



Royal Netherlands Meteorological Institute
Ministry of Infrastructure and Environment

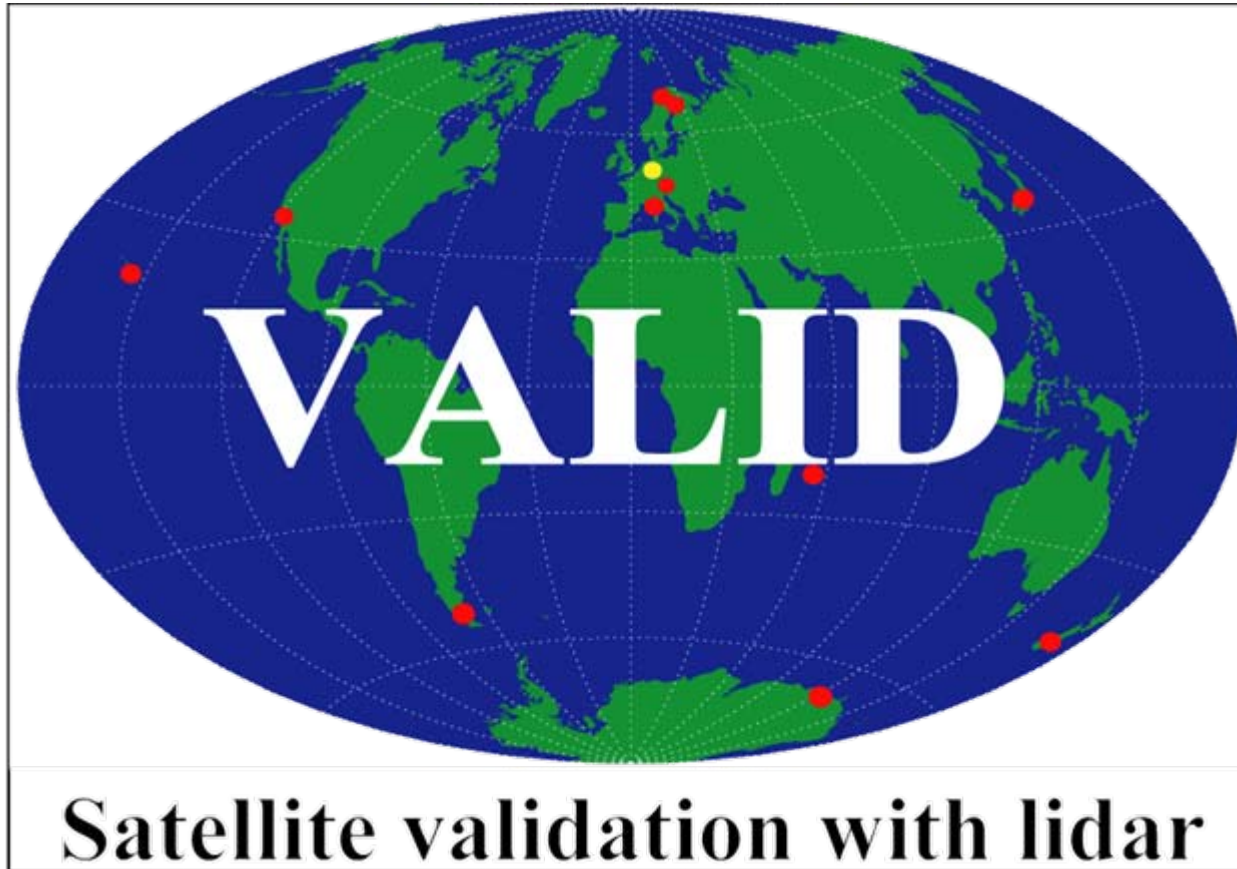
Satellite profile validation with lidar (+ sonde & microwave radiometer)

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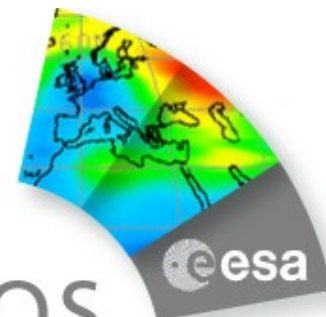
EQUAL and VALID projects



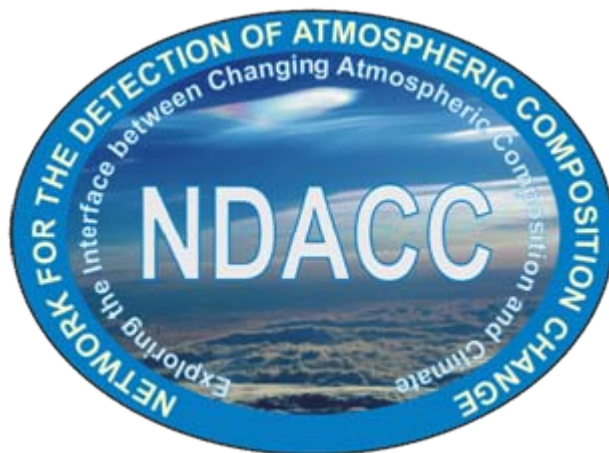
Ozone
Temperature
NO₂



What is it all about?



