Atmospheric concentration measurements and analyses assisting national-scale greenhouse gas inventory reporting

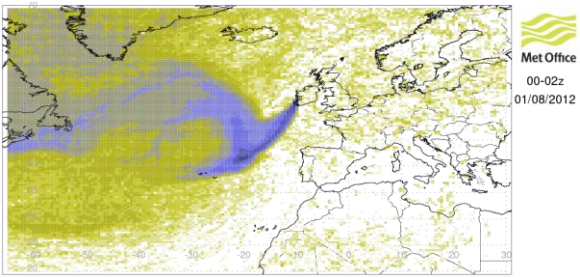
Alistair Manning (Met Office), Stefan Reimann (EMPA),

IG3IS team

Estimating national emissions using observations

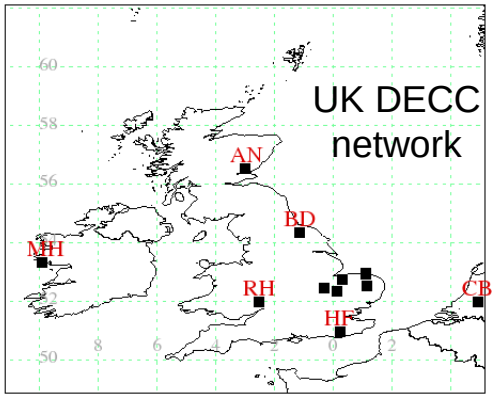
To understand the recent history of the air arriving at measurement stations

Atmospheric Transport Model



Prior Knowledge

Atmospheric Observations of GHG

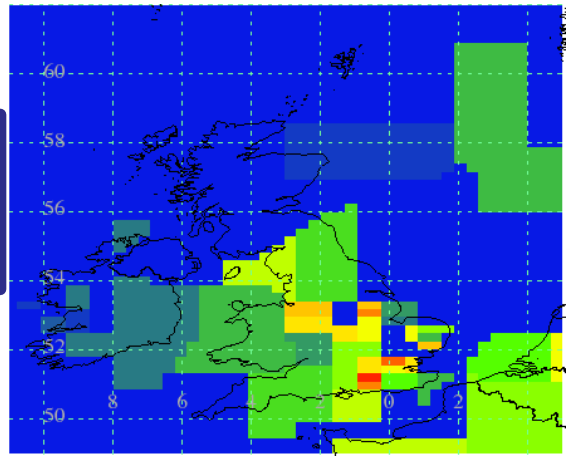


With Estimated Uncertainties

To estimate the surface emissions that best describe the observations

Inverse Modelling System

Estimate of surface emissions



Uncertainties Estimated

Inverse Modelling System

$$C = (M'e' - y)^T R^{-1} (M'e' - y) + (e' - e'_p)^T B^{-1} (e' - e'_p)$$

M' = M [t x n] | P [t x p] | F [t x f]

M = Dilution matrix
P = Baseline Perturbation
F = Location Bias

e' = e [n] | b [p] | q [f]

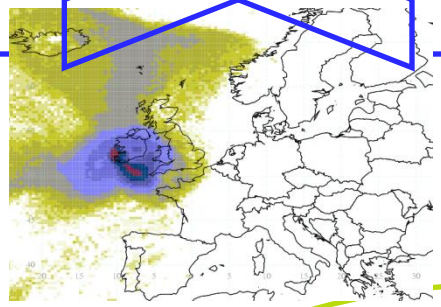
e = Surface Emissions

y [t]

Times series observations

$e'_p = e_p \mid b_p \mid q_p$

e_p = Prior Emission



- Air history maps from transport model
- Time-series of relative contributions of each surface source to each observation

