OSSSMOSE results on trace gas measurements

Tijl Verhoelst, Daan Hubert, and Jean-Christopher Lambert

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 640276.

Outline

- What is OSSSMOSE? (short recap)
- Ozonesondes: the impact of balloon drift
- Ozone MWR measurements: a non-vertical LOS
- Stratospheric ozone LIDAR measurements: significant integration times
- Prospects

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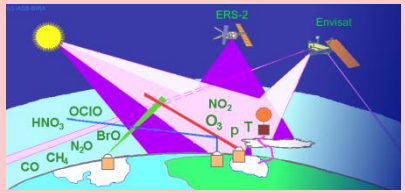
What is OSSSMOSE: short recap

Observing systems metadata library

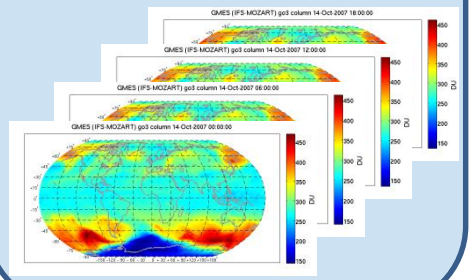


Multi-dimensional observation operators

- Multi-D Averaging Kernels
- 4-D airmass parametrization
- Balloon trajectories
- …

- ERA-Interim
- CAMS
- MERRA(-2)
- BASCOE

High resolution atmospheric fields library



More details: Verhoelst et al., AMT v8, 2015; Based on research supported by ProDEX/Belspo (A3C, AcroSat) and the EC in FP6 GEOMon and H2020 GAIA-CLIM

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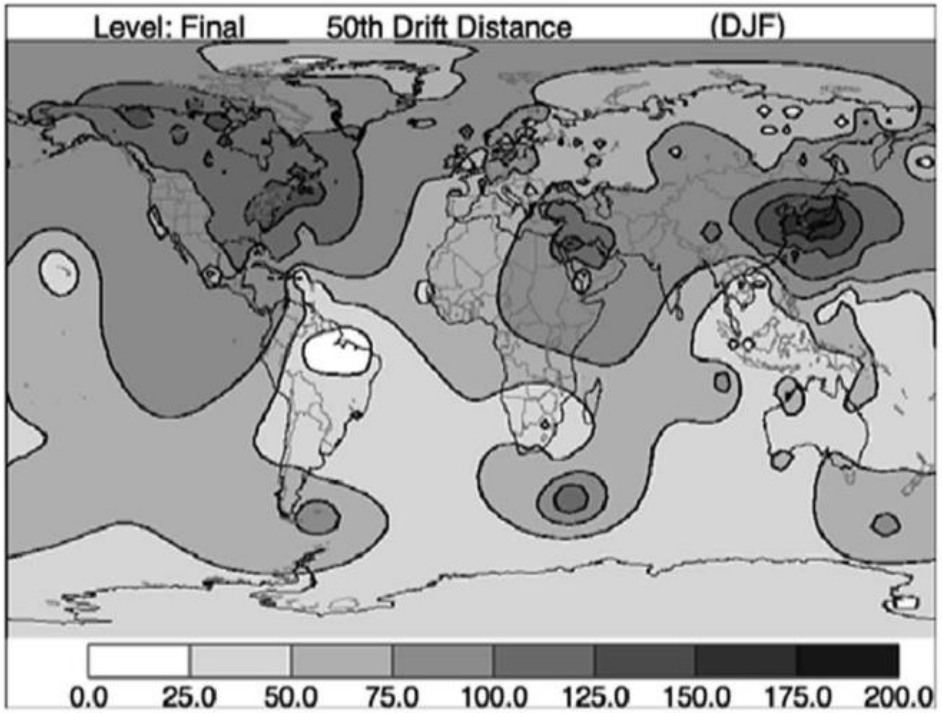
Ozonesondes: the impact of balloon drift



Seidel et al., JGR v116, 2011

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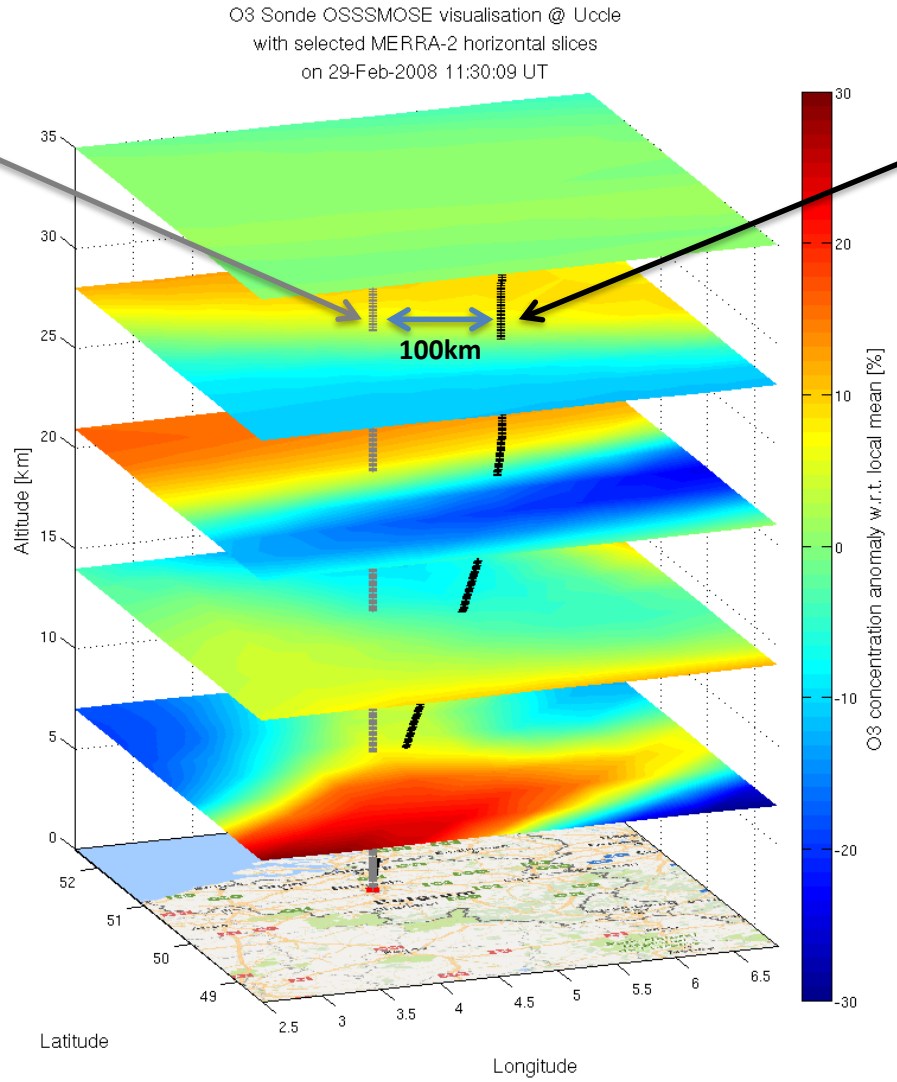
Ozonesondes: the impact of balloon drift



