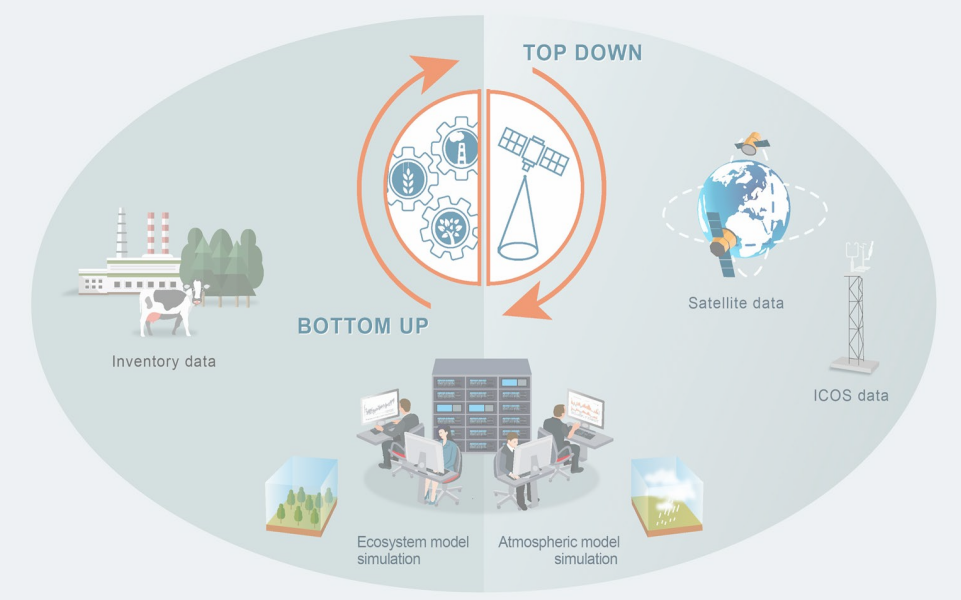
VERIFY General Assembly

Connection of VERIFY with the revised 2019 IPCC guidelines: General developments and the example of Switzerland

Stefan Reimann, Martin Steinbacher, Stephan Henne, Dominik Brunner

May 9th -11th , 2022



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2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Volume 1

General Guidance and Reporting

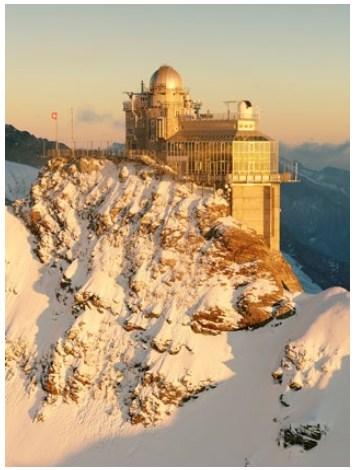
Edited by Calvo Buendia, E., Tanabe, K., Kranjc, A., Baasansuren, J., Fukuda, M., Ngarize S., Osako, A., Pyrozhenko, Y., Shermanau, P. and Federici, S.