GOMOS
Global Ozone Monitoring by Occultation of Stars



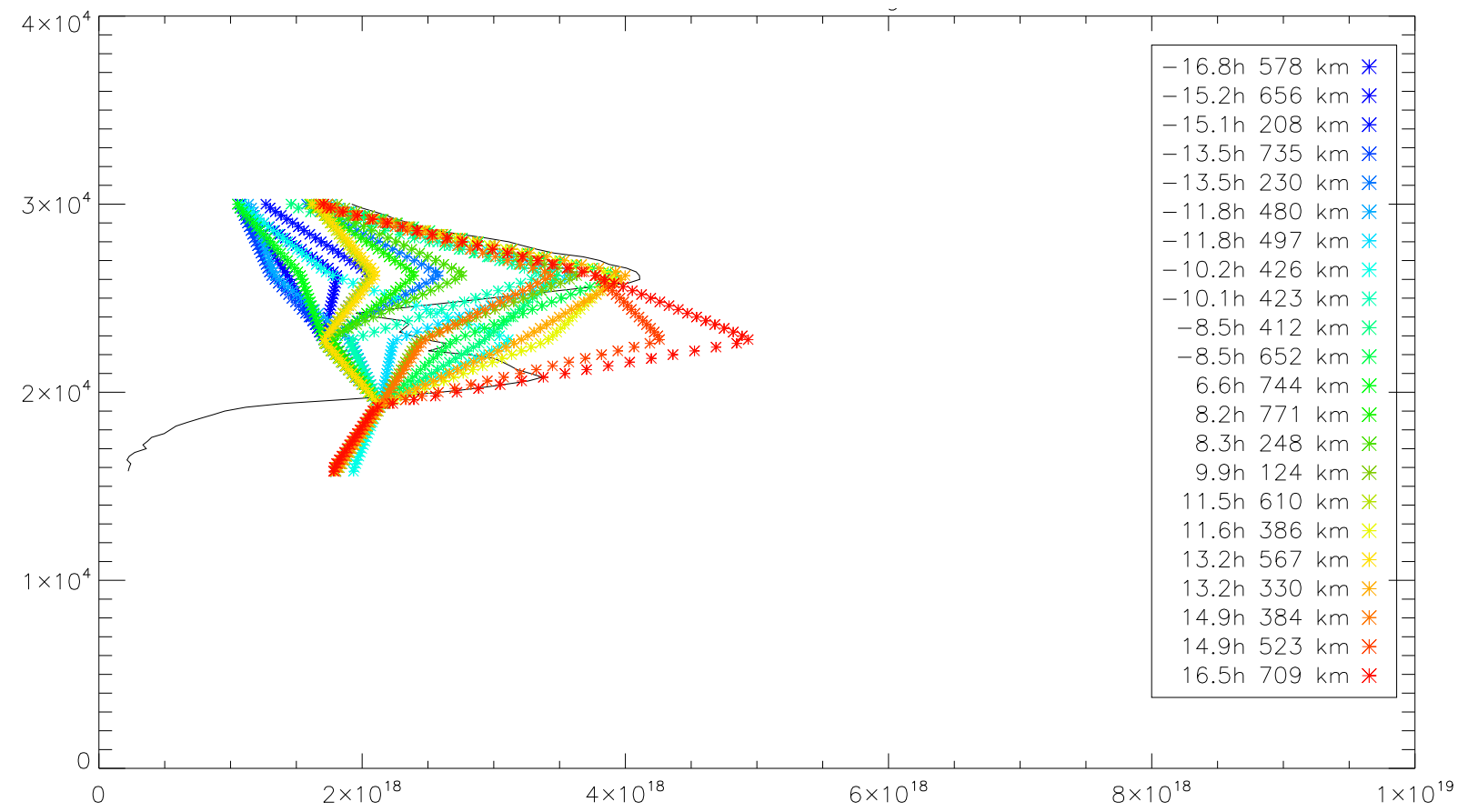


It's about finding the differences





Example of multiple collocations (SCIA v3.01 O₃ vs Belgrano sonde)





Issues with comparisons and validations

Differences in space (distance and spatial coverage)

Differences in time (also measurement duration and discontinued time series)

Differences in sampled air masses

Differences in vertical resolutions

Differences in measured quantities

Differences in used ancillary data

Differences in interpretation of variable names/terminology

Differences in the reported uncertainties

Dependencies (circular validation)

