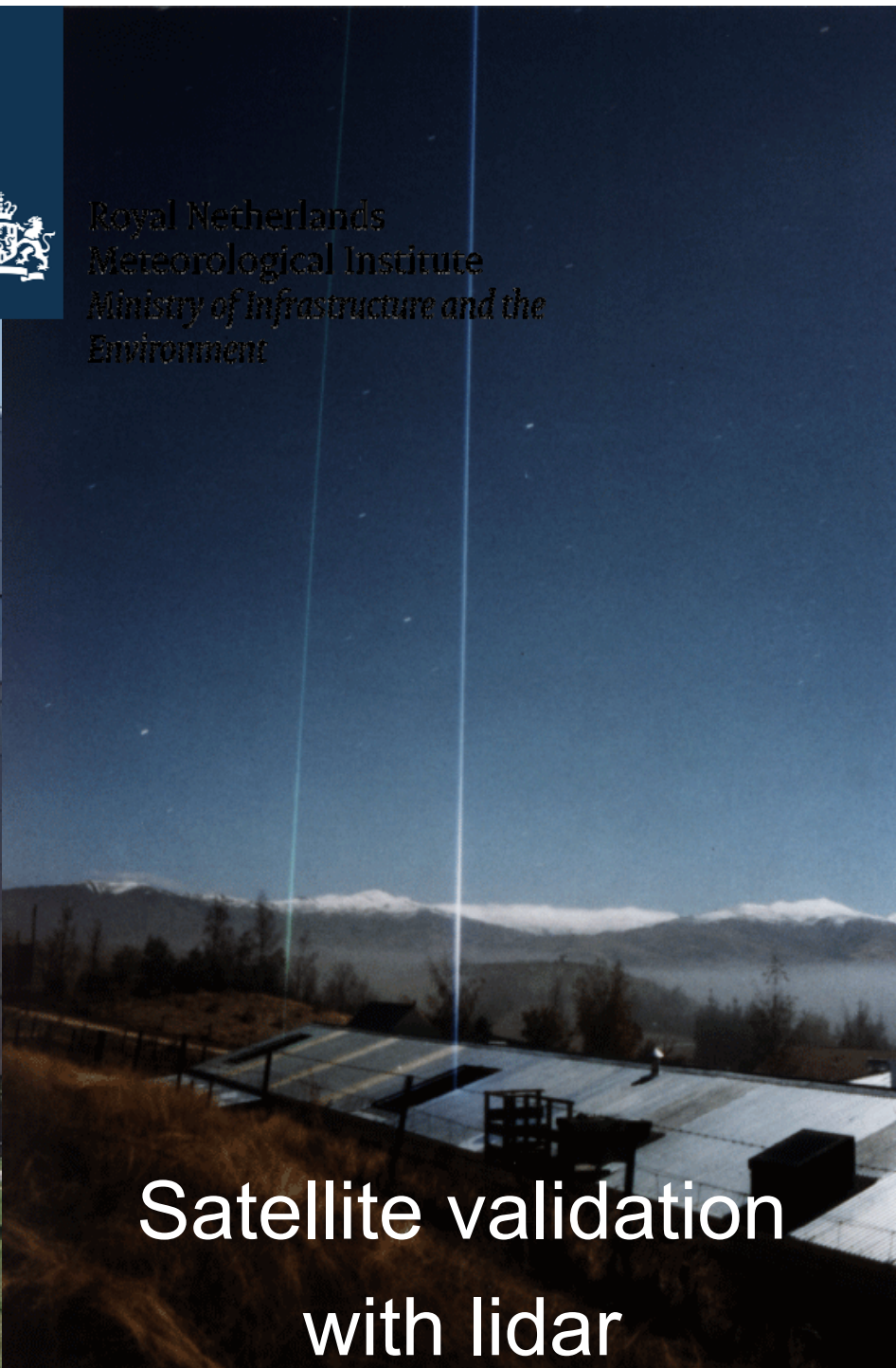




Royal Netherlands
Meteorological Institute
Ministry of Infrastructure and the
Environment