Task Force on National Greenhouse Gas Inventories

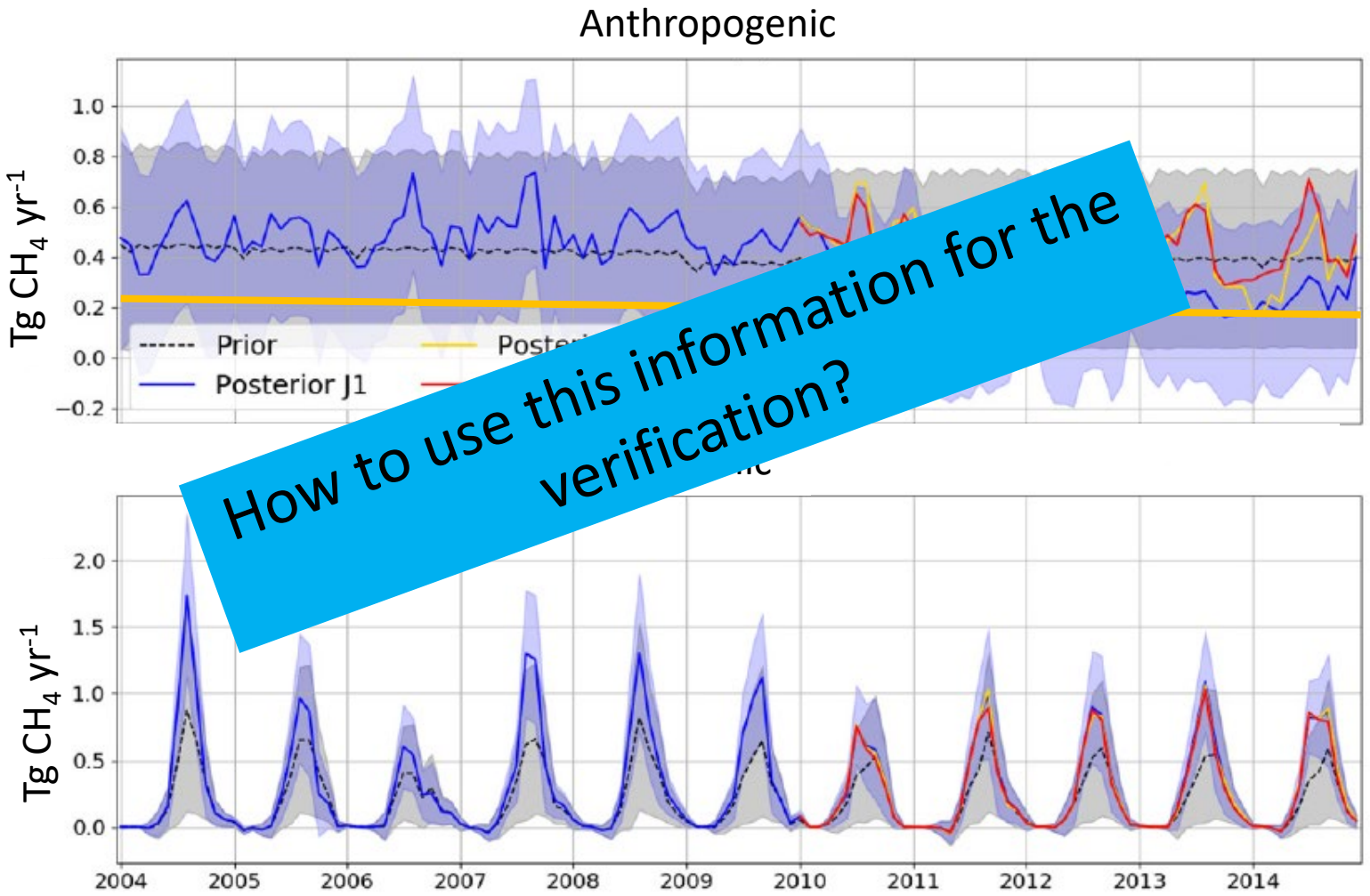
WMO UNEP

Pillars of Quality Assessment

Quality Control	Quality Assurance	Verification
•Consistency checks •Archive material •Addressing errors	•Independent third party review •Audits	•Use external data independent of the inventory



Example of a country-based estimate from a research paper
CH_4 emissions from Finland (Tsuruta et al. (2019)



How to use this information for the verification?

UNFCCC inventory

Chapter 6.10.2.6: PROCEDURES FOR INVENTORY COMPARISON TO ESTIMATES BASED ON ATMOSPHERIC MEASUREMENTS

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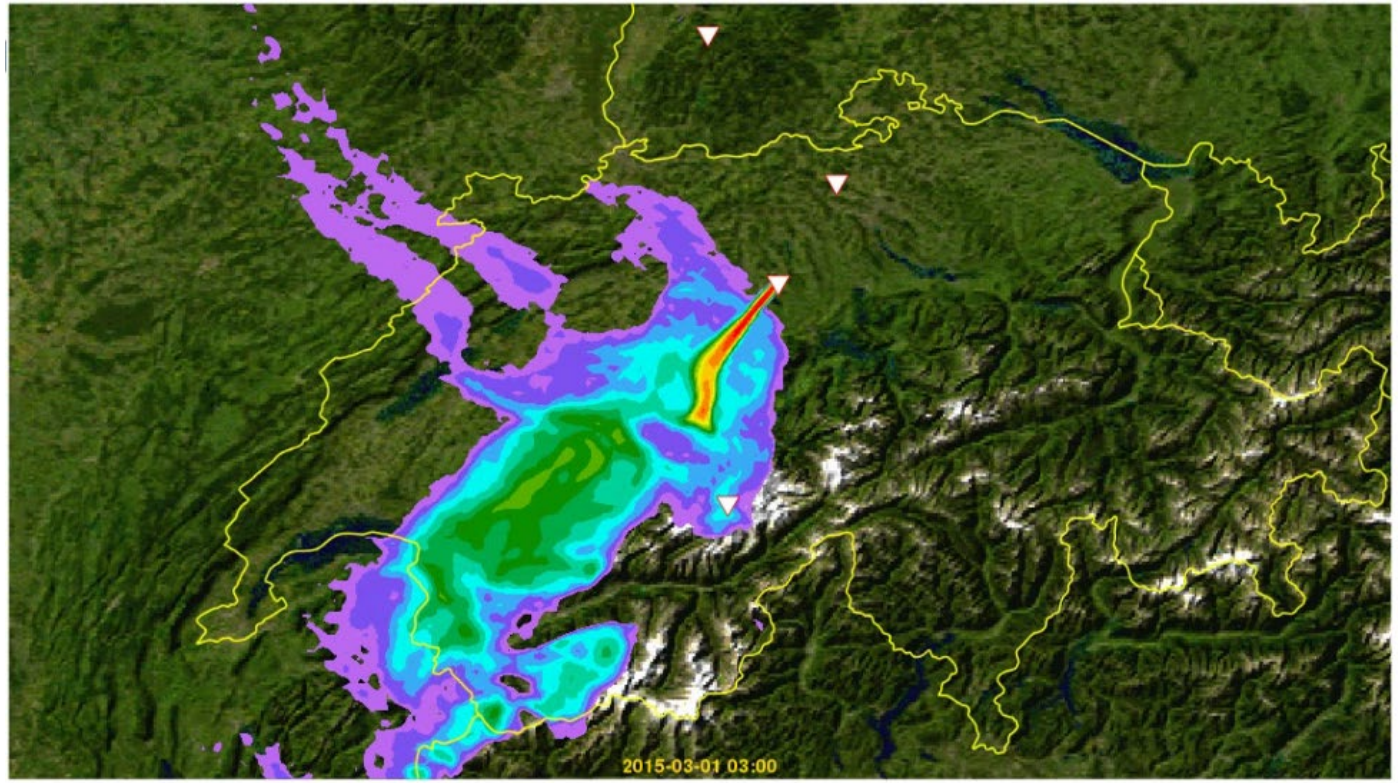
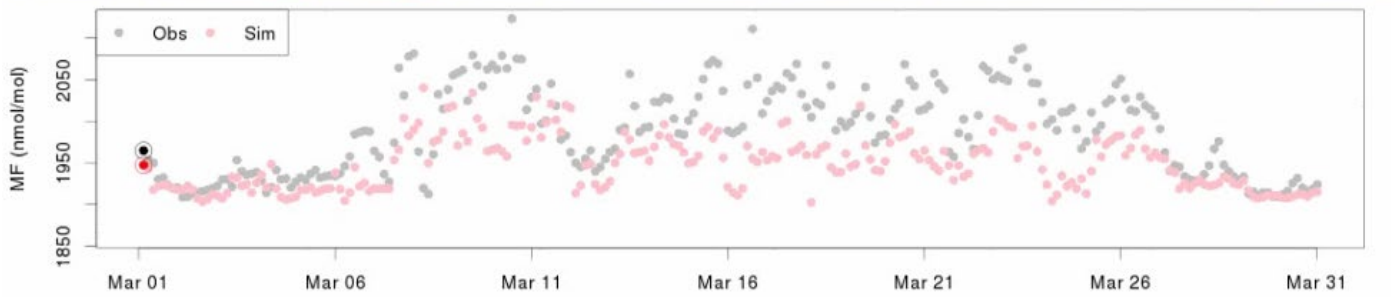
TABLE 6.3 (NEW)
IMPLEMENTATION STEPS AND SHARE OF RESPONSIBILITIES BETWEEN PARTNERS