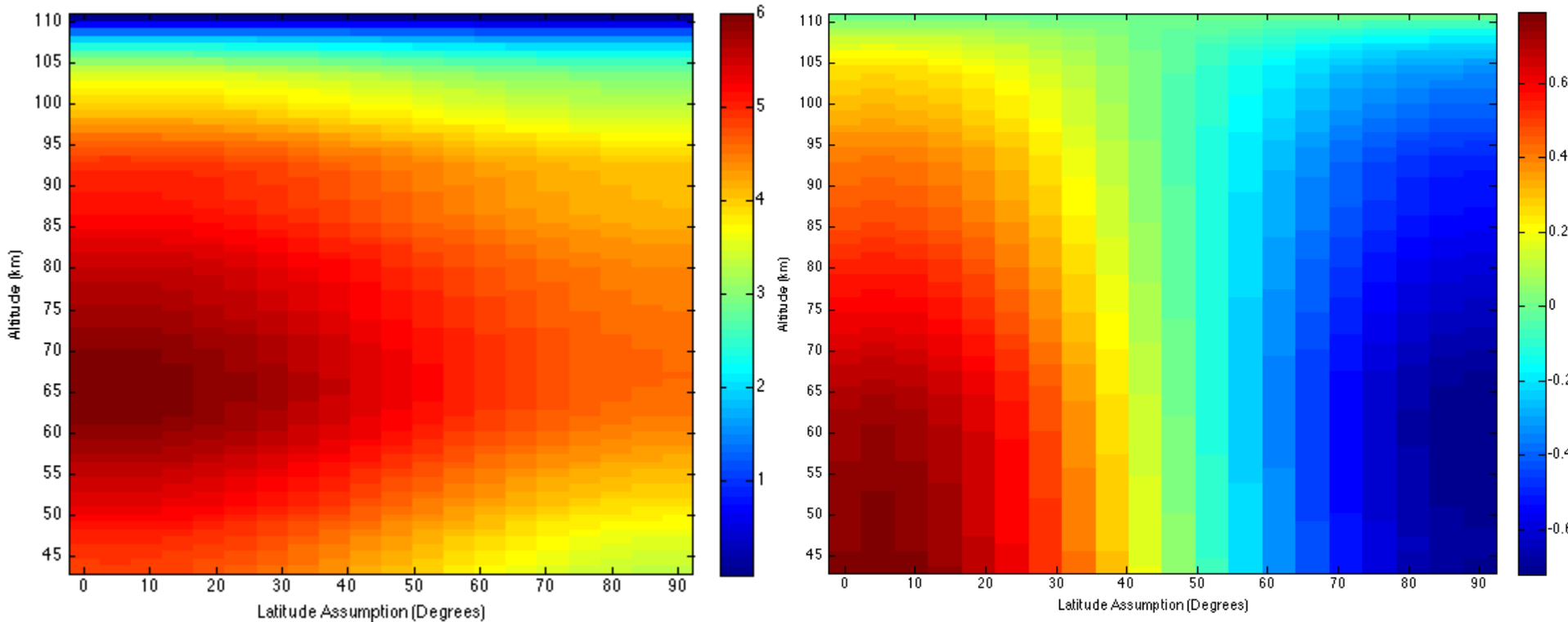
Incomplete/missing/unverified information

What is the reference (who is right, how right are they, and are they always right)?



Effect of basic assumptions: gravity on temperature from lidar

Assuming constant gravity to 6 K differences in the gravity model derived to 0.8 K differences in the temperature



Computed differences based on simulations done by Bob Sica e.a. (NDACC/ISSI team work)



What to report?