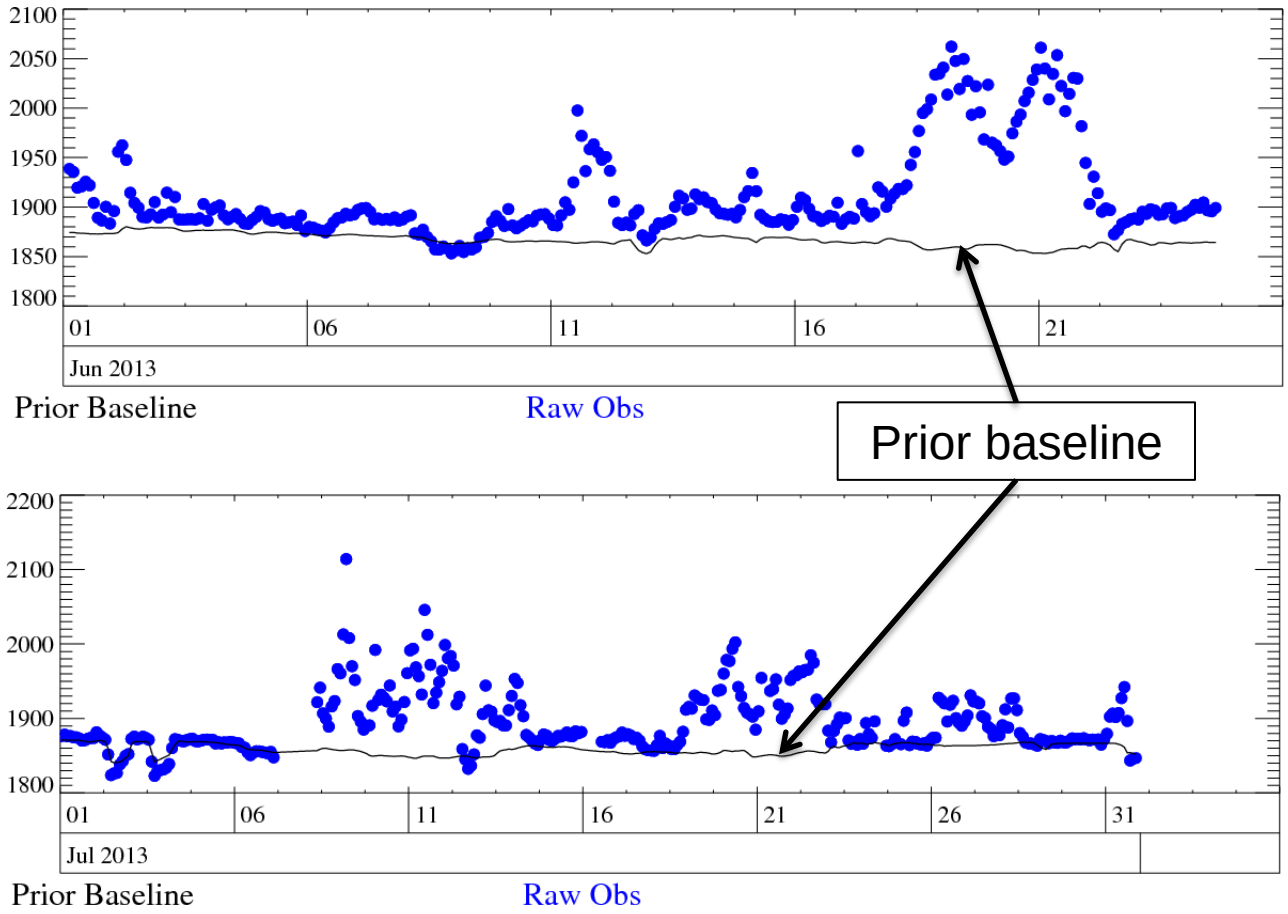
B [n' x n'] : Prior uncertainty

R [t x t] : Model-Obs uncertainty

Uncertainty Analysis Matrix

$$A = \left(M'^T R^{-1} M' + B^{-1}\right)^{-1}$$

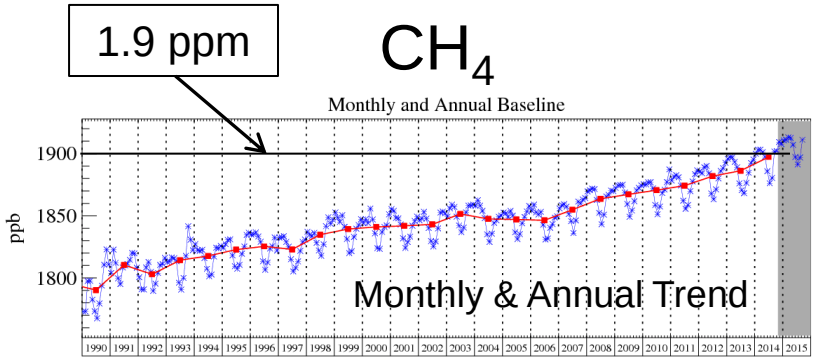
Raw Methane Observations (examples)