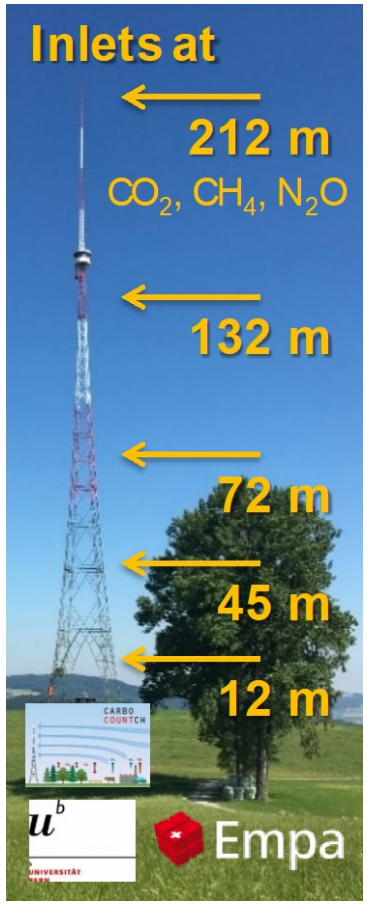
Step	Work package	Responsible group
1	Acquisition of GHG observations from a surface network (and when available, from aircraft and satellites) that has sufficient coverage of the country's emissions. The observation data have to be linked to the same calibration scale and be processed by the compatible routines across the network.	Observation /atmospheric modelling
2	Preparing gridded (spatially and temporally disaggregated) prior emissions data.	Gridded inventory
3	Preparing and operating the inverse model, other observation-based emission estimation methods.	Atmospheric modelling
4	Quality Assurance / Quality Control to the inverse model output.	Atmospheric modelling
5	Comparison, verification, and reporting. Production of final outputs and update of the GHG inventory improvement plan.	Inventory/ Atmospheric modelling

Simulated Footprints and Concentration Timeseries

1

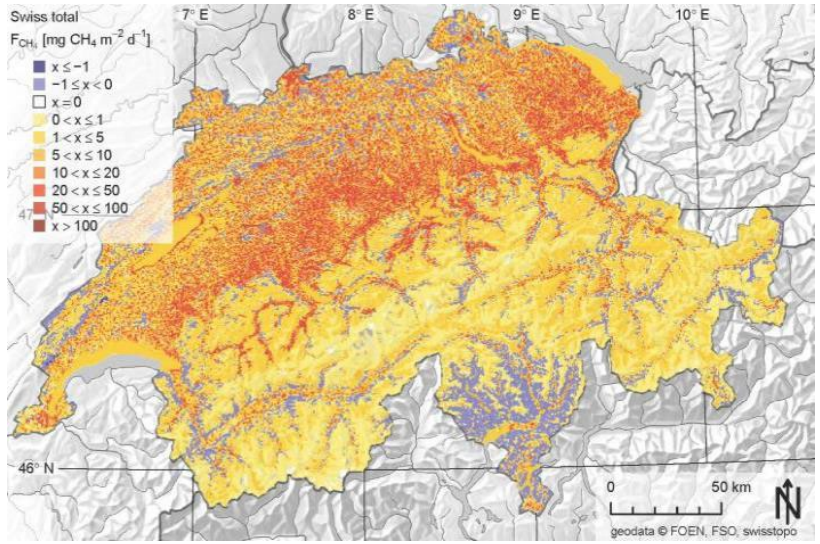






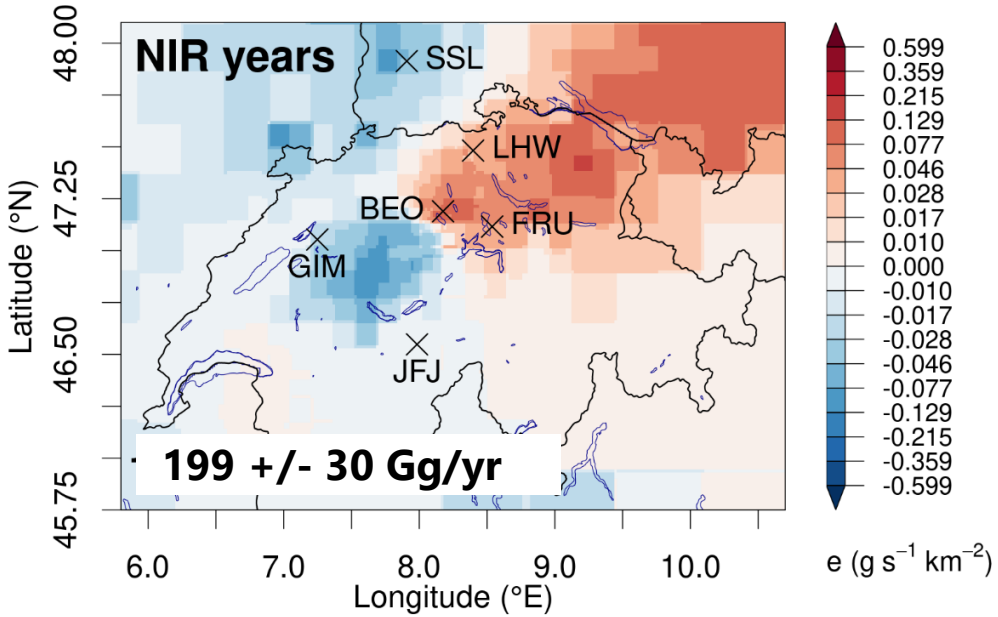
Swiss CH_4 Emissions (2013 – 2020)