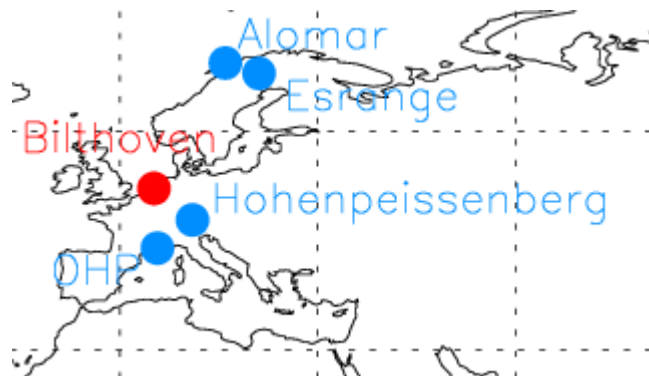
Satellite validation
with lidar

Anne.van.Gijssel@{RIVM,KNMI}.nl

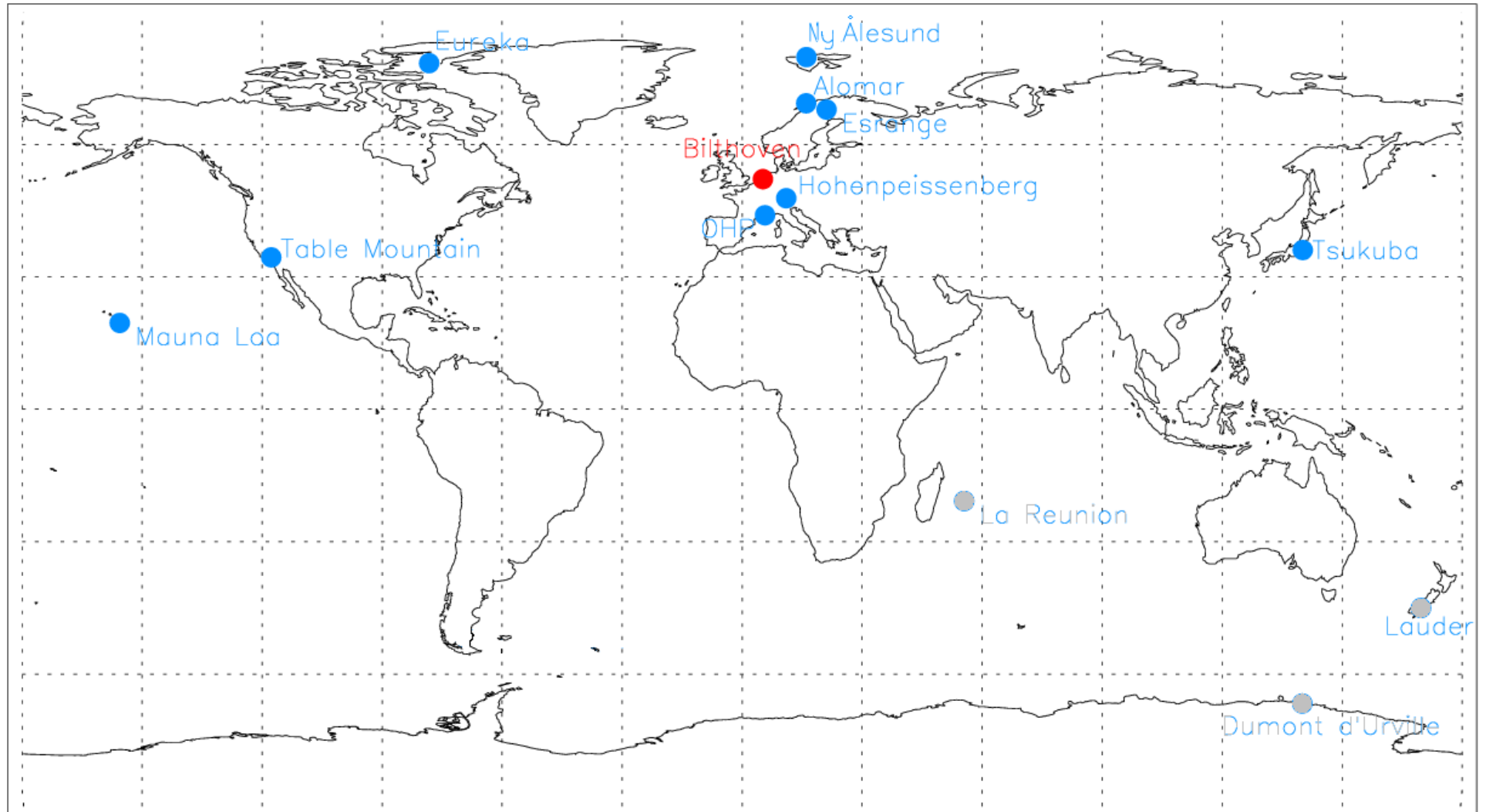
RIVM strato₃ lidar

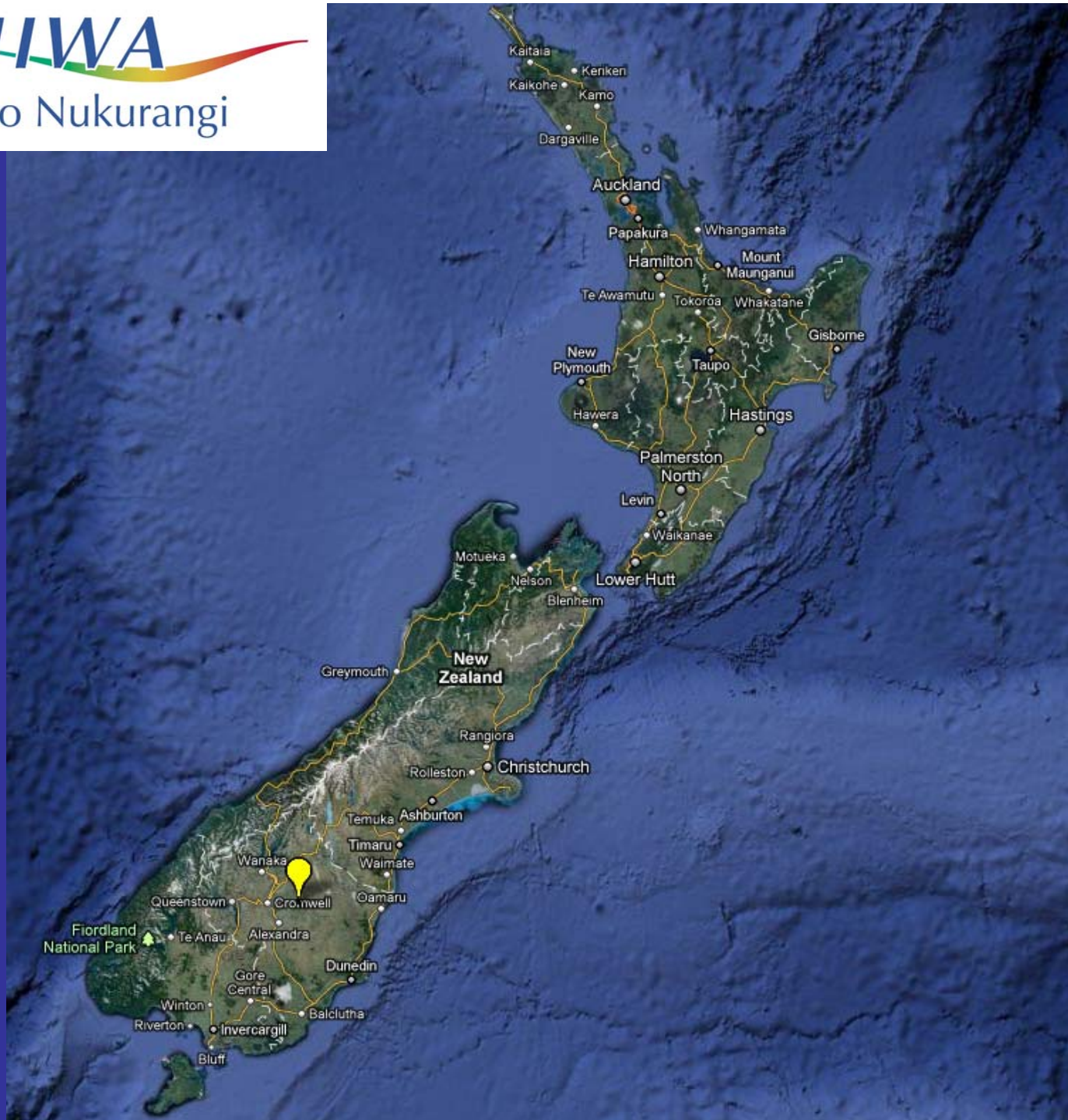
- Development at RIVM
- Shipment to Lauder (New Zealand): why?