Tacolneston:
June 2013

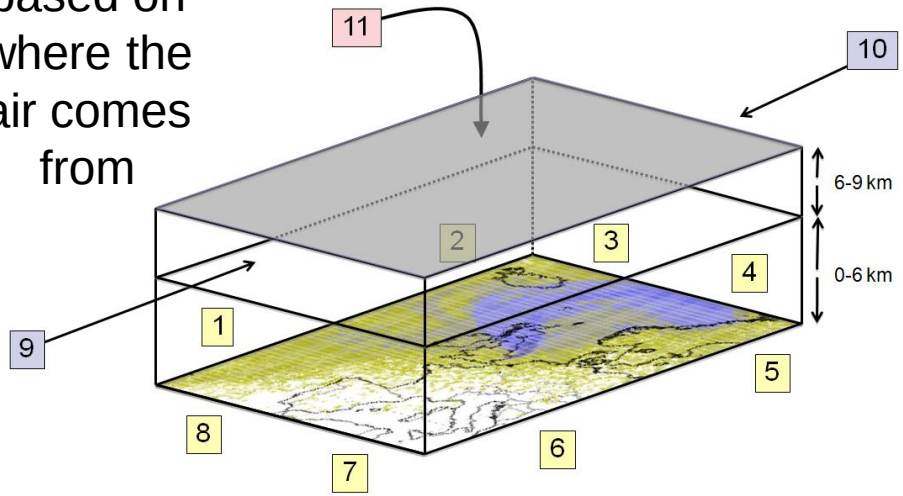
Mace Head:
July 2013

Prior knowledge



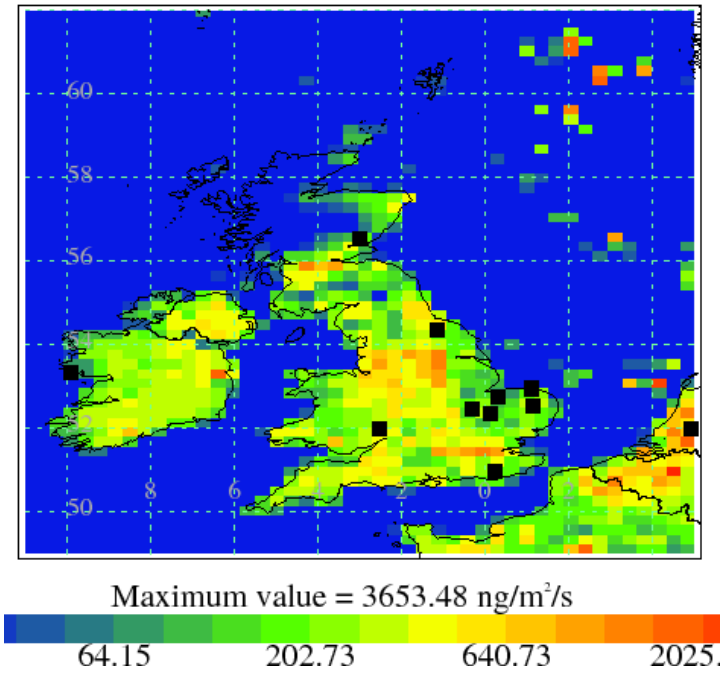
Baseline modified based on where the air comes from

BASELINE



Inversion modelling can identify areas of the inventory where further investigation can help improve the inventory