$$\delta x(z_i) = \frac{x_{traject.}(z_i) - x_{zenith}(z_i)}{x_{zenith}(z_i)}$$

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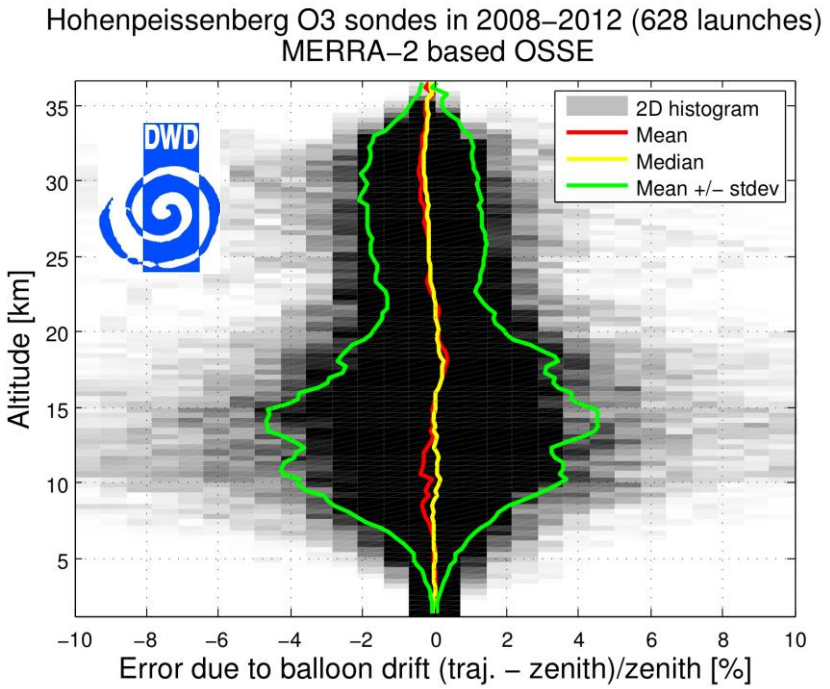
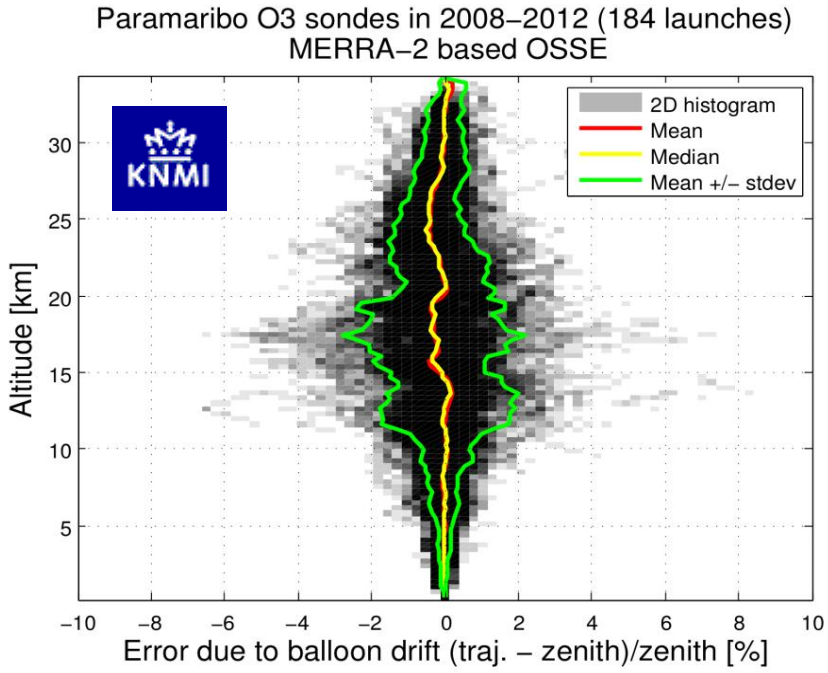
Ozonesondes: the impact of balloon drift