RIVM strato₃ lidar



RIVM strato₃ lidar

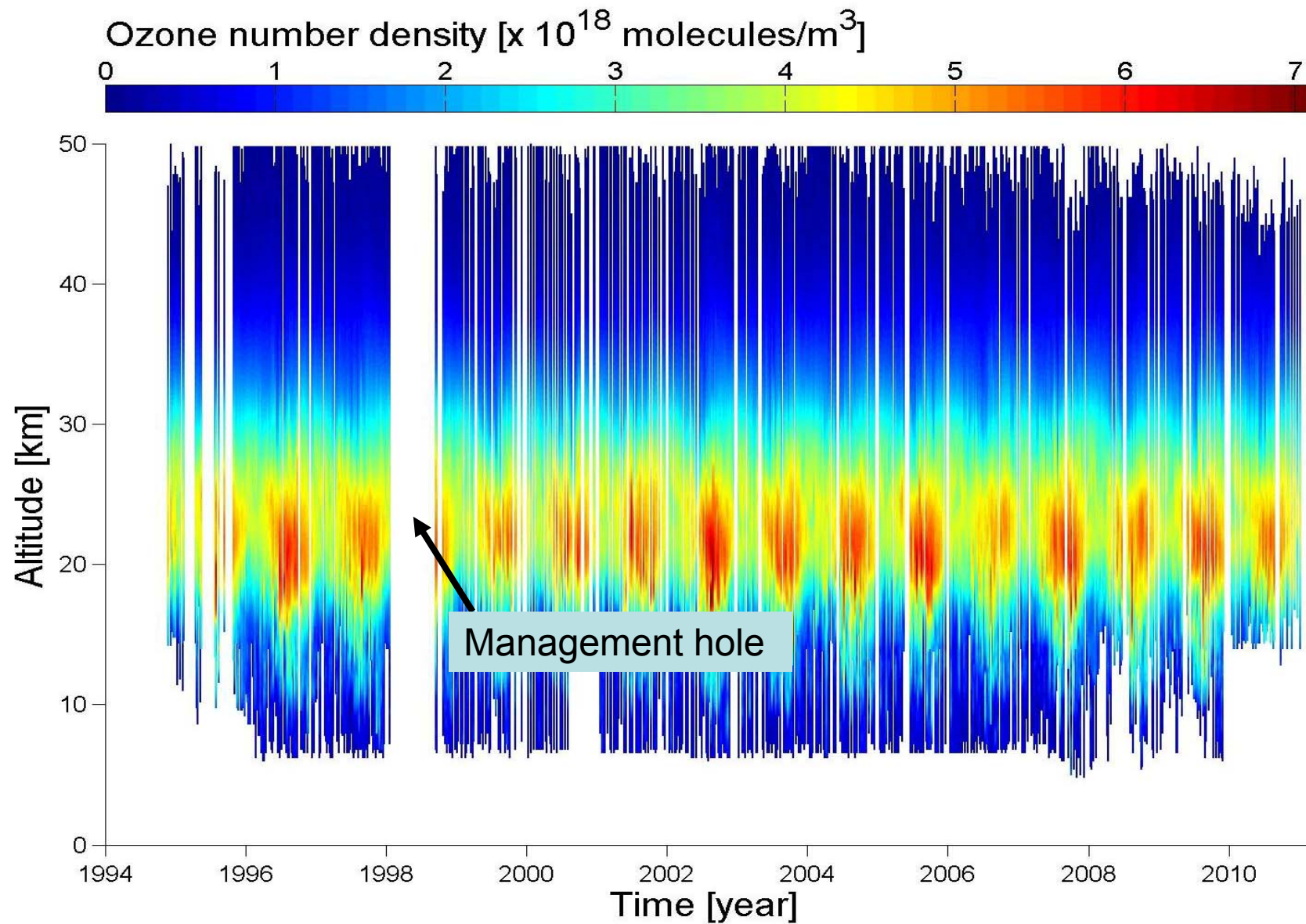




RIVM strato₃ lidar

- Development at RIVM
- Shipment to Lauder (New Zealand): why?
- Intercomparison campaigns
- Measuring ozone profiles from 1994 onwards

Lauder ozone lidar timeseries



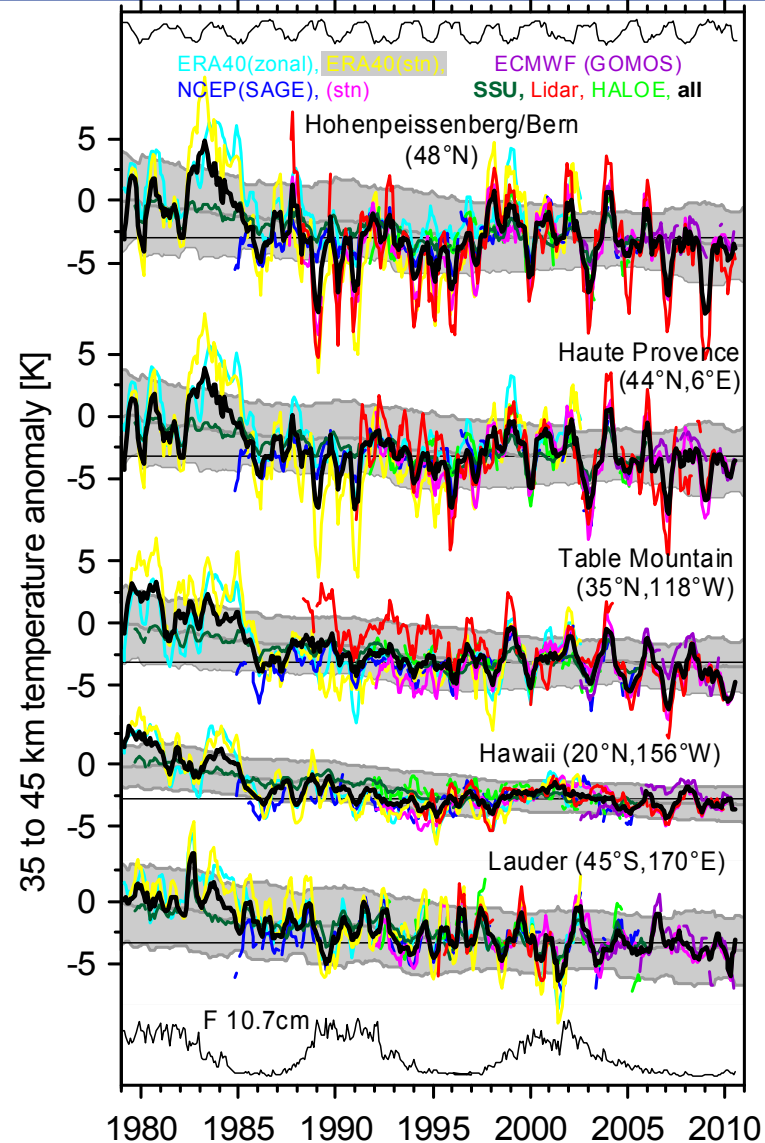
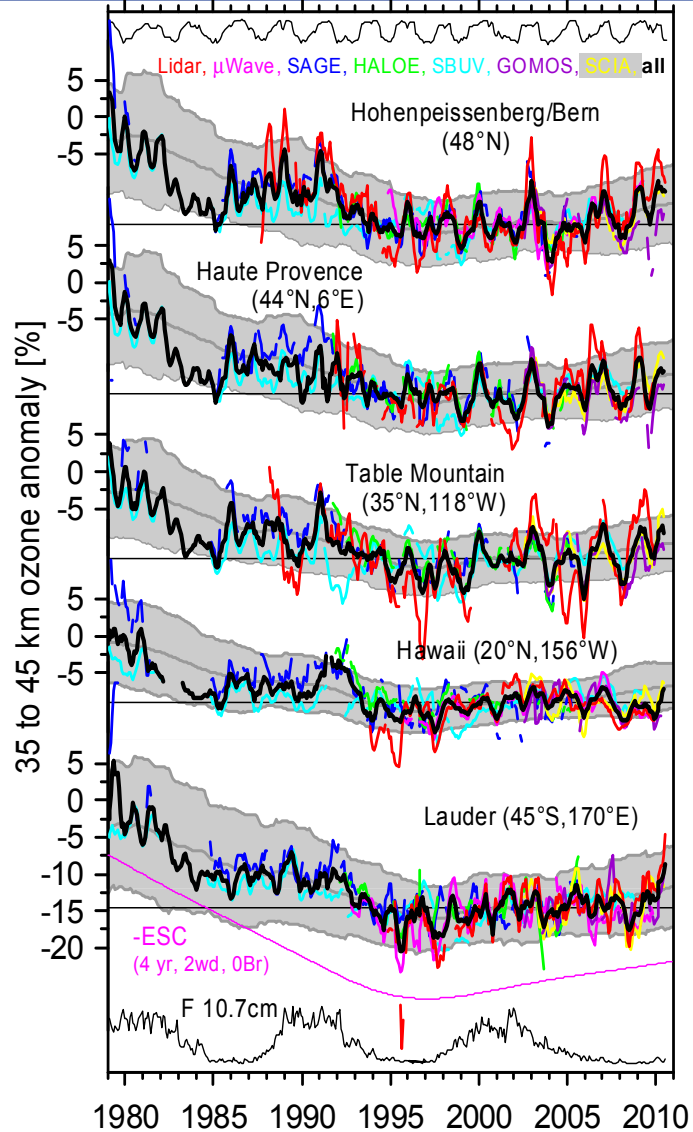
Work in progress