INVENTORY EMISSIONS



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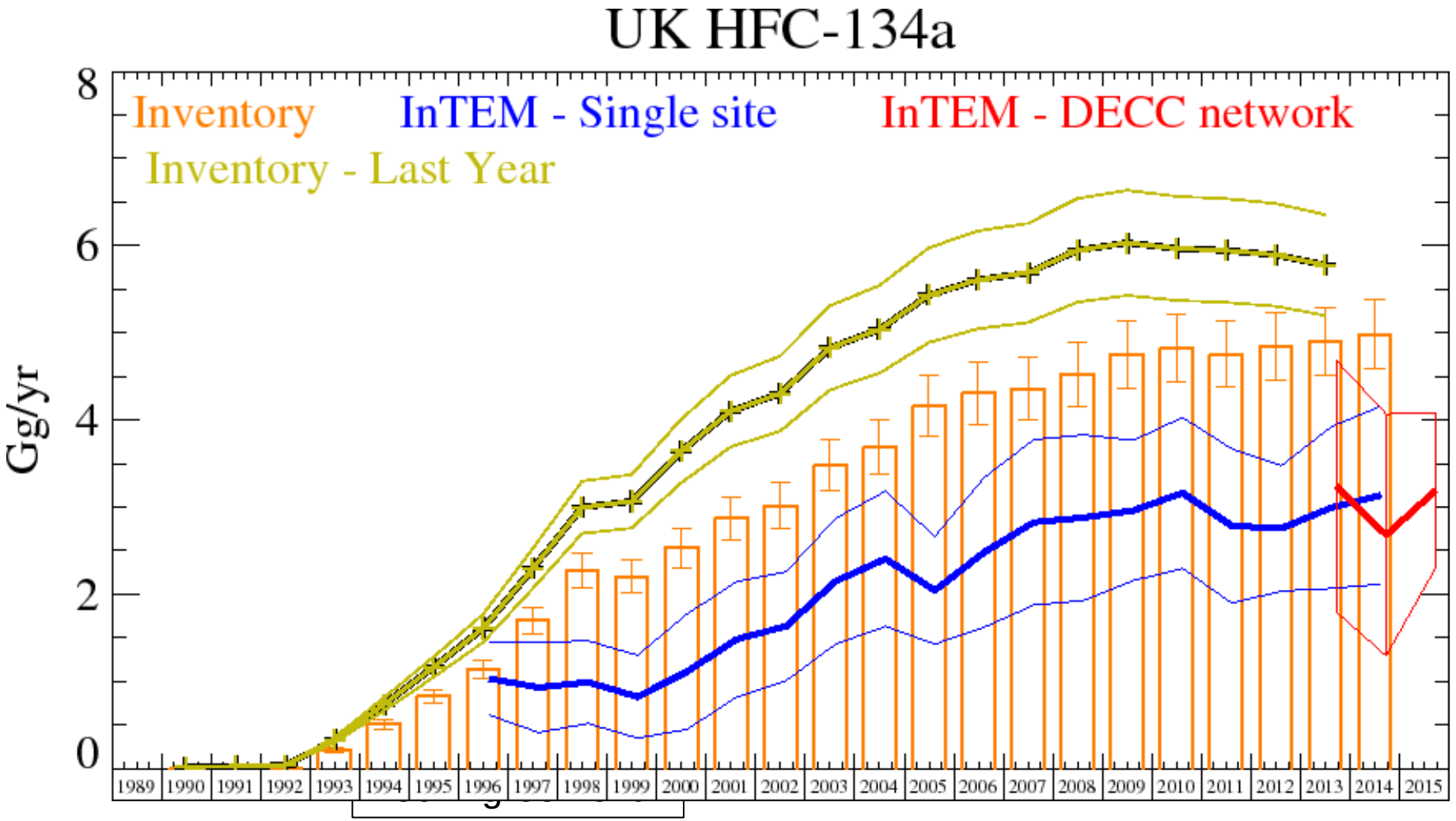
InTEM emission estimates
Negligible prior emission information