Hohenpeißenberg, Germany (47.8˚N, 11.0˚W): 3/week by DWD



Paramaribo, Suriname (5.75˚N, 55.2˚W): weekly launches by KNMI

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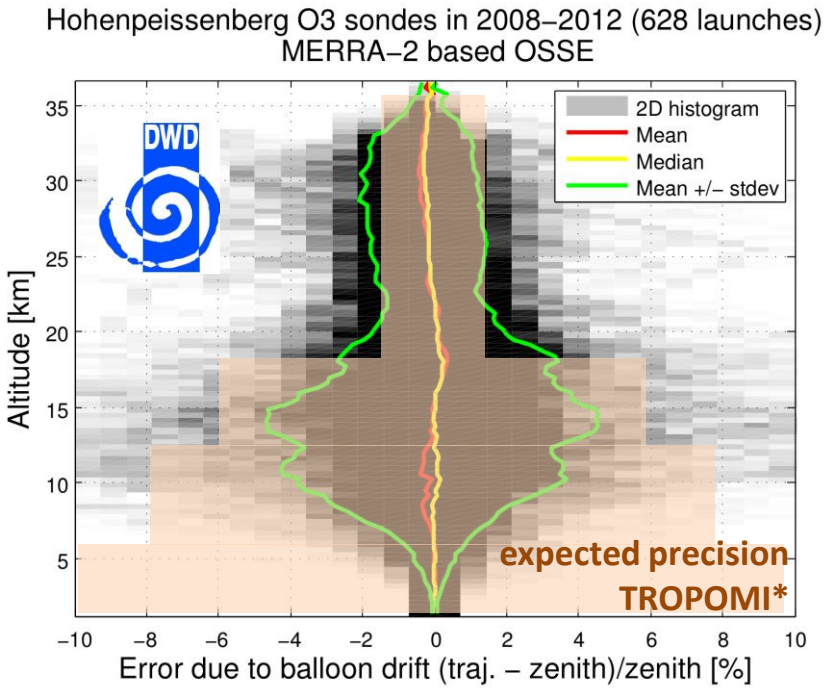
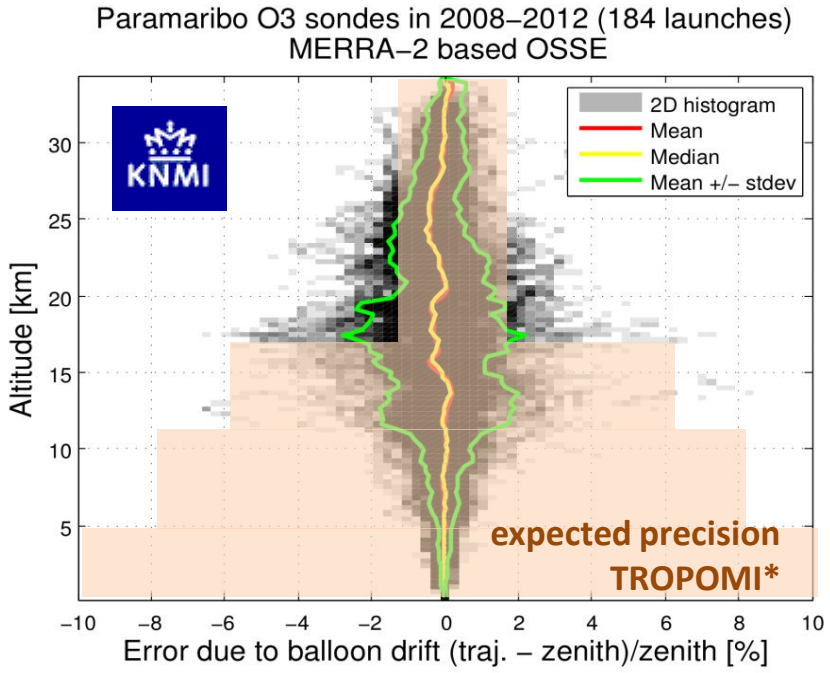
Ozonesondes: the impact of balloon drift





(*) TROPOMI ATBD: Table 7.1 in S5P-KNMI-L2-0004-RP, issue 0.13.0

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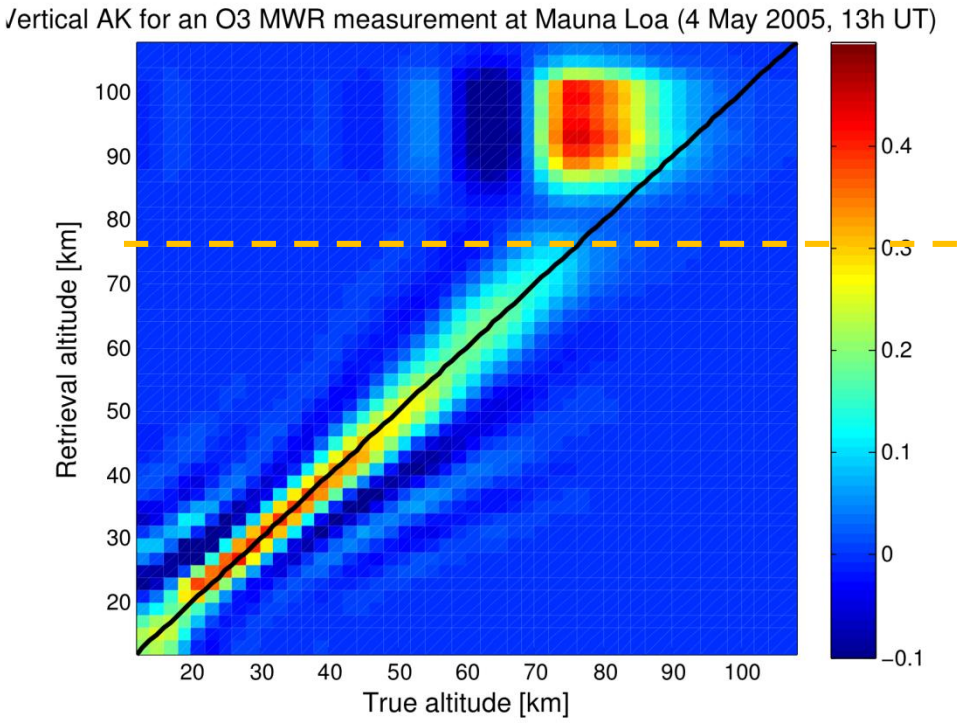
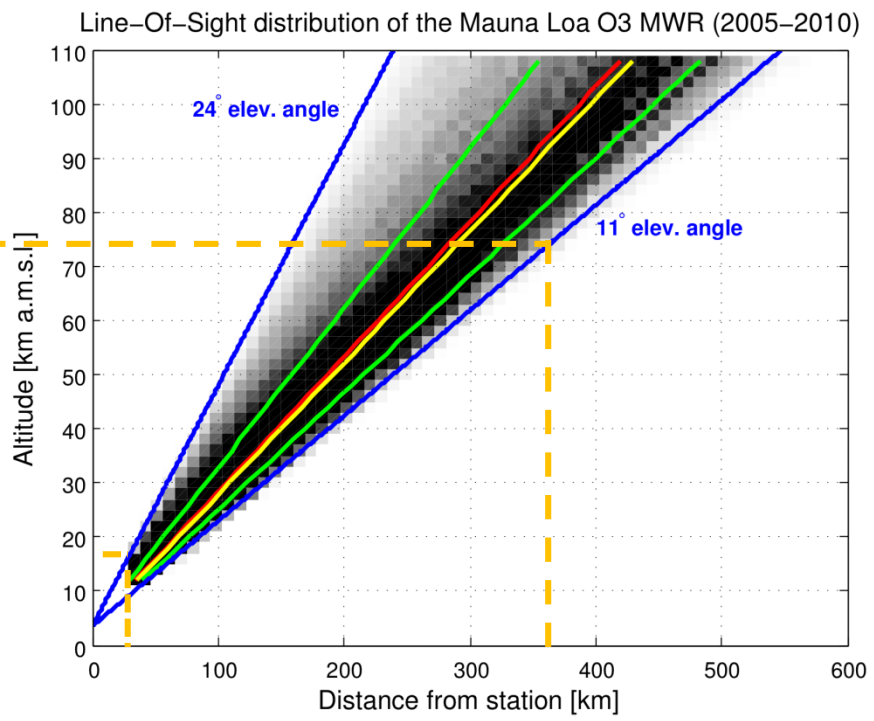
Ozone MWR measurements: a non-vertical LOS