A priori inventory [Hiller et al., 2014]



2

A posteriori difference



3

NIR: 194 ± 32 Gg yr^{-1}, ±16 %

A posteriori: 199 ± 30 Gg yr^{-1}, ±15 %

4

5

Henne et al., ACP, 2016

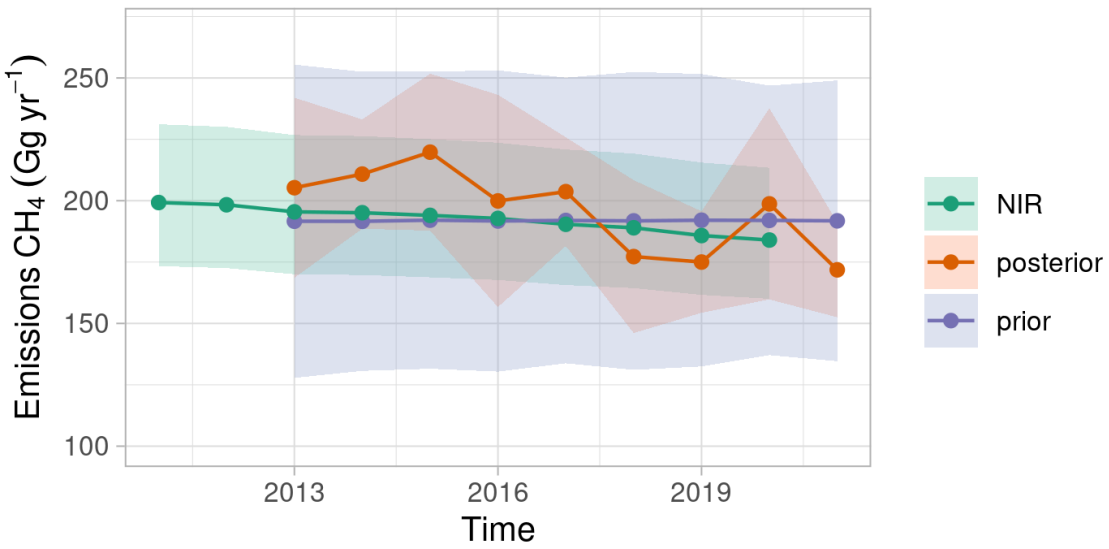
Validation of the Swiss methane emission inventory by atmospheric observations and inverse modelling

Stephan Henne[1], Dominik Brunner[1], Brian Oney[1], Markus Leuenberger[2], Werner Eugster[3], Ines Bamberger[3,4], Frank Meinhardt[5], Martin Steinbacher[1], and Lukas Emmenegger[1]

Empa

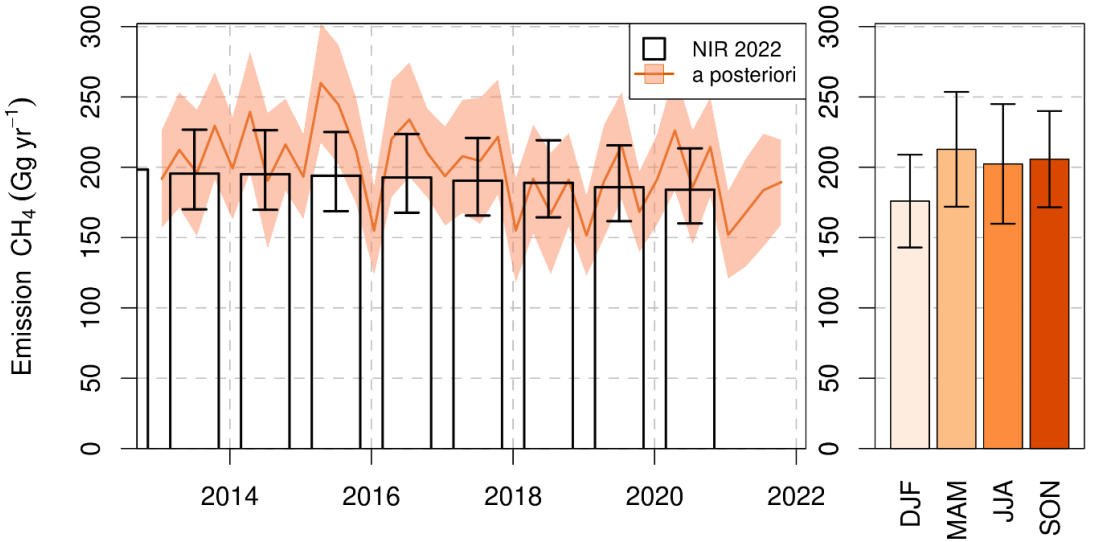
Swiss Methane Emissions (2013 – 2020)