Mean profiles for satellite and validation instruments

Standard deviations of these profiles

Mean differences

Standard deviation of the differences

Median differences

Standard errors

(inter)percentile differences

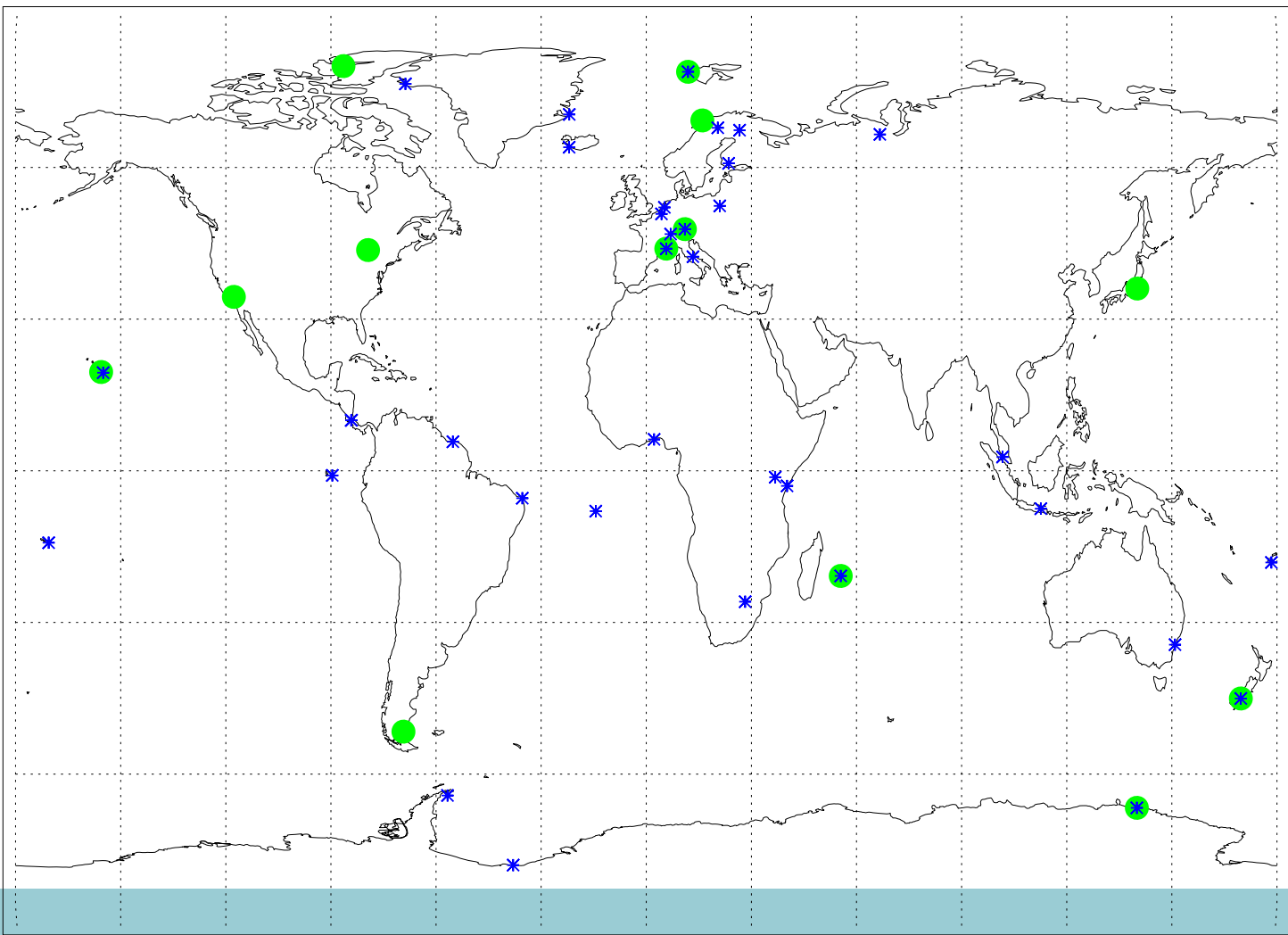
....

Necessary to group by certain observation characteristics when behaviour is very different

But, request of satellite operator to summarise the quality into a single number !