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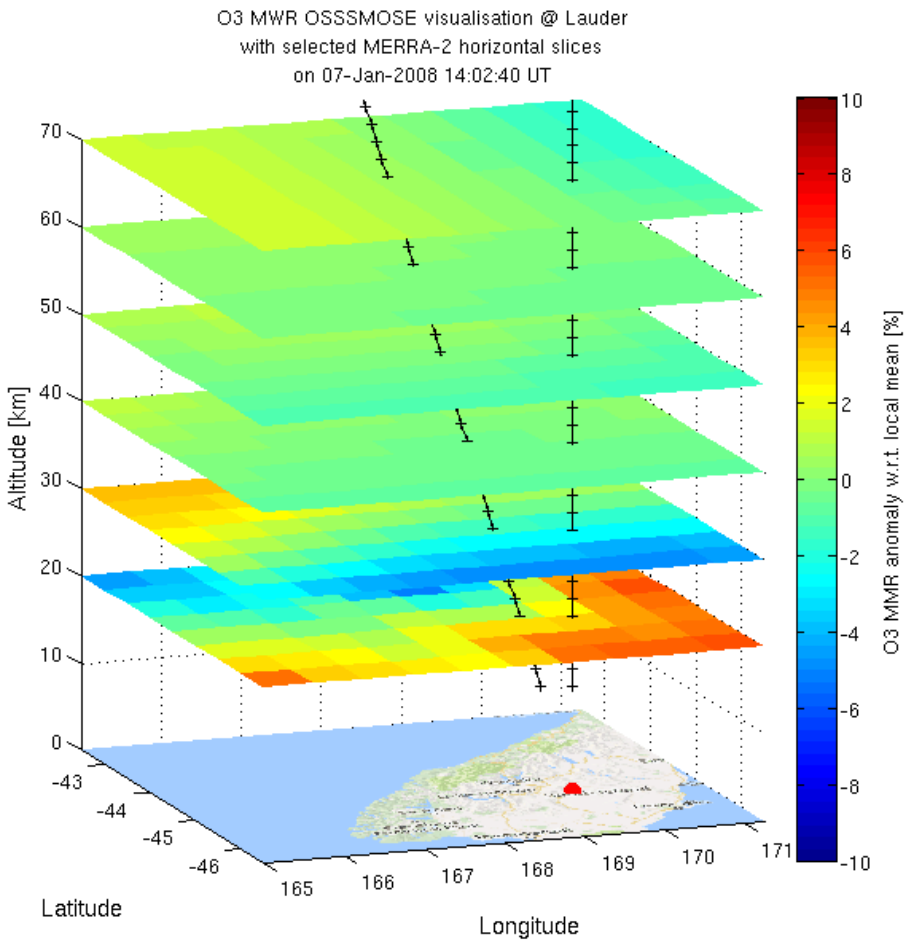
Ozone MWR measurements: a non-vertical LOS



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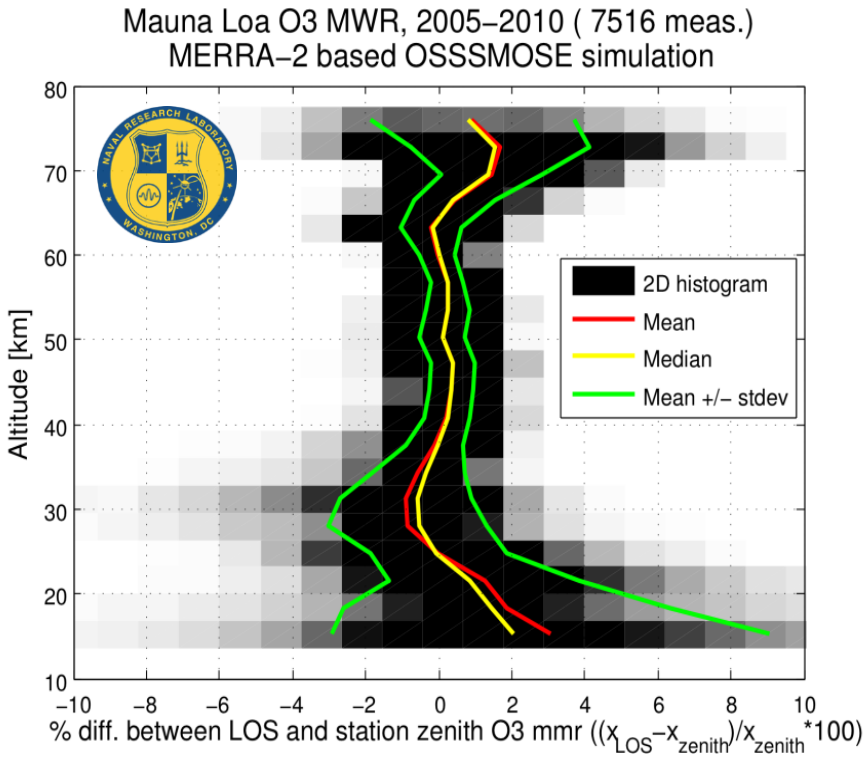