- Temperature algorithm
 - From return signals and using ND a-priori at 30 km, derive density profile
 - From ND profile and a-priori temperature at top of profile, derive temperature profile
 - Combine different measurements (altitude specific) into a single temperature profile
- Validation campaign June/July

Research done with StratO₃ lidar

- Ozone distribution and development with time (first years by Ellen Brinksma)
- OH⁻ measurements at 75-85 km (E.B.)
- Trend analyses for ozone

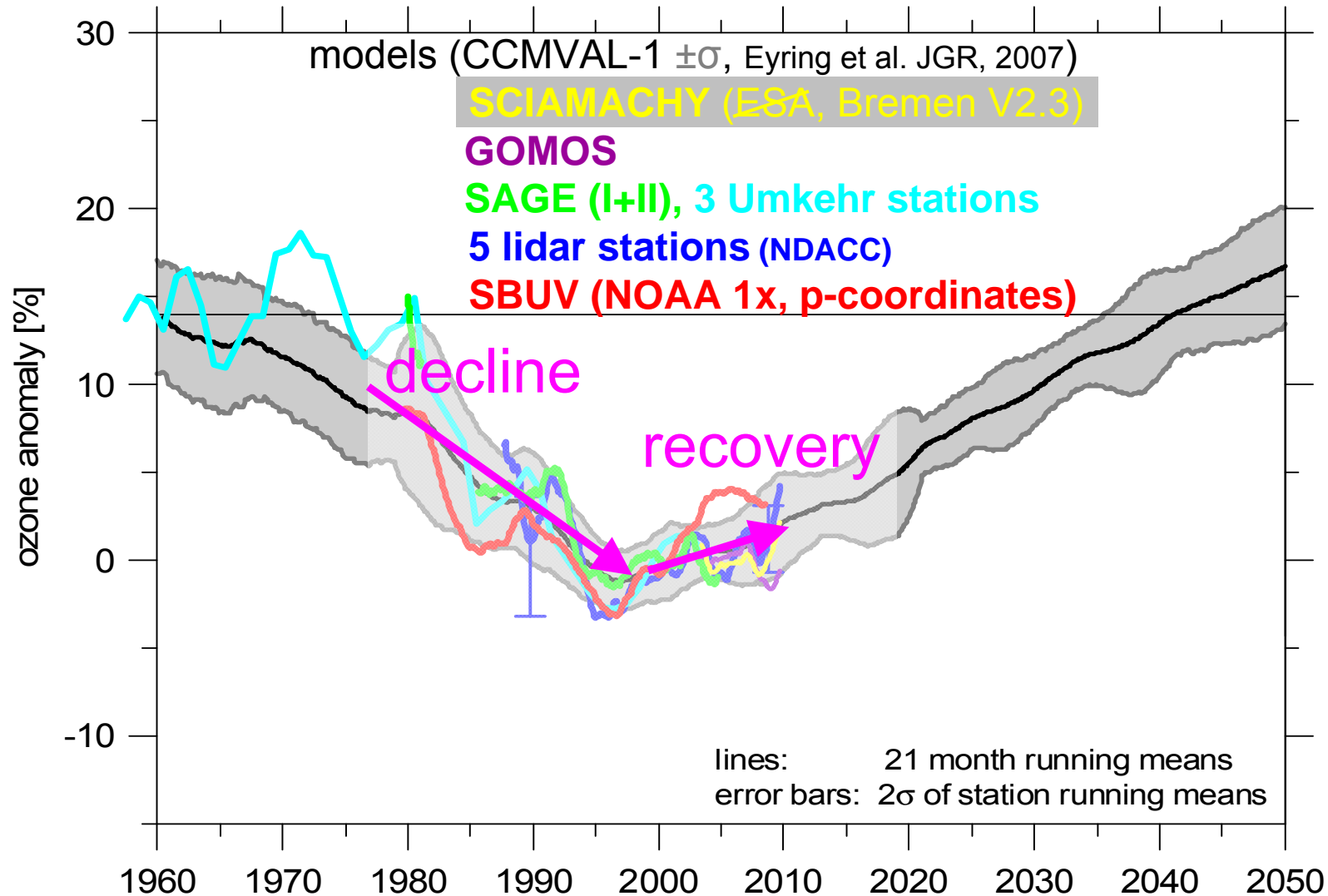
Ozone & T @ 5 NDACC stations



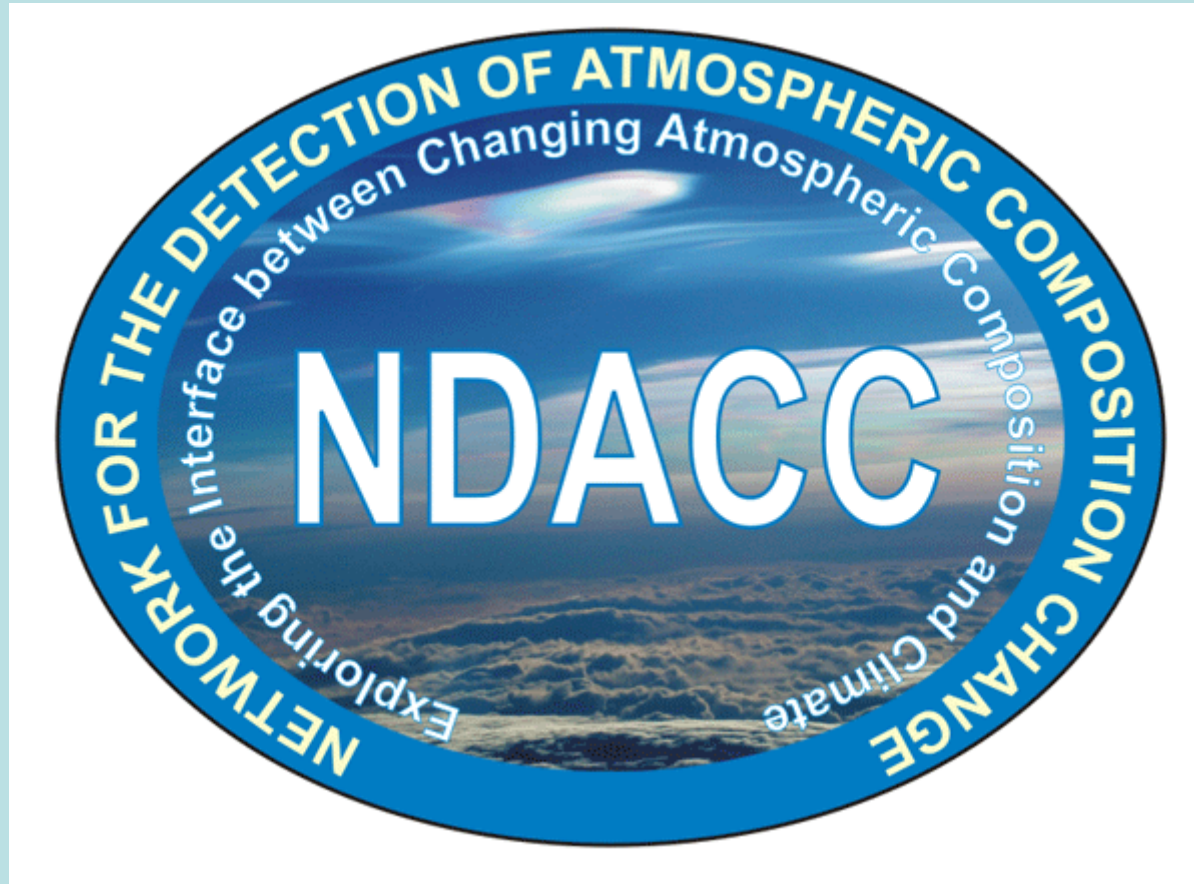
O₃ evolution @ 40 km



ozone anomalies, ~40 km (2 hPa), 60°S to 60°N



NDACC-lidar.org



- Focus: “detection of trends in overall atmospheric composition and understanding their impacts on the stratosphere and troposphere, and establishing links between climate change and atmospheric composition”.