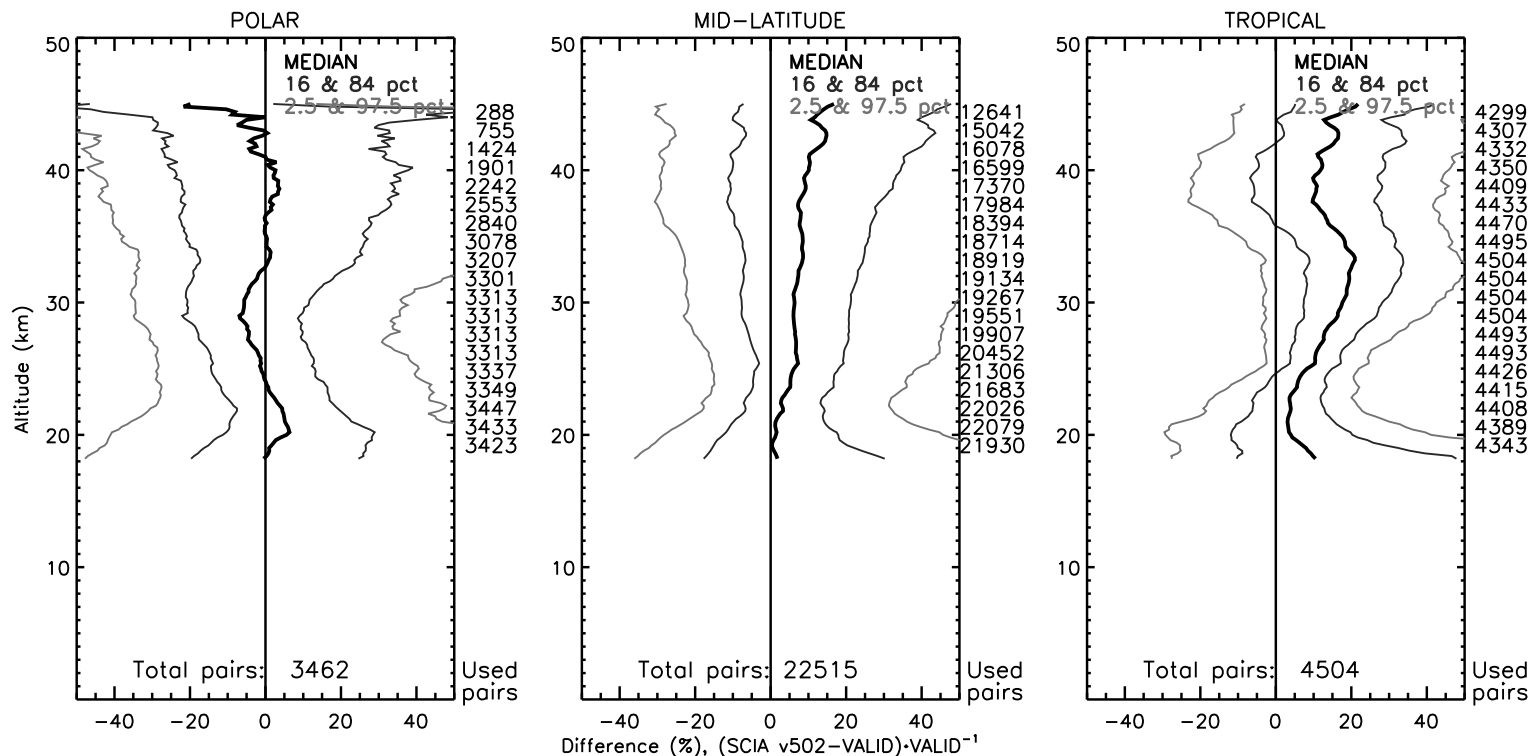


Example of used sites (lidar = green, balloon = blue)