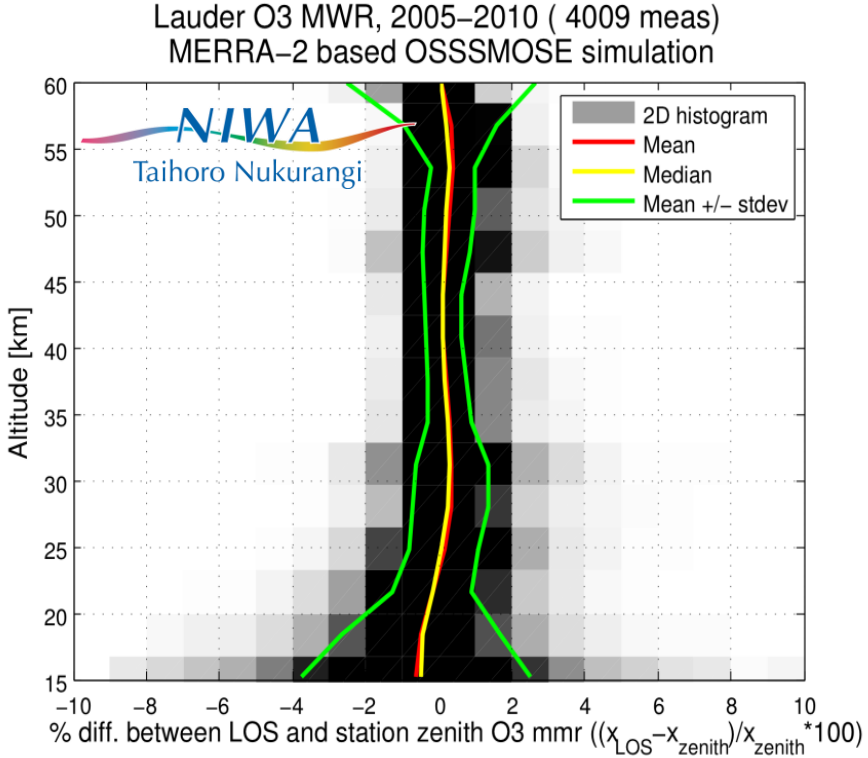

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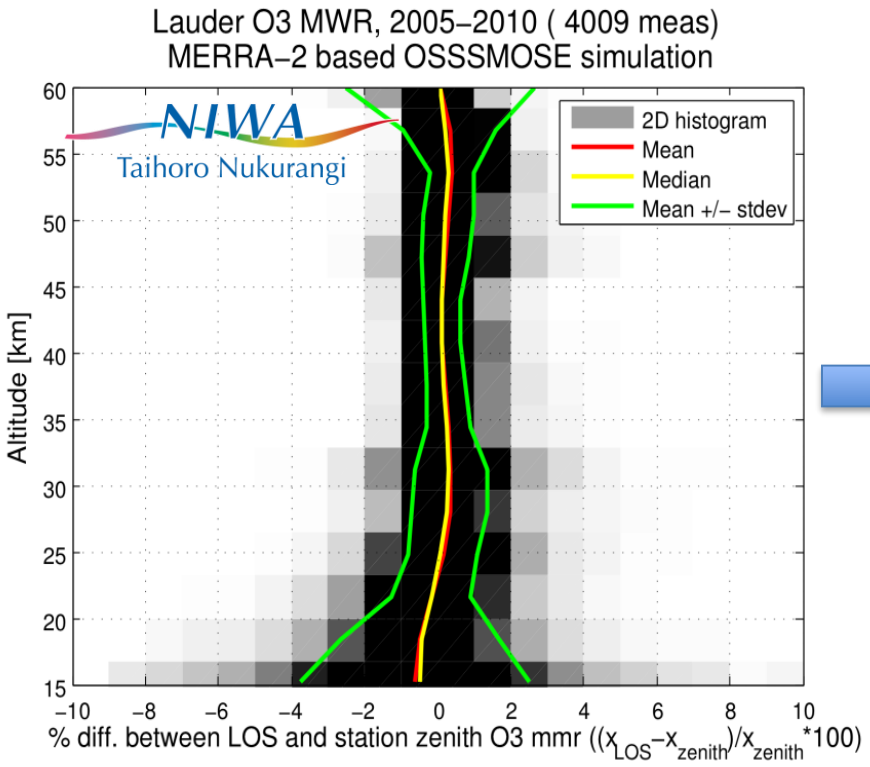
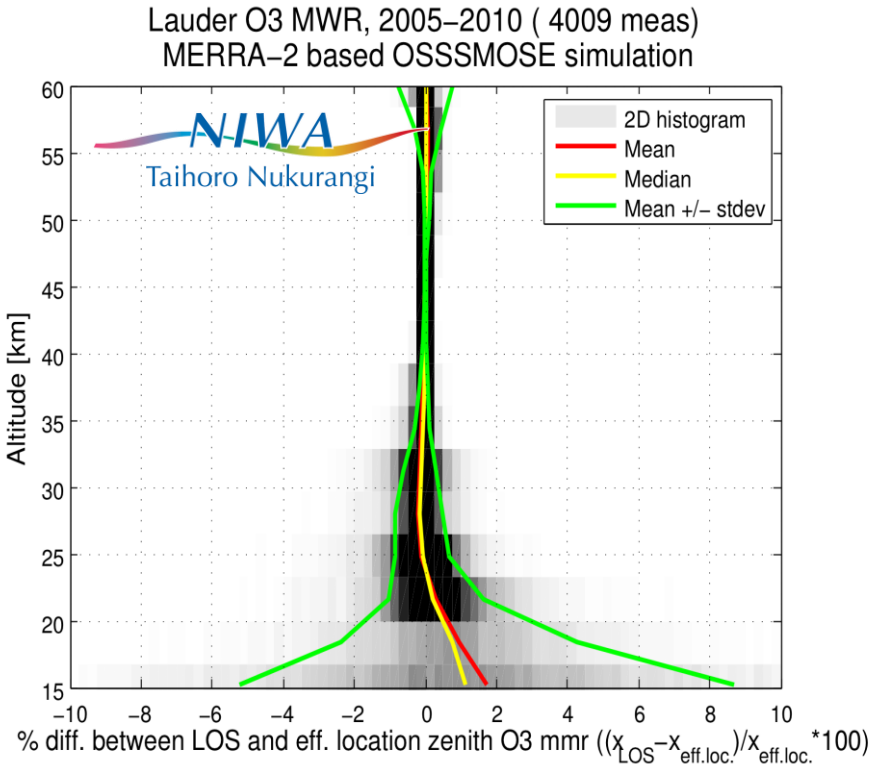
Ozone MWR measurements: a non-vertical LOS

For upper stratospheric and mesospheric applications, consider using an "effective" location, corresponding to the projection on the ground of the 45km level