Temporal evolution



Based on 8 sensitivity inversions per year

Seasonal variability

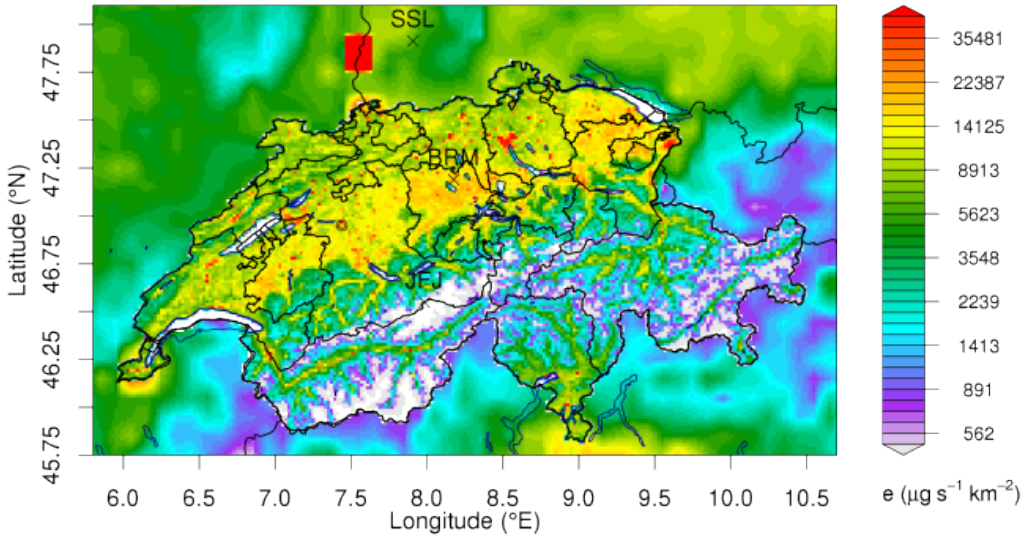


Spring maximum & winter minimum
Seasonal amplitude: ±20 %

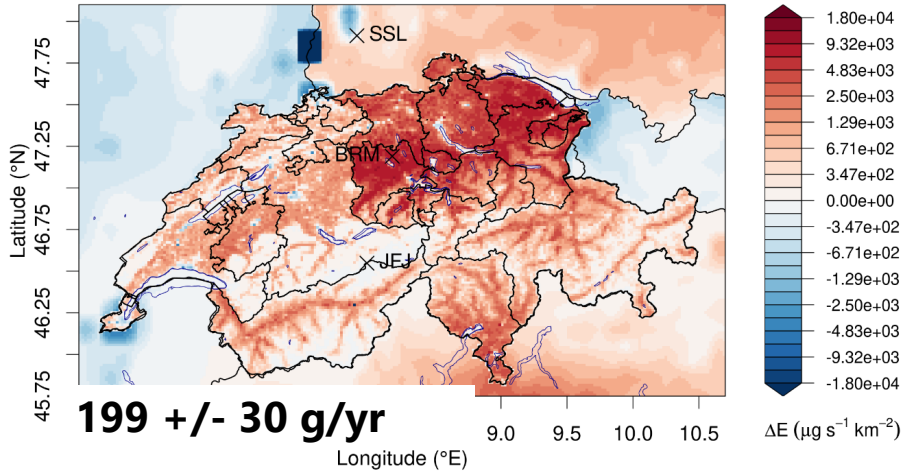
Based on 4 sensitivity inversions with seasonal variability per year

Swiss Nitrous Oxide Emissions (2017 – 2020)

A priori inventory



A posteriori difference



199 +/- 30 g/yr

NIR (w/o 2020): 10.1 (4.1 – 18.3) Gg yr^{-1}, ~±70 %

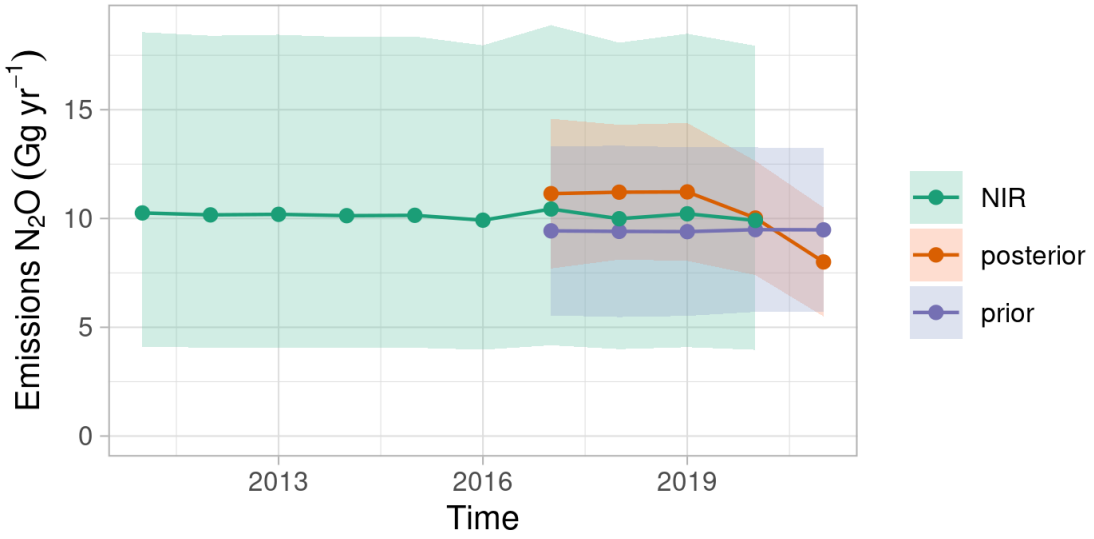
A posteriori: 10.9 ± 3.1 Gg yr^{-1}, ±28 %