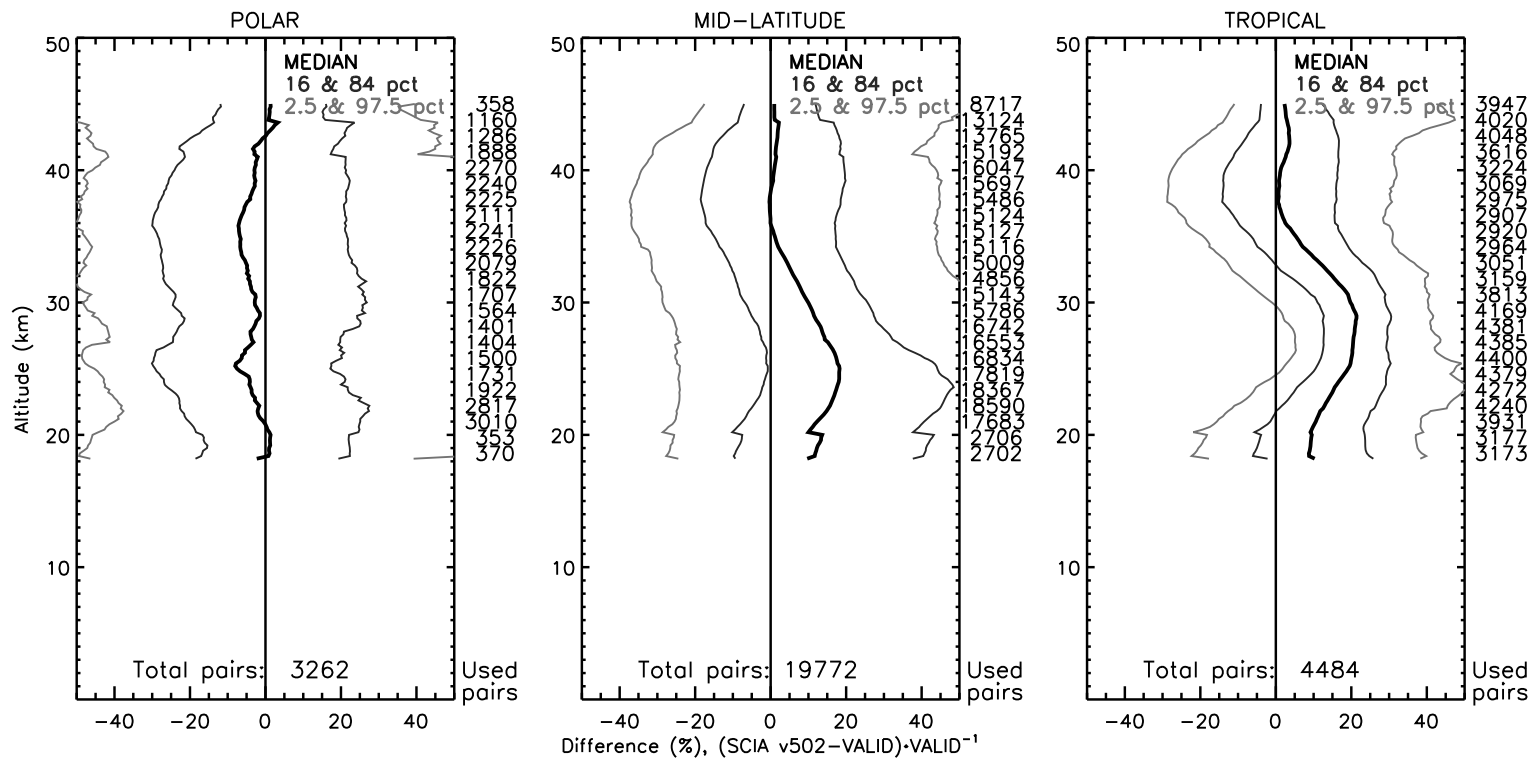
SCIAMACHY v5.02 ozone profiles vs lidar



Without convolution of the lidar data with the averaging kernels of SCIAMACHY



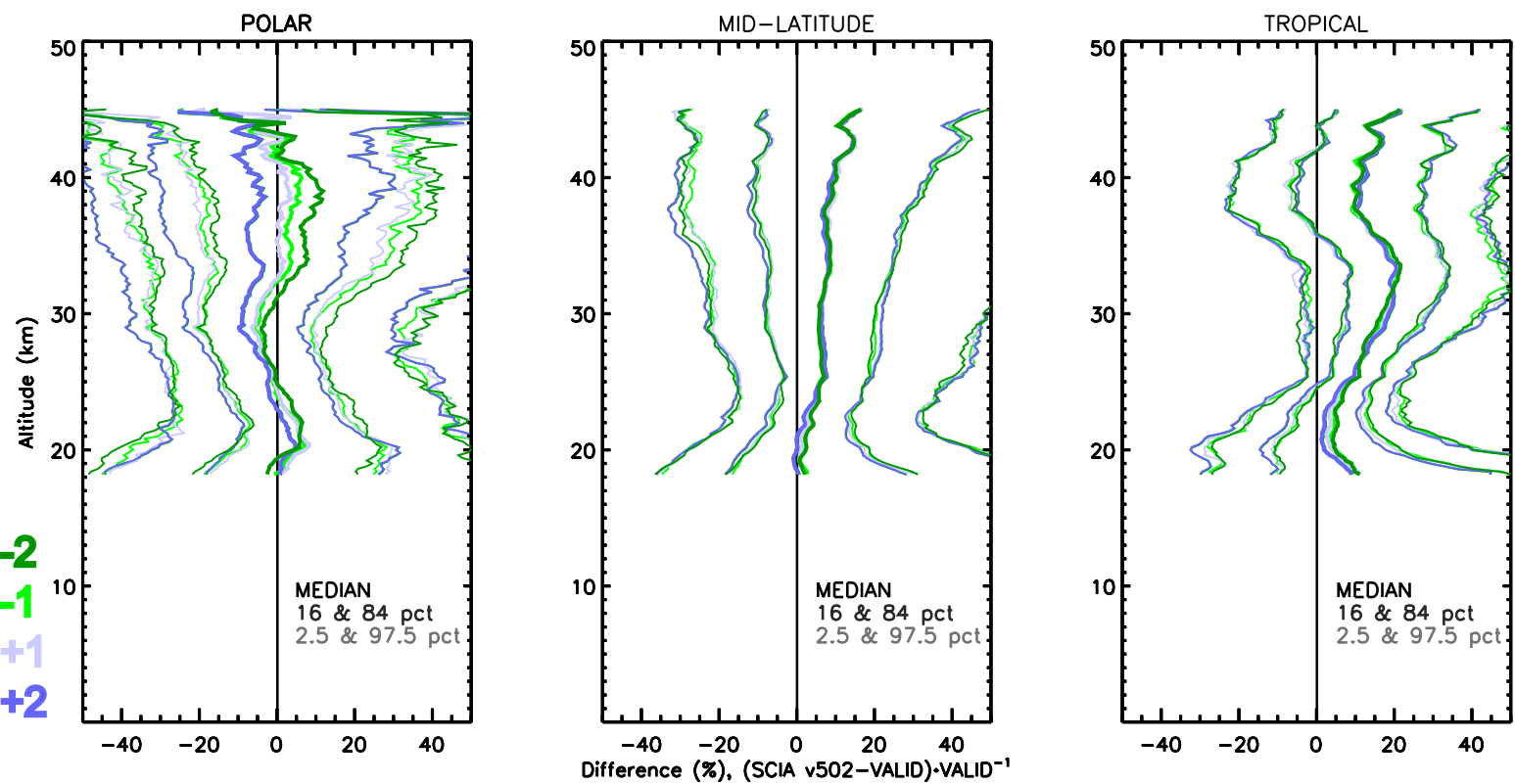
SCIAMACHY v5.02 ozone profiles vs lidar – application of AVKs



Assumption was that convolved lidar data would agree better with SCIAMACHY..