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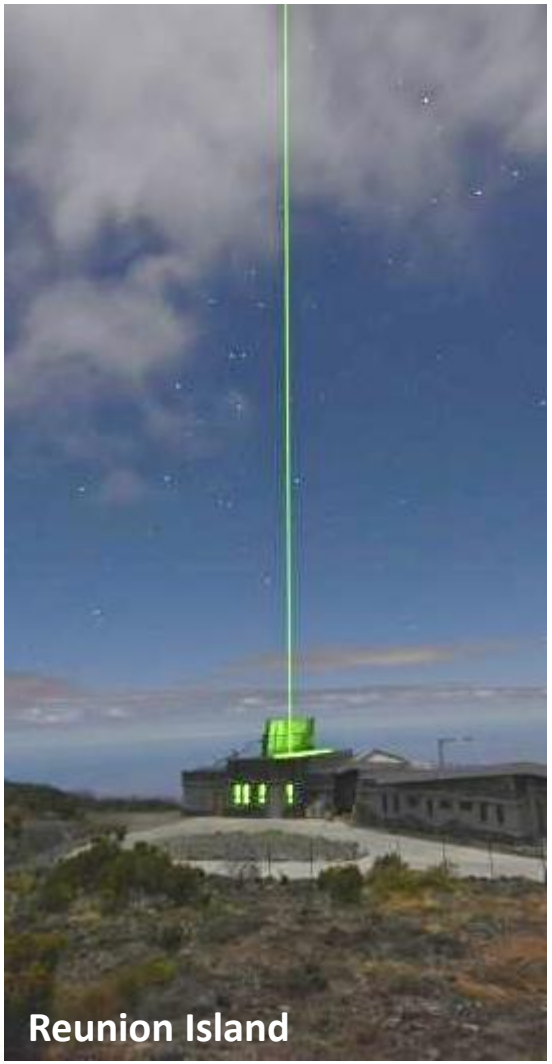
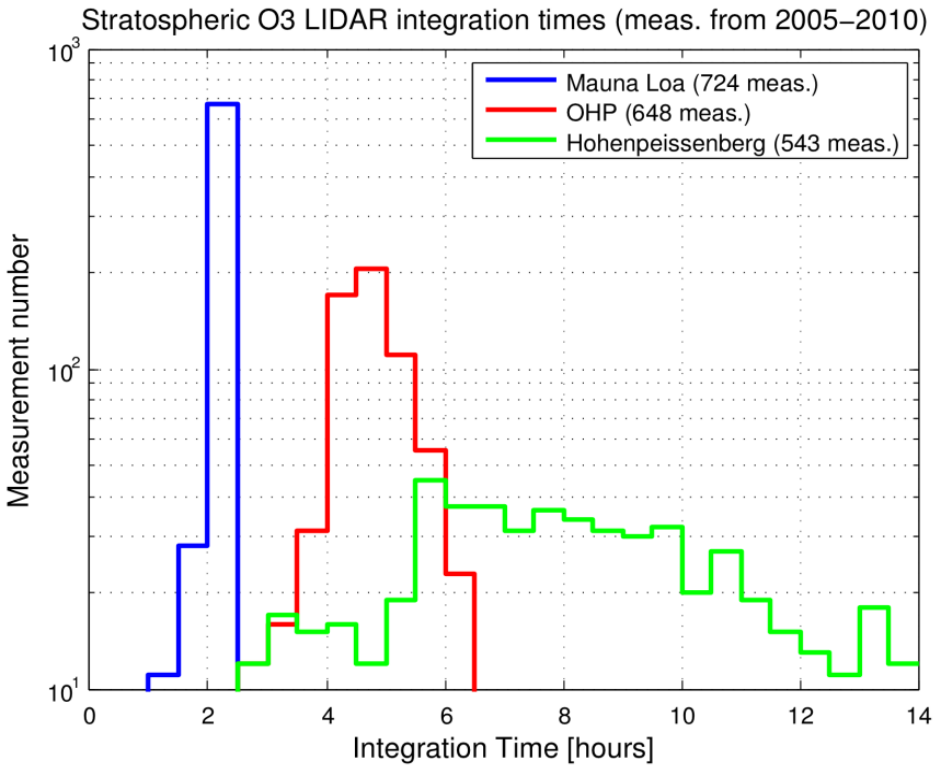
Stratospheric ozone LIDAR measurements: significant integration times





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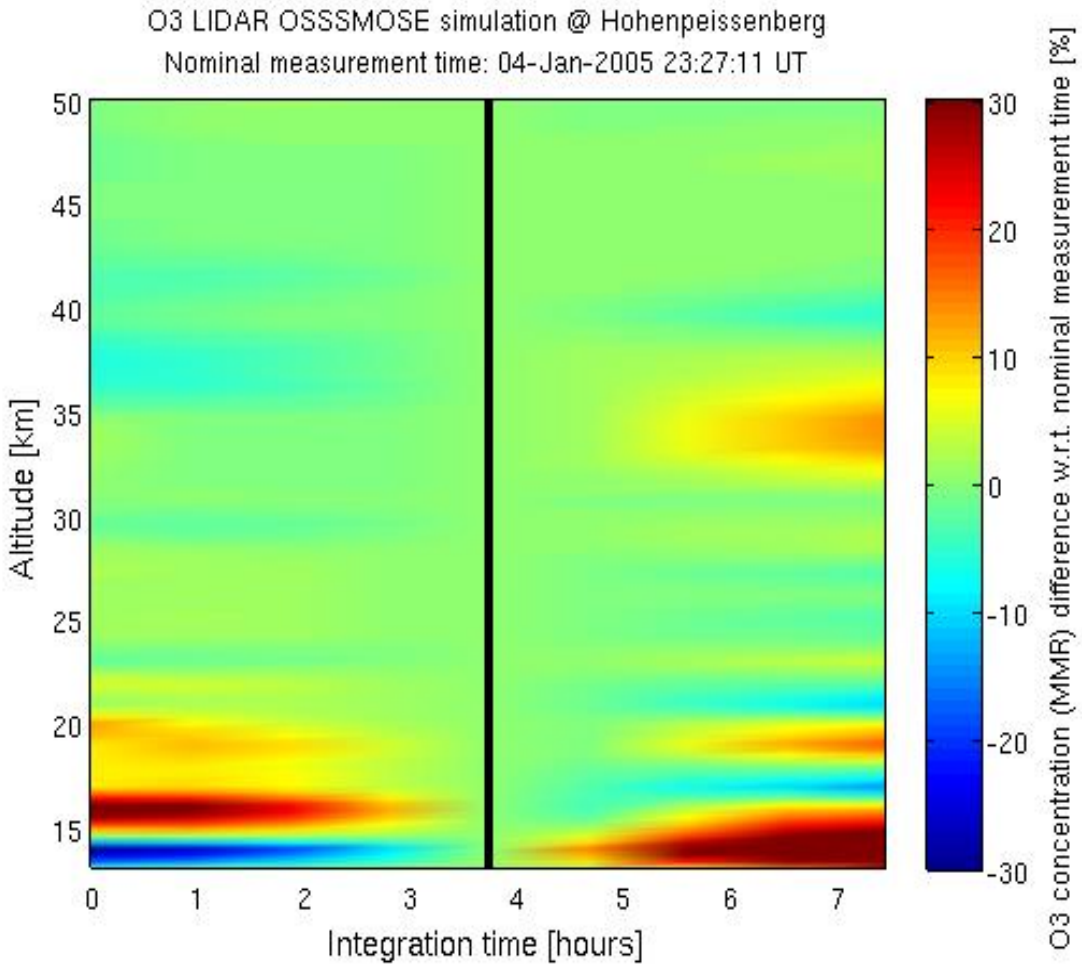