Inventory: UNFCCC



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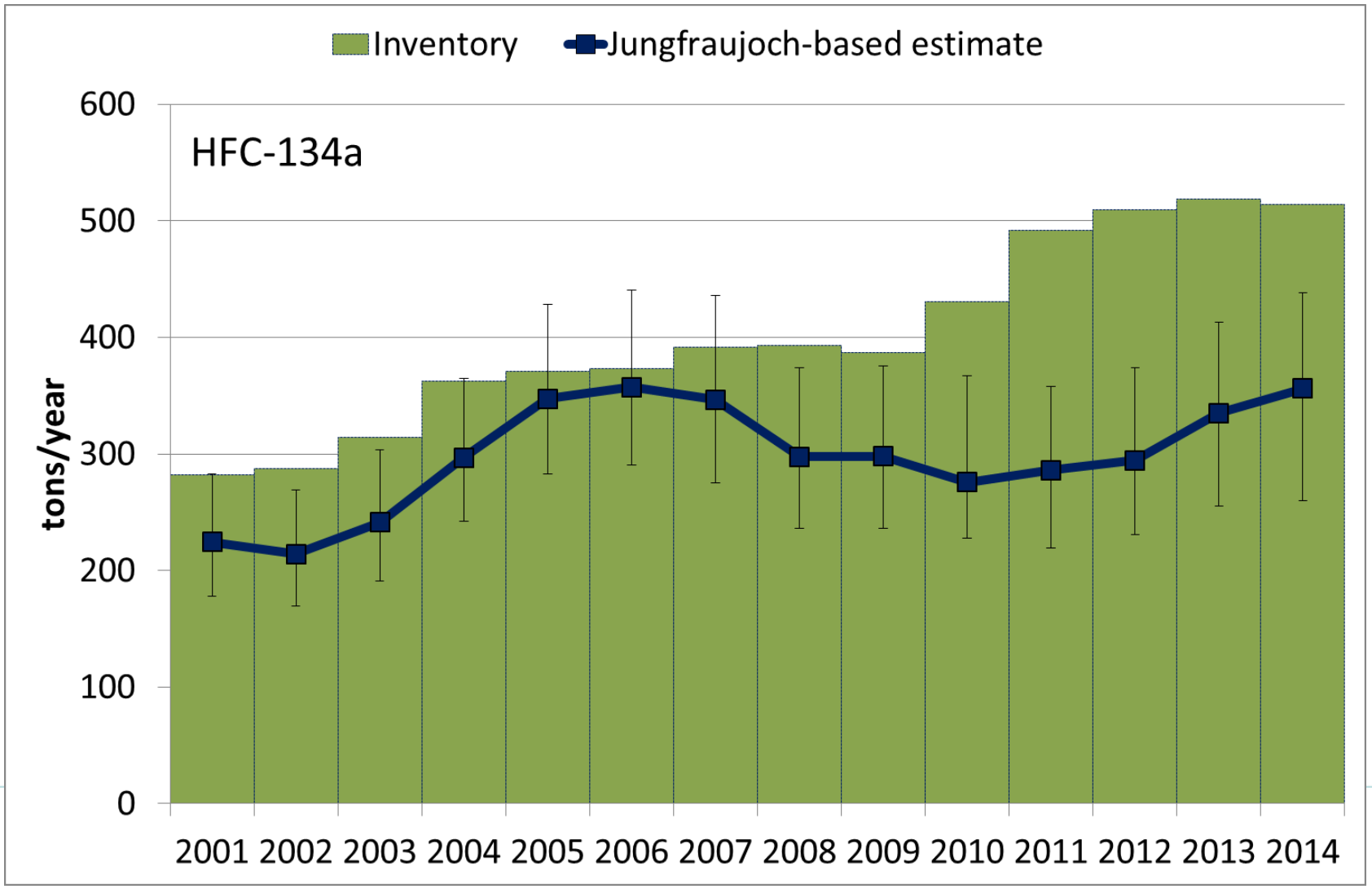
Switzerland's Greenhouse Gas Inventory

Annex 5: Additional information

A 5.1 Independent verification of the National Swiss Inventory for F-gases



Conclusions

Atmospheric Measurements and Inverse Modelling can help national governments improve their national-scale inventory reporting

Effective method to prioritise improvements to an inventory