Additional application of lidar data

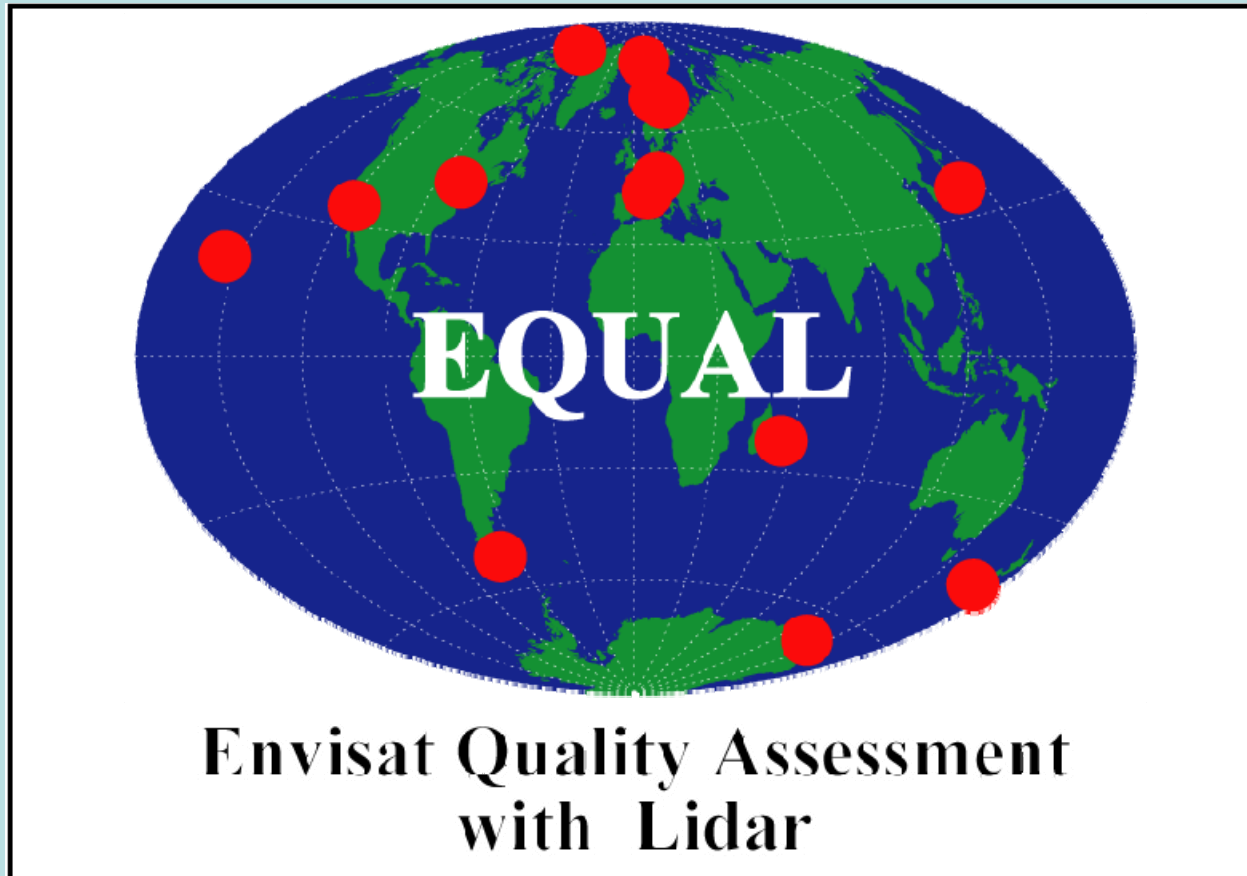
- Validation of satellite measurements

VALID history



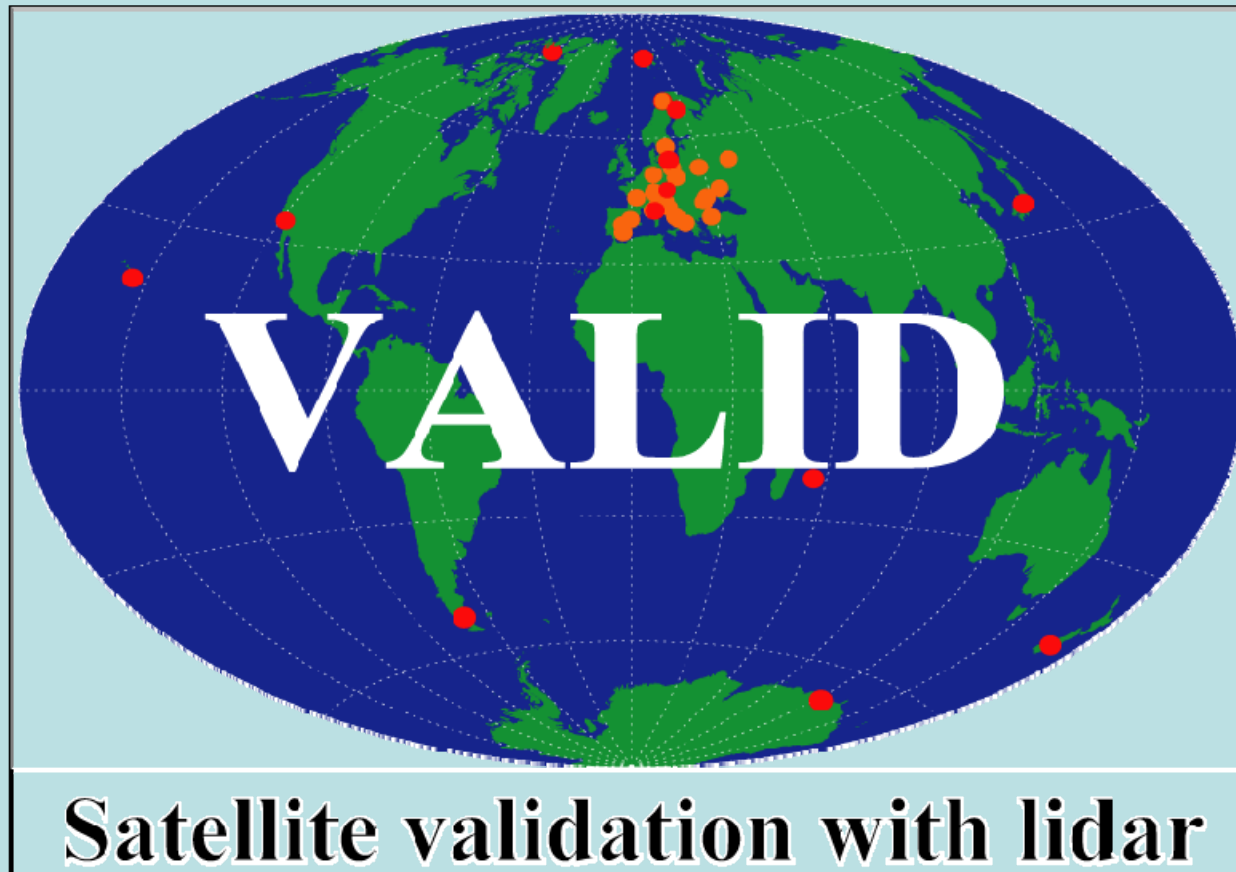
- SCIAMACHY and GOME validation
- EQUAL projects (2004-2007)
 - ENVISAT quality assessment with lidar
 - Stratospheric ozone
 - Stratospheric and mesospheric temperature
- VALID-1 project (2008-2010)
 - Multi-mission focus
 - Ozone and temperature profiles
 - Aerosol and cloud properties (Earlinet)