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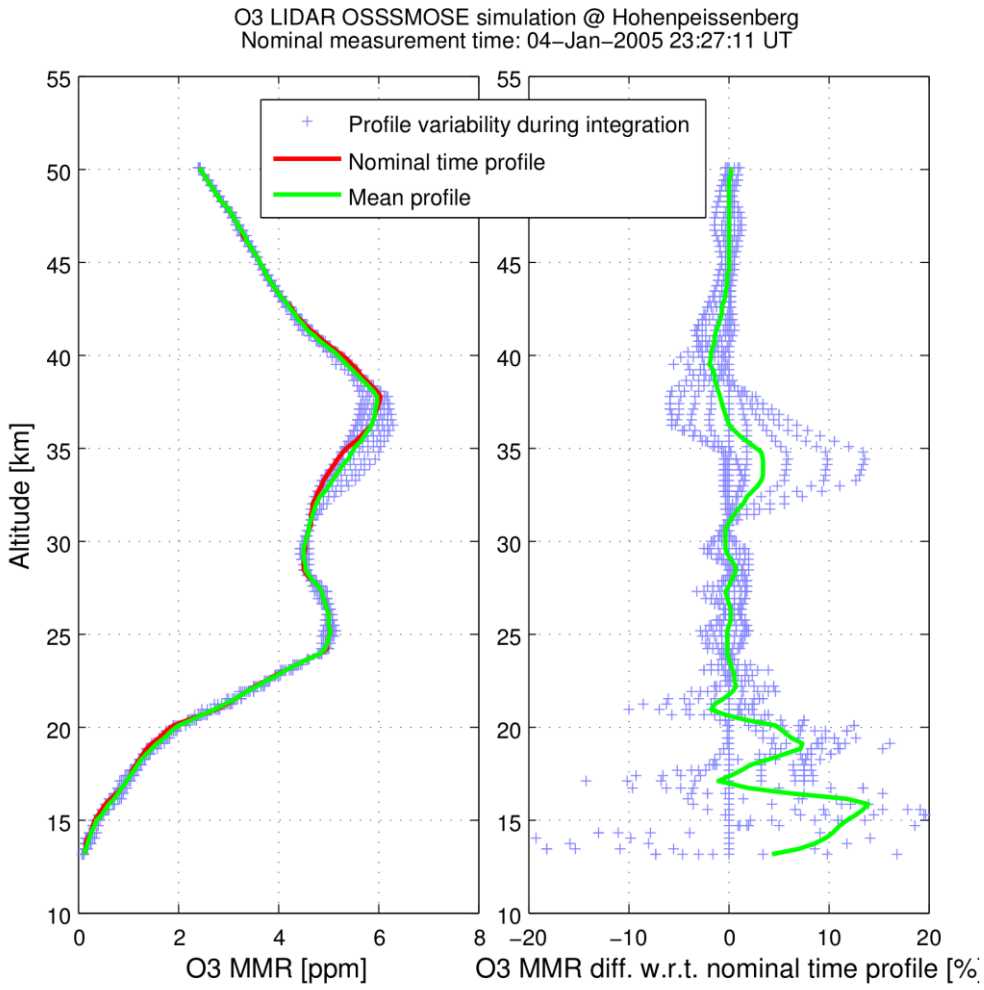

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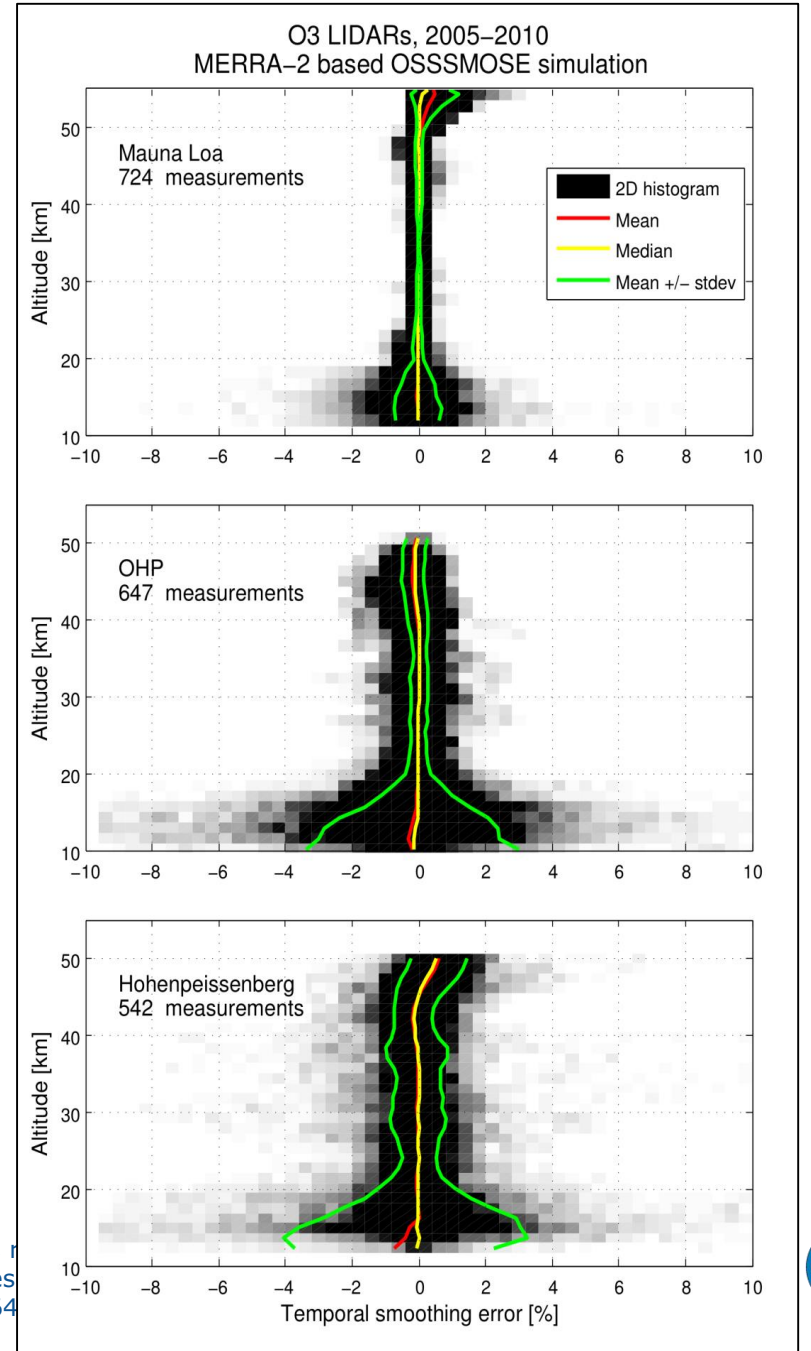
Stratospheric ozone LIDAR measurements: significant integration times