95 % CI

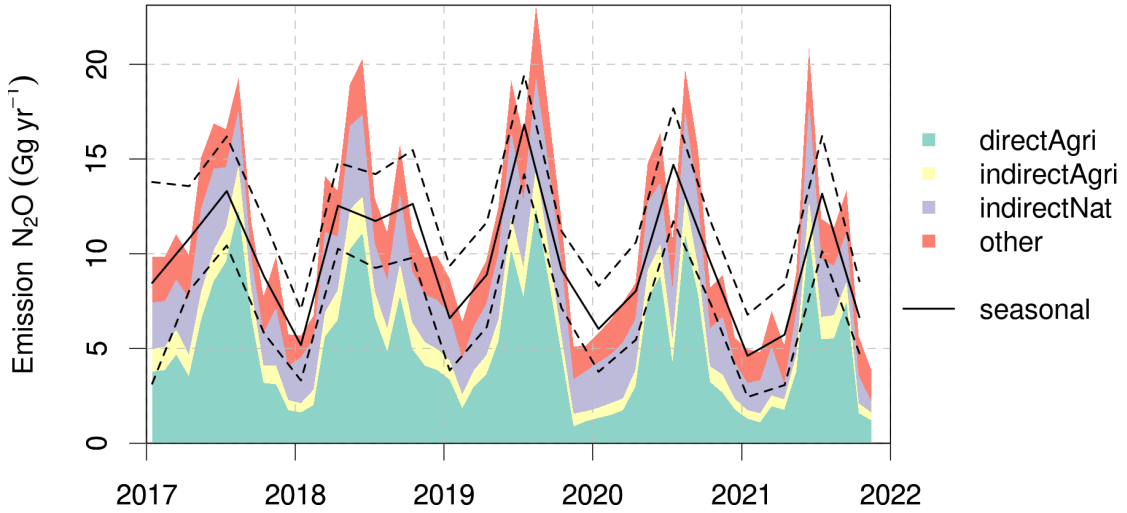
Empa

Trend & Seasonality of N_2O Emissions

Temporal evolution



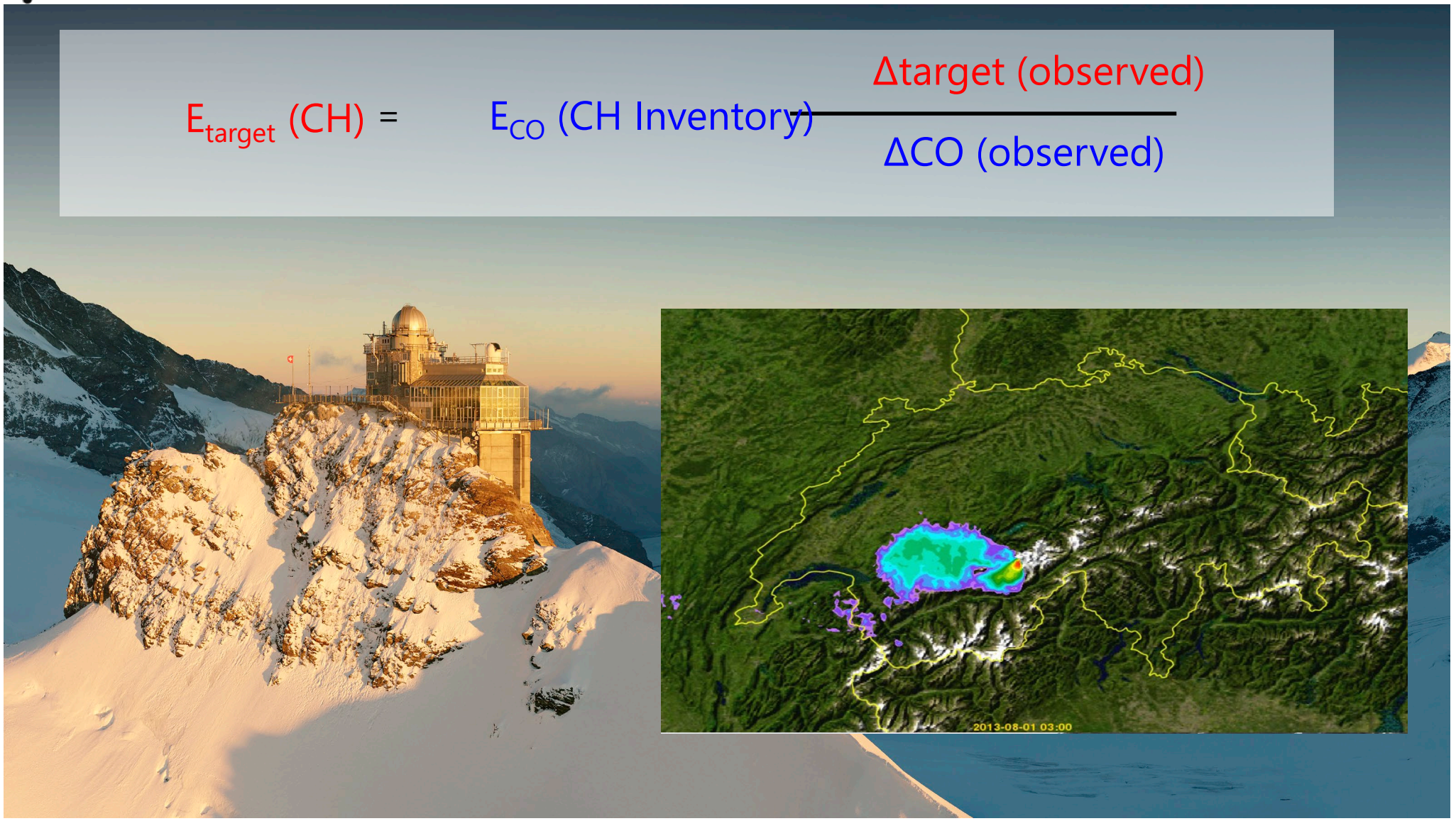
Seasonal variability by source



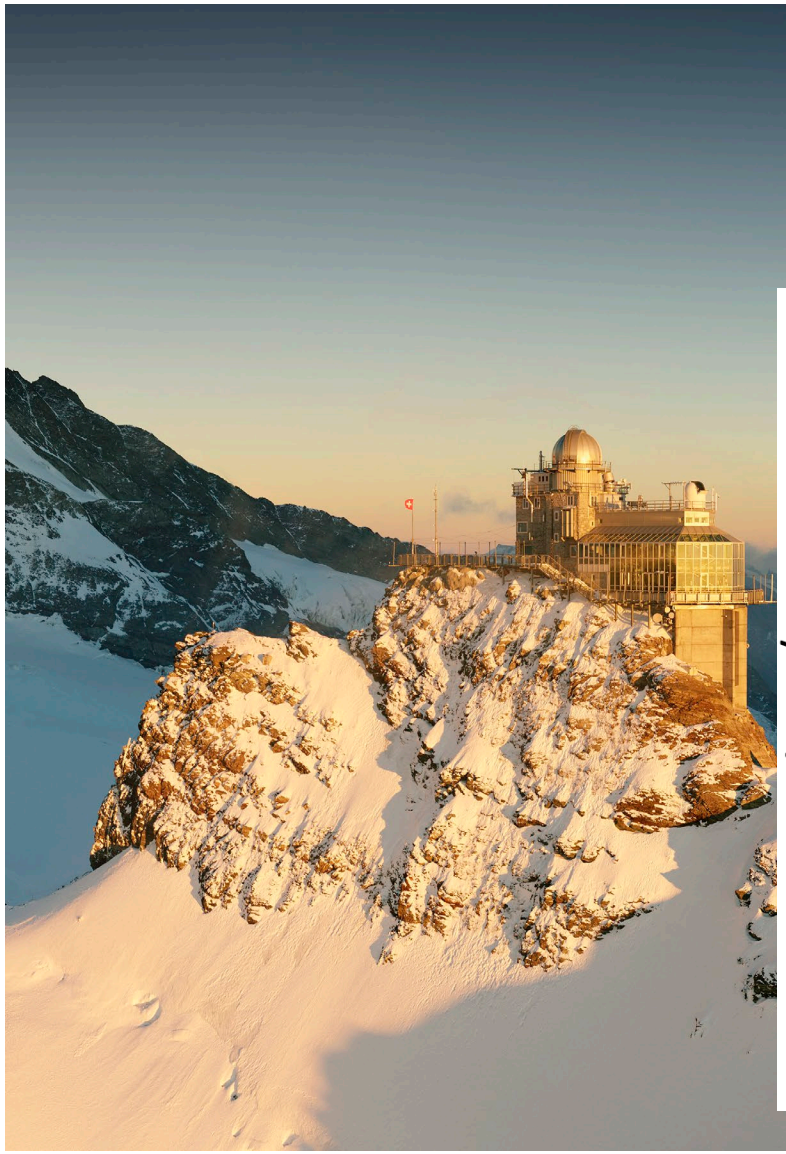
- Pronounced seasonality in soil emissions (±50 % summer/winter)
- Variability from year to year