Logo evolution



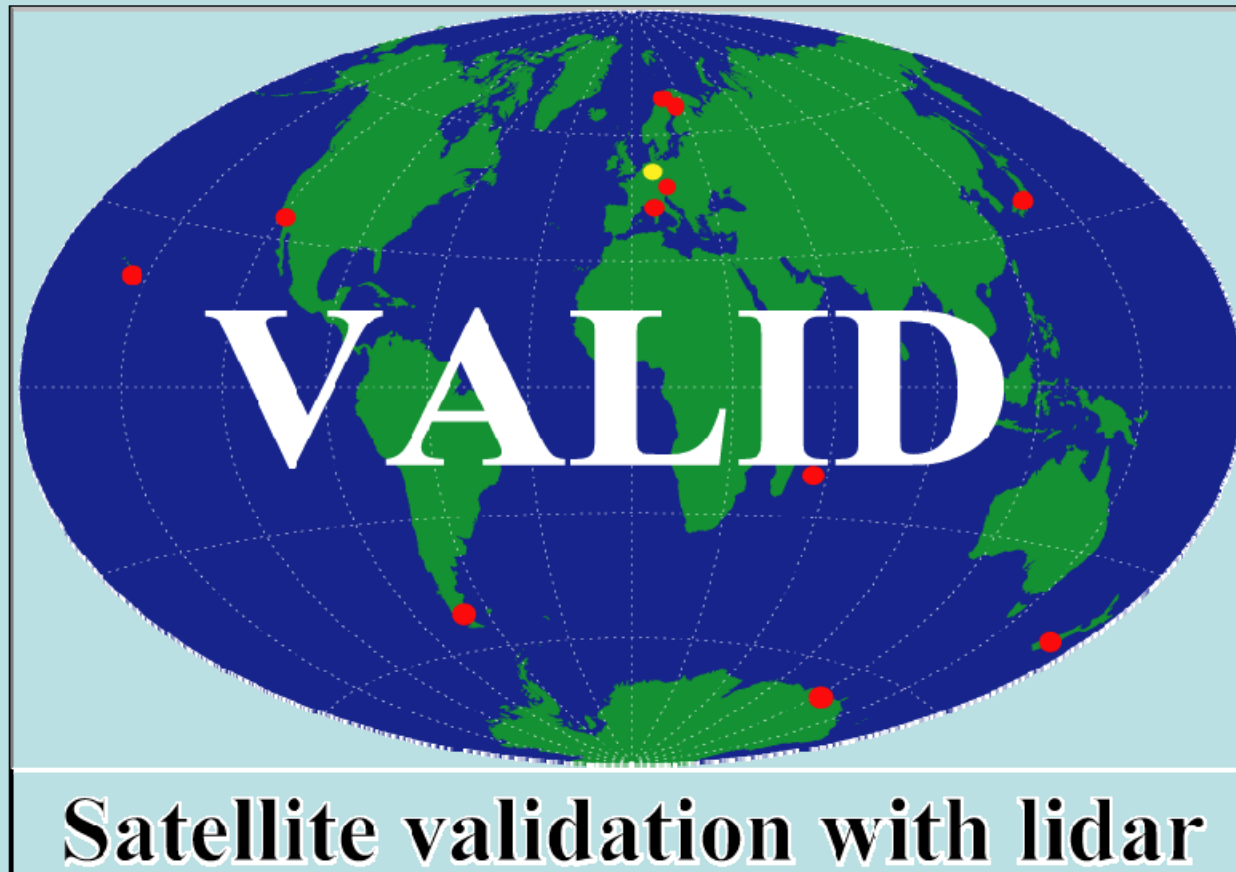
- EQUAL

Logo evolution



- VALID-1

Logo evolution



- VALID-2

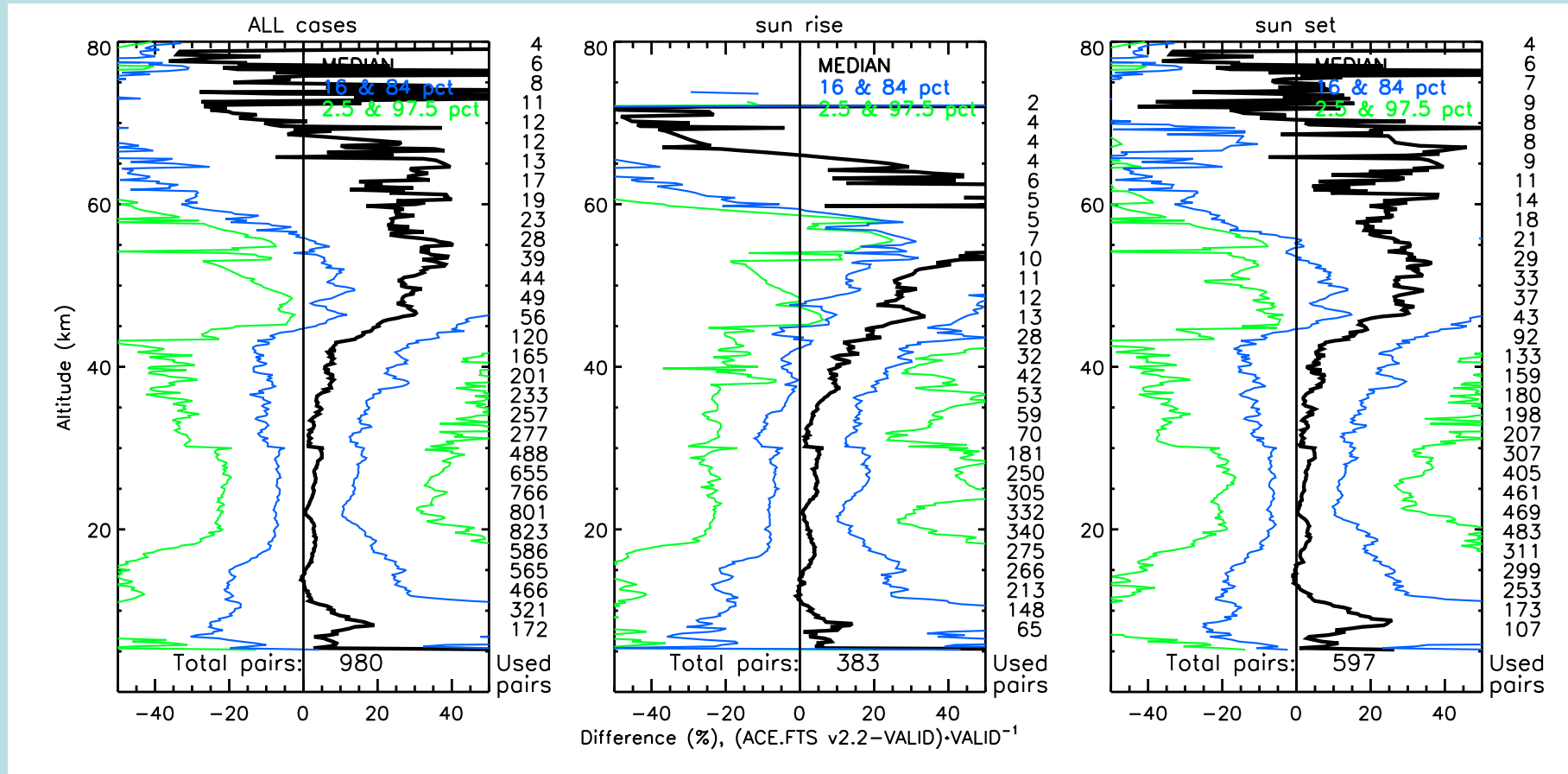
VALID-2

- no aerosol/cloud properties validation
- less ozone + T stations
- Addition of NO₂ profiles
- RIVM → KNMI

Project work flow

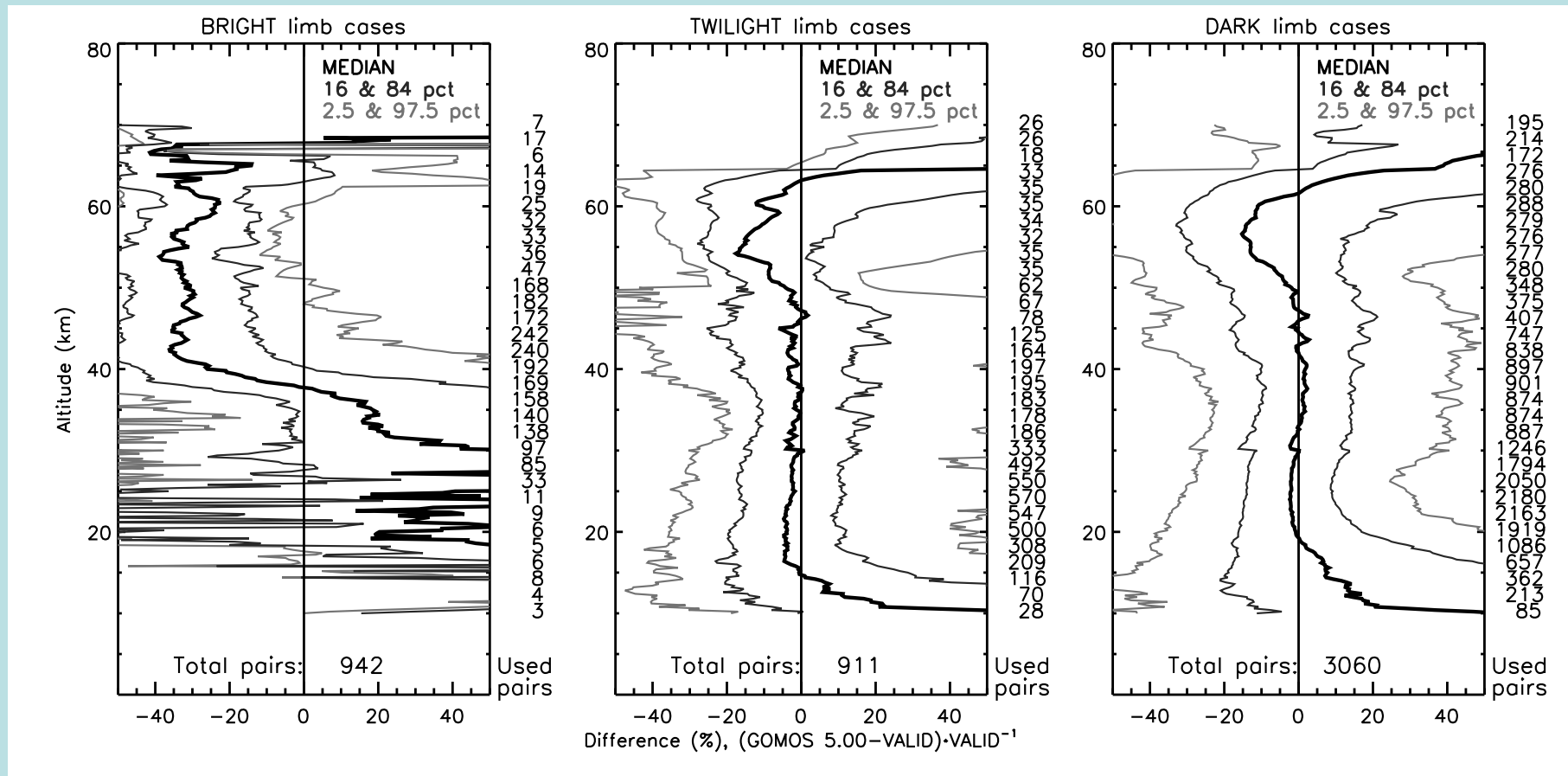
- **Collect** lidar profiles → quality check and submit to databases
- **Collocate** with satellite profiles → extract useful data to intermediate HDF
- Define **comparison** criteria and analyse data in sets → produce comparison figures
- For unexpected results, repeat criteria selection and/or consult data providers
- **Support** QWG in algorithm development