$$\delta x_{temp.smoothing}(z_i, t_0) = \frac{\int_{t_0-\Delta t/2}^{t_0+\Delta t/2} x(z_i, t)dt \Big/ \Delta t - x(z_i, t_0)}{x(z_i, t_0)}$$



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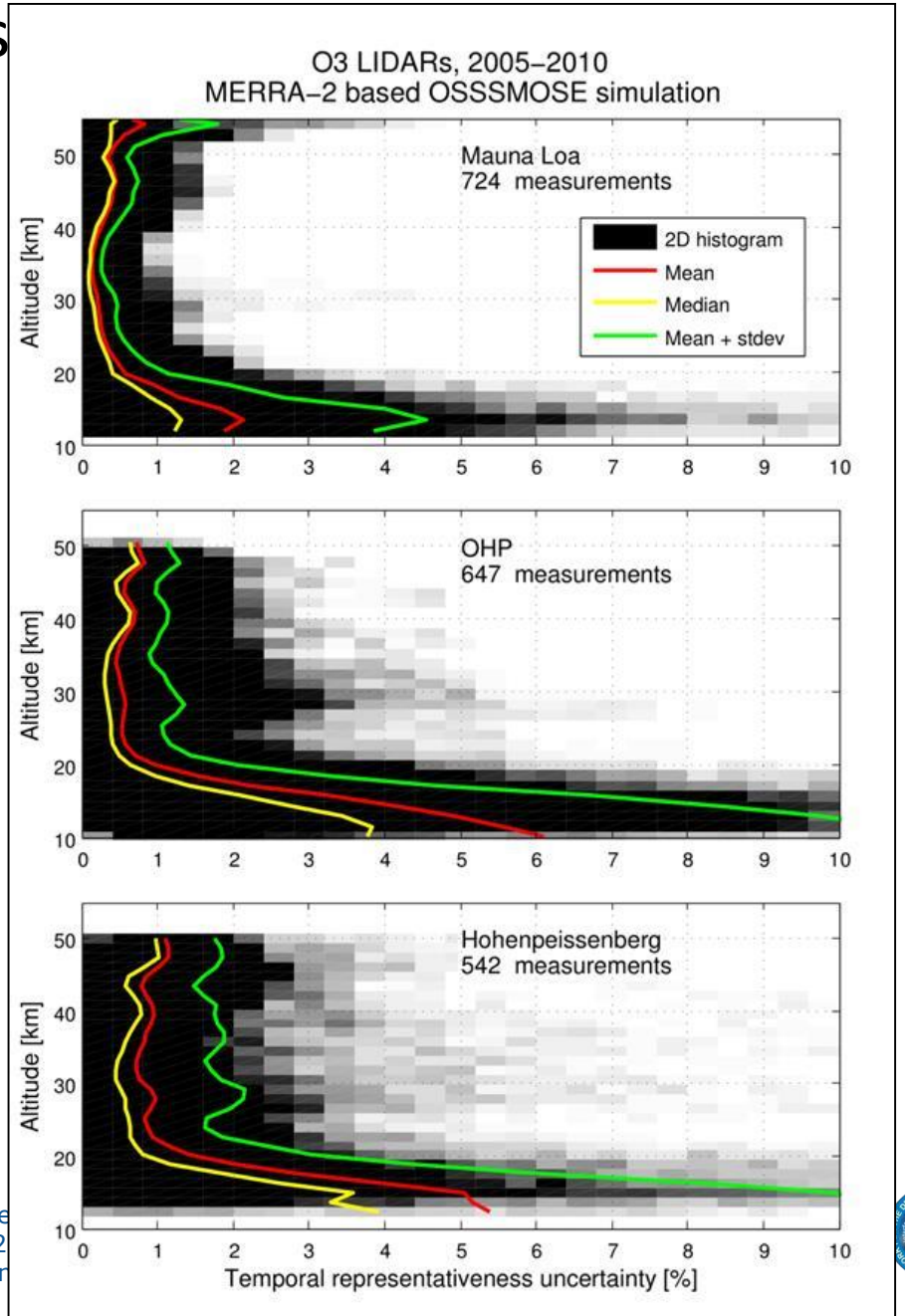
Stratospheric ozone LIDAR measurements: significant integration times

$$\delta x_{temp.representativeness}(z_i,t) = \frac{x(z_i,t) - \int_{t_0-\Delta t/2}^{t_0+\Delta t/2} x(z_i,t)dt \Big/ \Delta t}{\int_{t_0-\Delta t/2}^{t_0+\Delta t/2} x(z_i,t)dt \Big/ \Delta t}$$

$$\sigma_{temp.representativeness}(z_i) = stdev_t(\delta x_{temp.representativeness}(z_i,t))$$



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Prospects

- Ozone profile comparisons: GOME-2 versus Sonde and LIDAR (to be included in D3.4)
- Ozone profiles from FTIR
- Methane profiles from FTIR
- Methane profile comparisons: SCIAMACHY vs. FTIR

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Discussion on WP3 contributions to the VO

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Current status and open questions

- For Ozone total columns: LUTs based on OSSSMOSE simulations, available as HDF files (detailed documentation in progress).
- For water vapour: triangulation between GRUAN, NWP, and satellite sounder being investigated (link with WP4).
- For temperature and aerosol: potential solutions touched upon in D3.4.
- Integration into the VO still to be done (T3.3+WP5).
- What about co-location criteria? (cfr DOW)
- Upcoming deliverable: D3.5 (end of this month)
  - What can still be done?
  - How to deliver the LUTs? Note that these are “Beta” tools, so need further testing and refining. Not meant for public distribution.

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