- Low emissions in 2021 driven by lower emission in summer (preliminary)

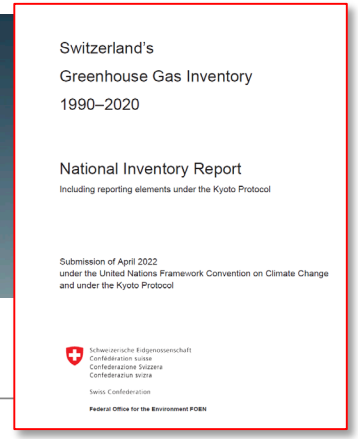
F-gas Emissions Based on Jungfraujoch Observations

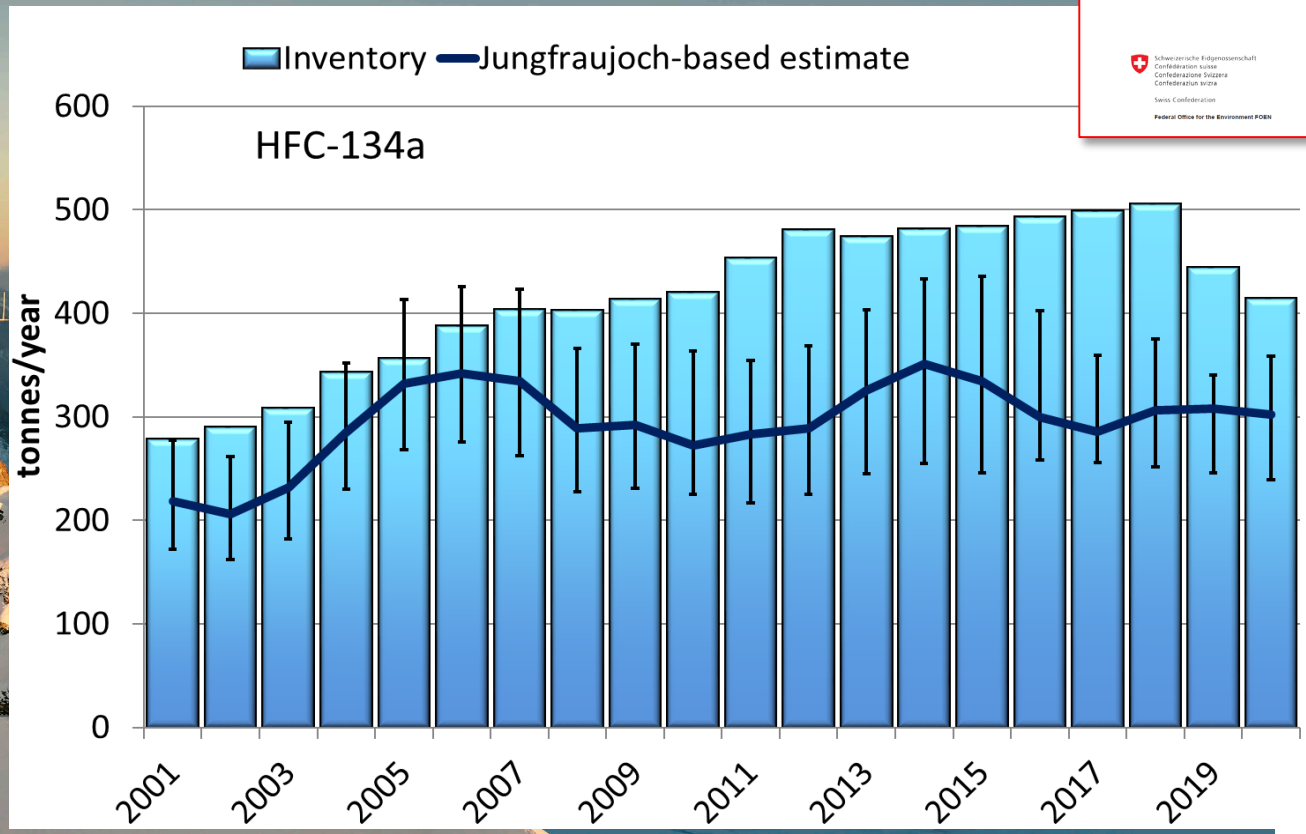
$$E_{target}\ (CH) = E_{CO}\ (CH\ Inventory) \times \frac{\Delta target\ (observed)}{\Delta CO\ (observed)}$$