ACE FTS v2.2+ ozone vs. sonde+micro+lidar



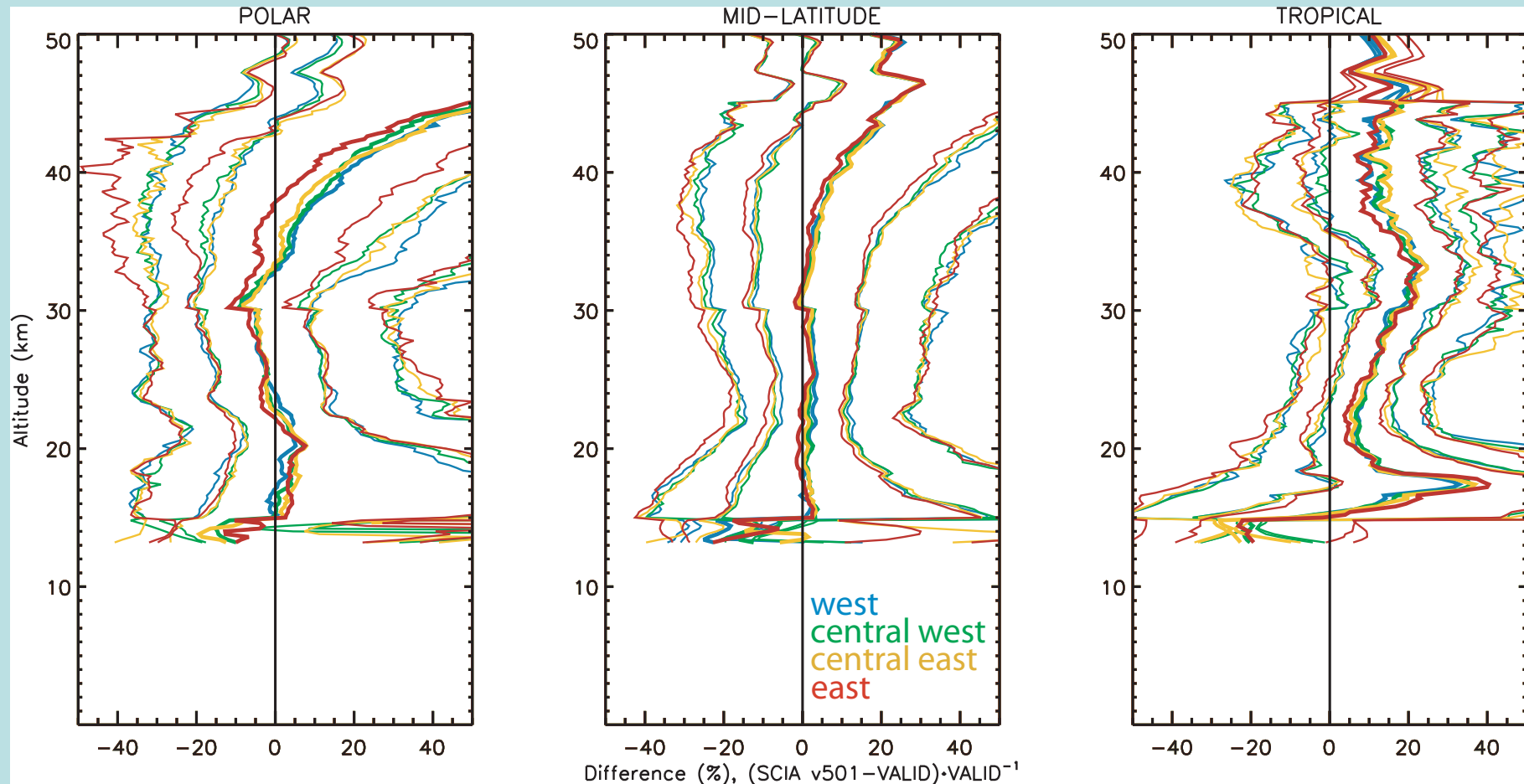
Plotting the 2.5, 16, 50, 86 and 97.5 percentiles of the difference with respect to the validation data as a function of altitude for all data together, sunrise (middle panel) and sunset (right panel) observations. On the right of each panel is the number of collocations at that altitude.

GOMOS v5.00 ozone profiles



- Tracking stellar signal through limb
- Shown: effect of SNR reduction due to solar light

SCIAMACHY v5.01 ozone

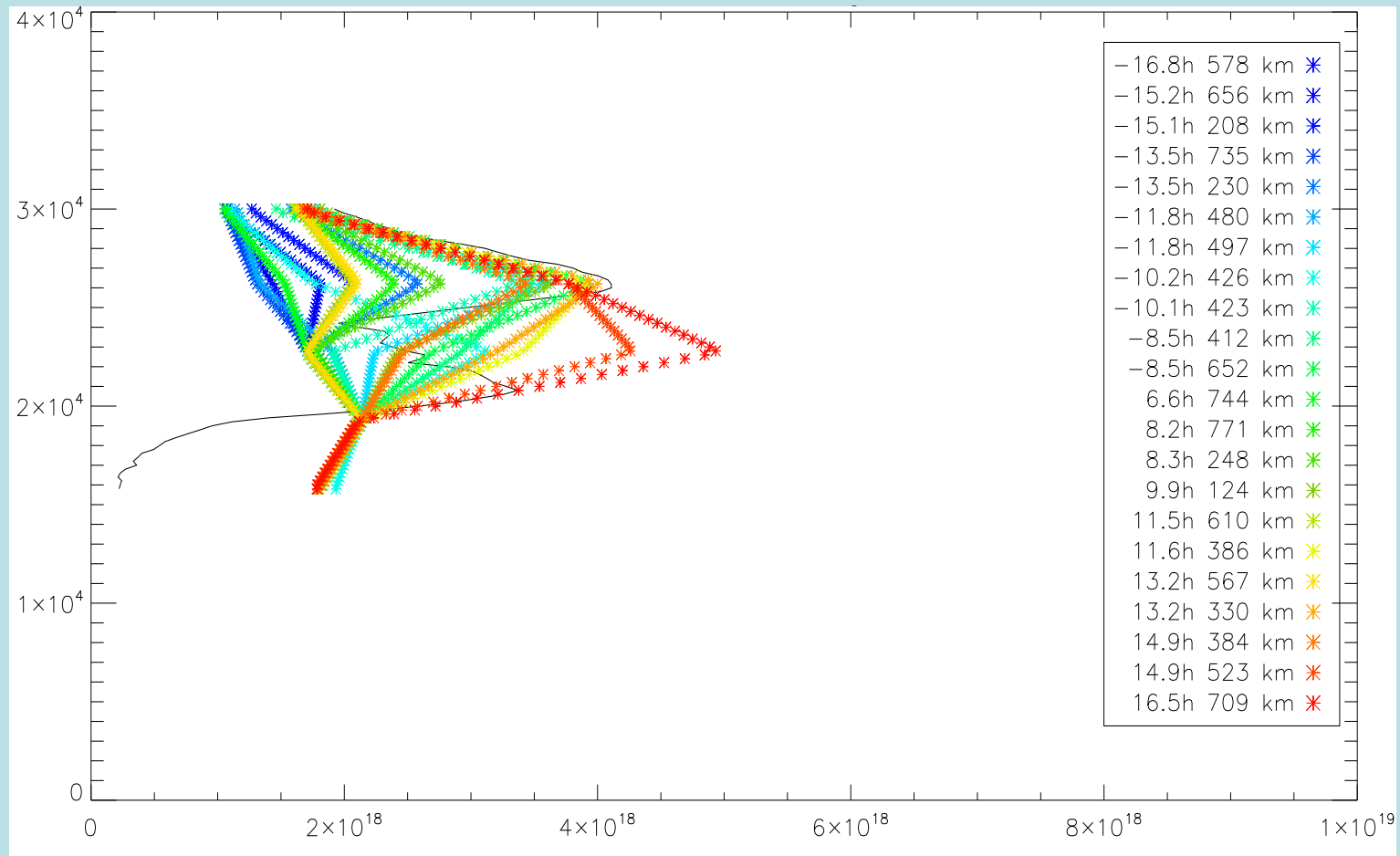


- Delta validation dataset
- a more negative bias for Eastern profiles → scan-angle dependent degradation

Outlook

- VALID is **multi-mission** → we can also assess quality of e.g. OMI and GOME-2 profiles (ESA's sensors have priority)
- **NO₂** profiles → quality of ground-based measurements to be determined as well as possible satellite products to match with
- Lidar → study **trends/variation** in O₃ and T
- Research → optimal **collocation** criteria?
- Website → development of **validation portal**

Thanks!



- Collocation optimisation problem (illus. SCIA v3.01 at Belgrano)