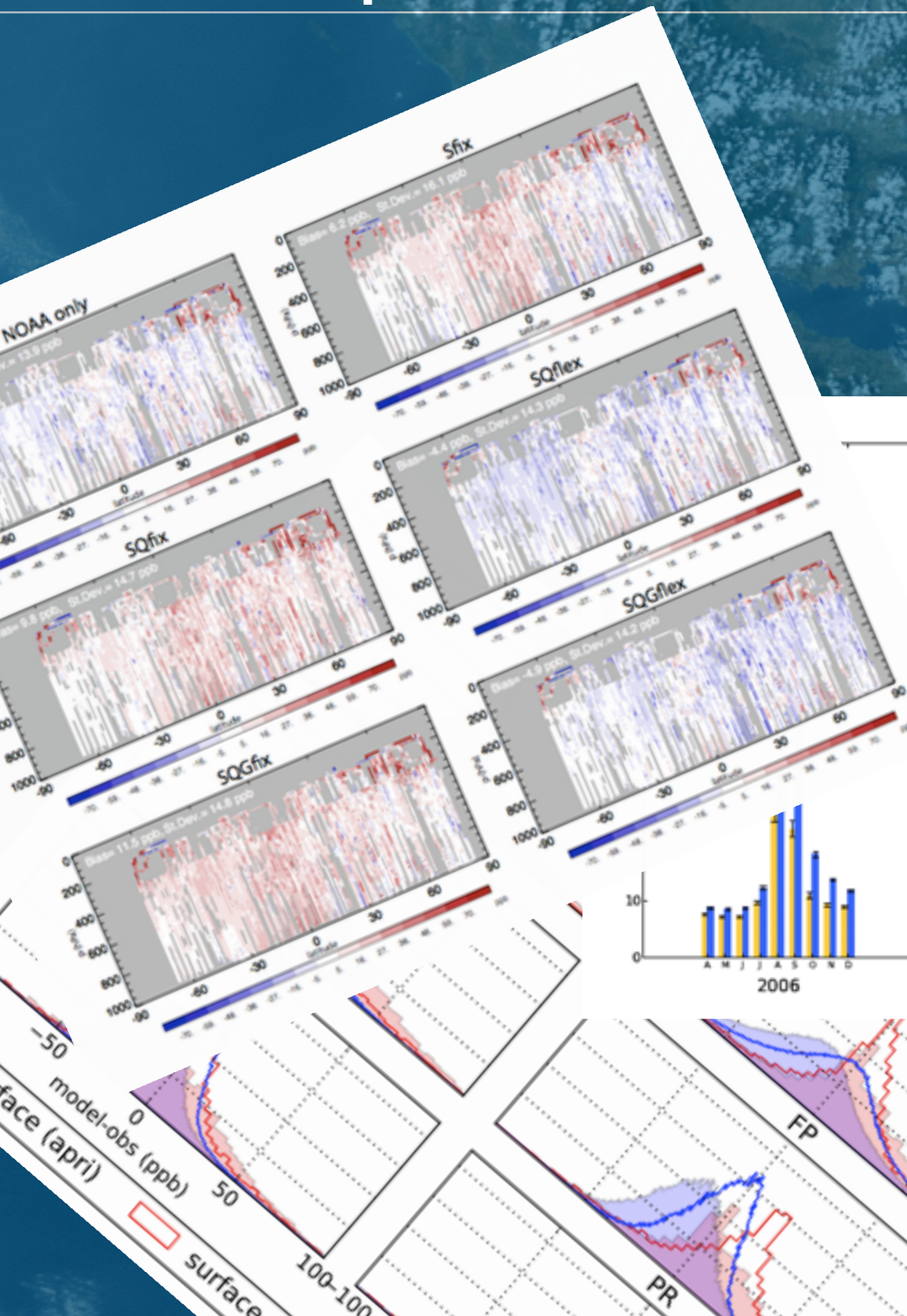
Status TM5-4DVAR

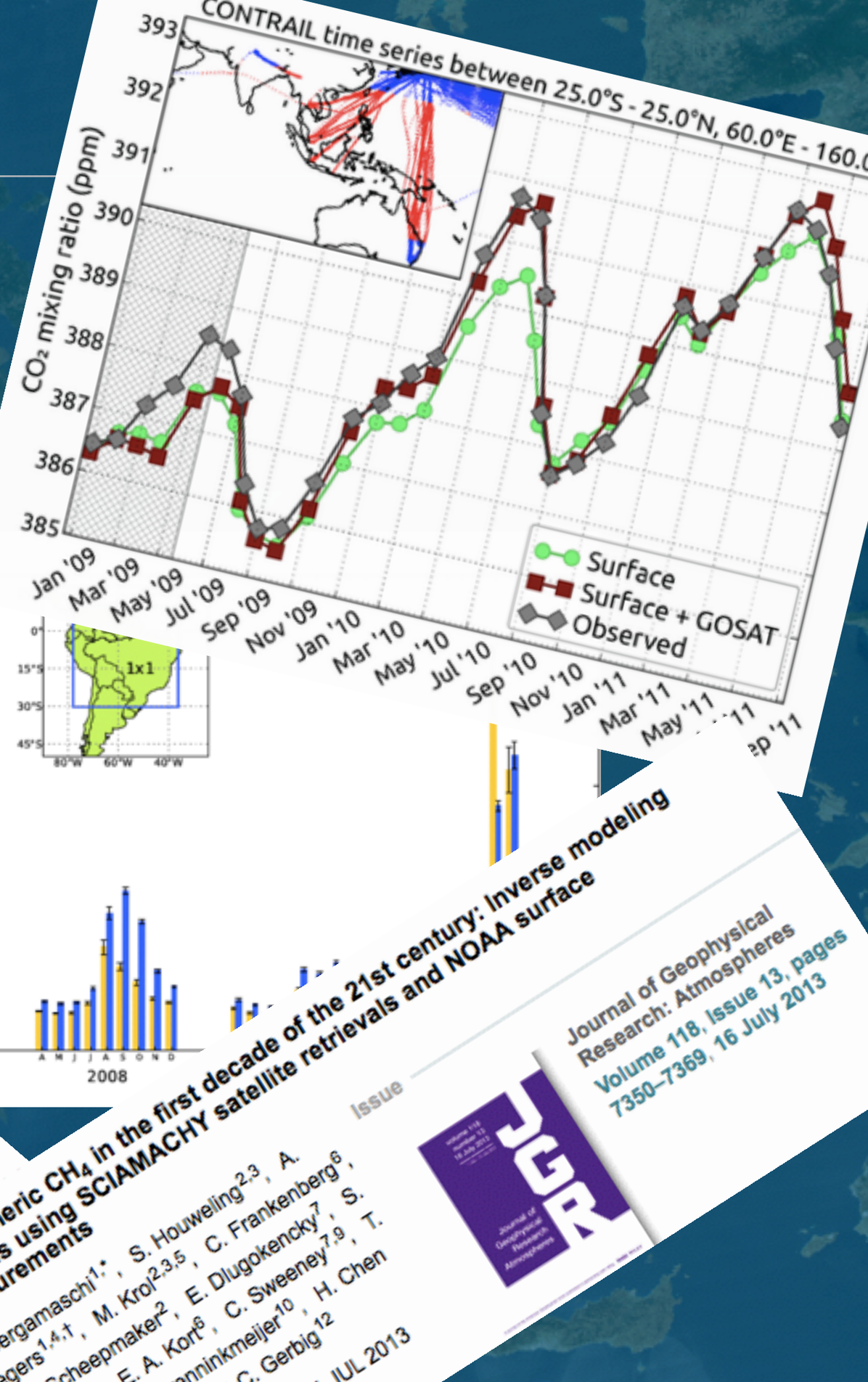
Maarten Krol & other developers

TM meeting, May 2014, Wageningen

ENVIRONMENTAL SCIENCES GROUP
WAGENINGEN UR

Great publications





status various versions

- multi tracer pyshell version
- Ispra version MACC. CH_4. N_2O
- various personal versions
  - Sander (bias correction)
  - Sudhanshu (ratio method)
  - Guillaume (GOSAT CH_4)
  - 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 di
(1) The basis should be Sourish's / Sander's multi-
(2) The new common version should include
m1qn3, optimization of initial fields, sur
error for station observations)

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

» End of summer

Continued development

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

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

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

Continued development

- Multi-tracer inversions
  - CO – CO_2 coupled inversions (Sourish, GO-proposal)
    - Emissions are coupled through the B-matrix
    - Observations (Hx – y) are correlated
    - Chemical CO_2 production from CO
  - CO_2 – CH_4 system (ratio method GOSAT)
  - …NO_2, CH_2O, …, 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)