SCIAMACHY v5.02 ozone versus lidar – scan angle dependence

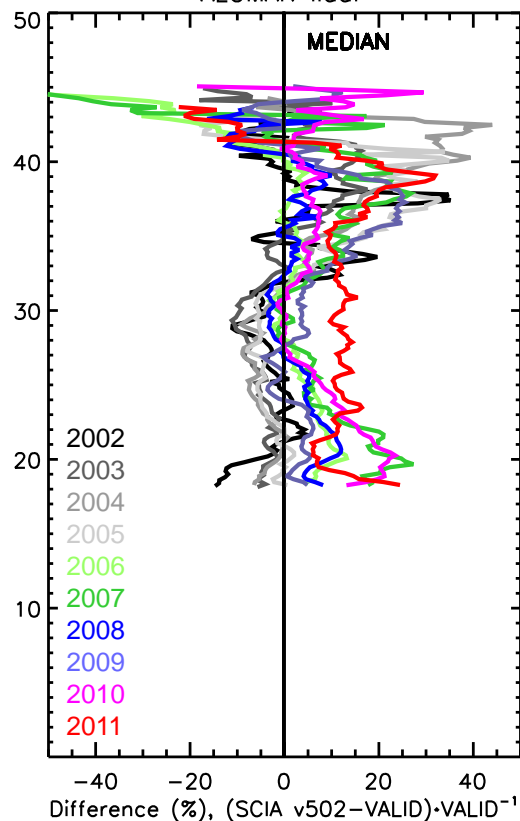


Without convolution



SCIAMACHY v5.02 versus lidar: ozone 2002-2011

ALOMAR lidar



HOHENPEISSENBERG lidar

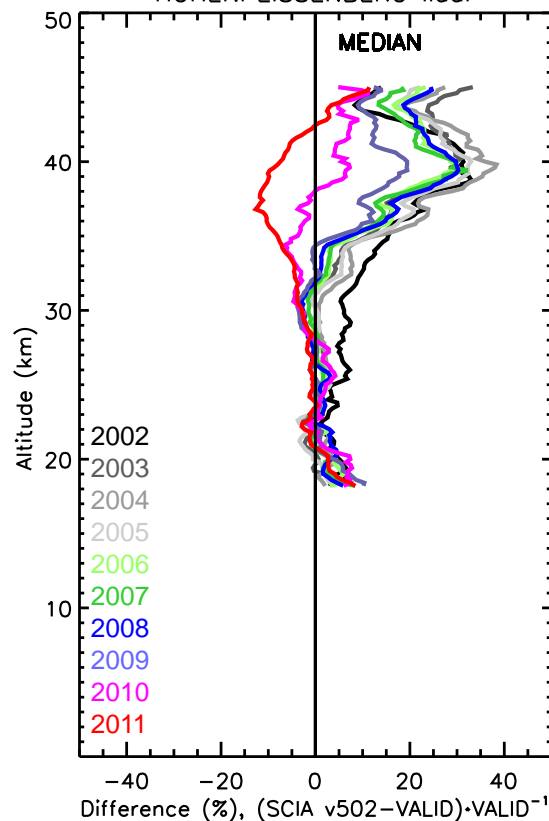
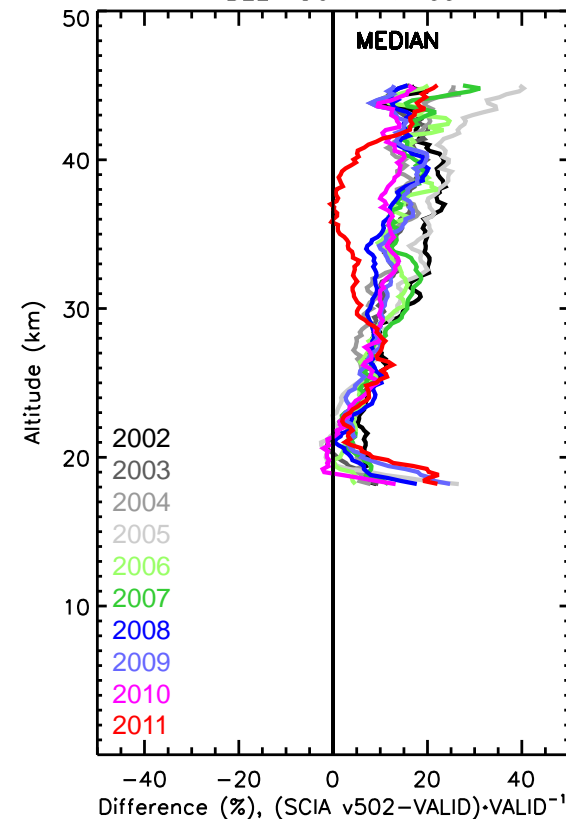