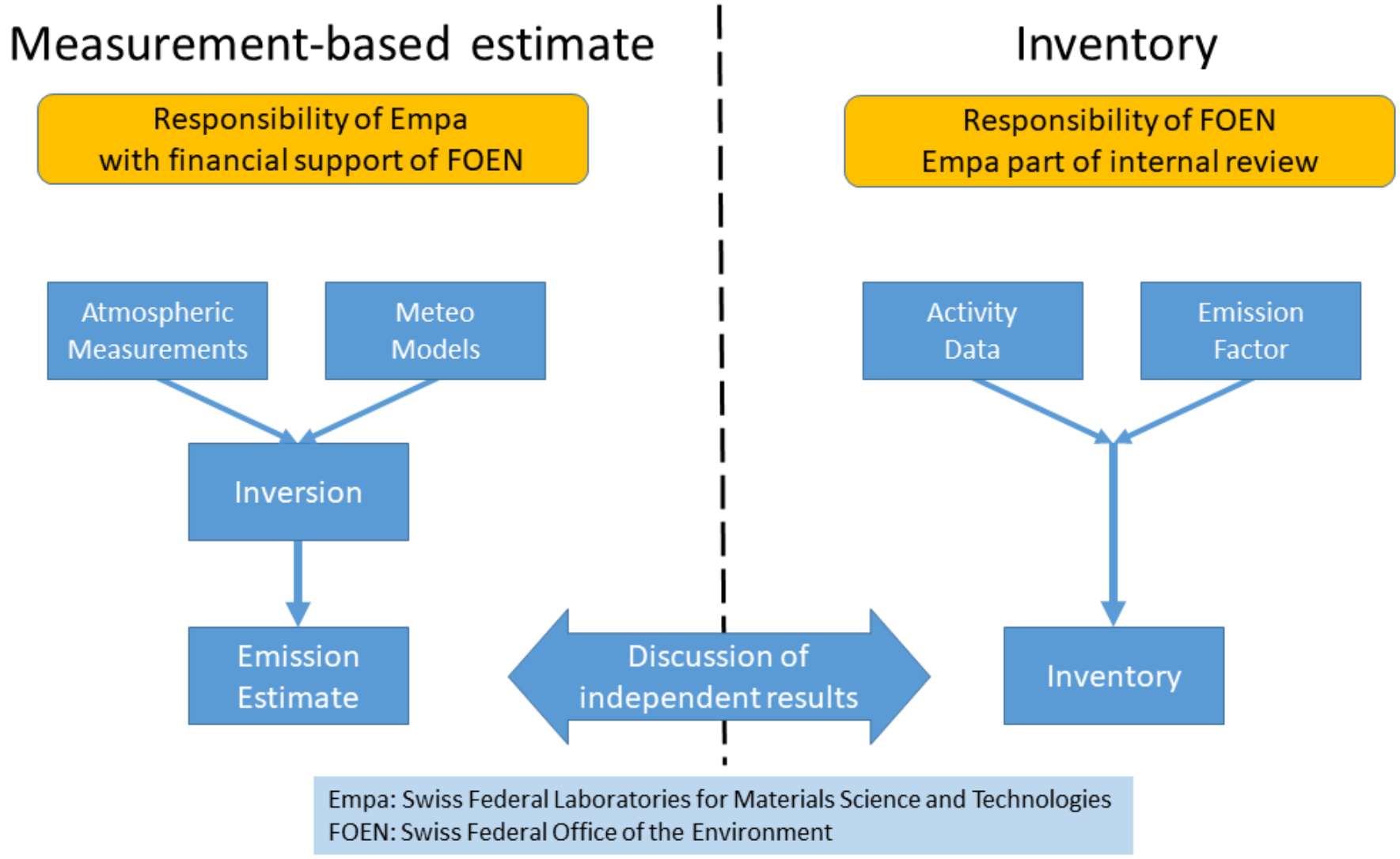
F-gas Emissions Based on Jungfraujoch Observations







The Swiss Verification System



Conclusions

- Atmospheric measurement-based (inverse) verification cannot be based on published literature only.
- Verification has to be connected to the inventory system, but has to stay independent.
- Changes to the inventory should not be justified on verification only.

Verification systems in place in UNFCCC reporting:
Switzerland (CH_4, N_2O, F-gases)
United Kingdom (CH_4, N_2O, F-gases)
Australia (CH_4, N_2O, F-gases)
United States (F-gases)