TABLE MOUNTAIN lidar



Without convolution



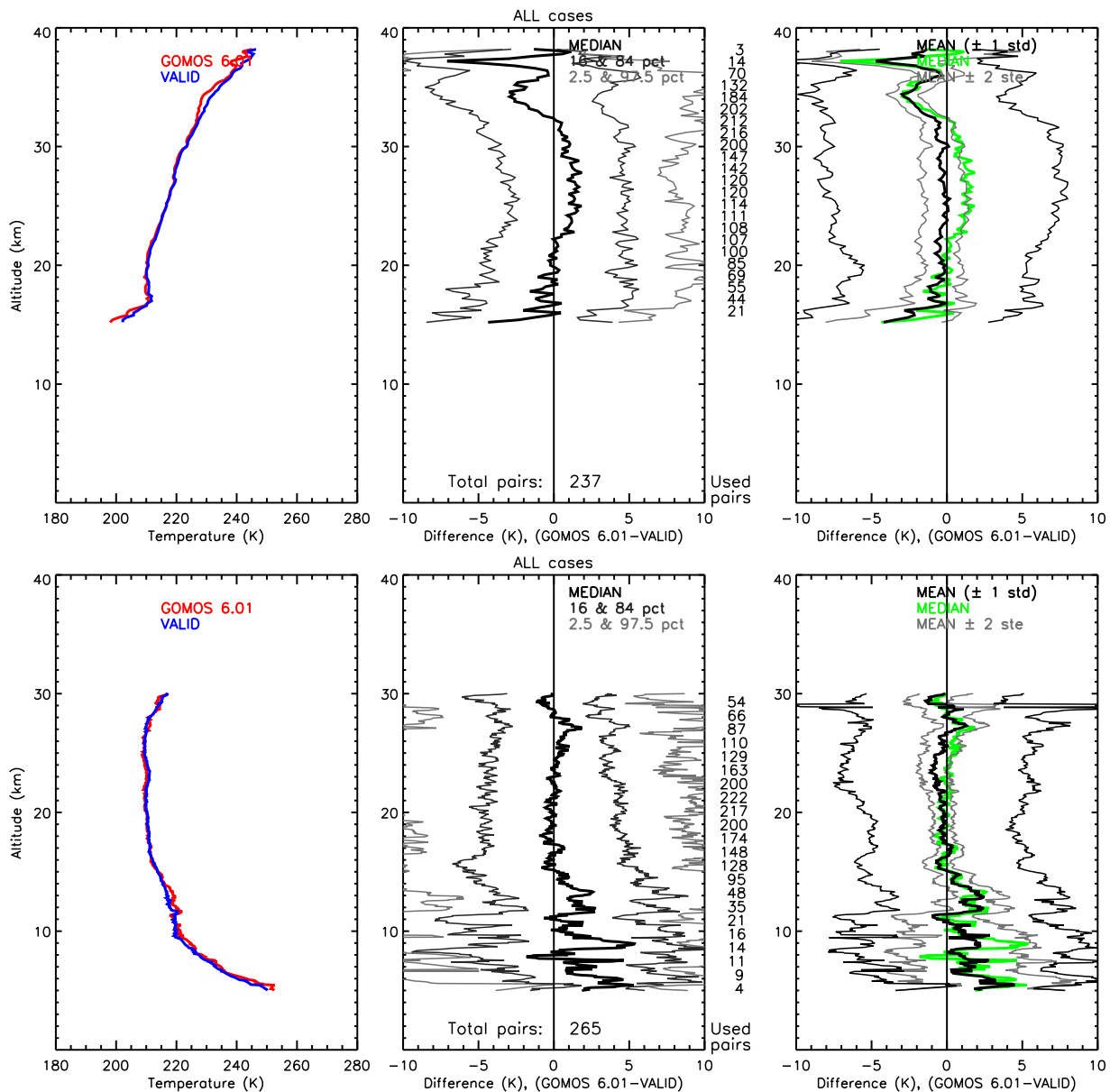
How do the “validation instruments” compare?

Overlap in altitude coverage between sonde and lidar, and between lidar and microwave radiometer

Other factors also play a role: site location, time of measurement, measurement frequency/distribution → observed differences do not always mean that the instruments would not agree

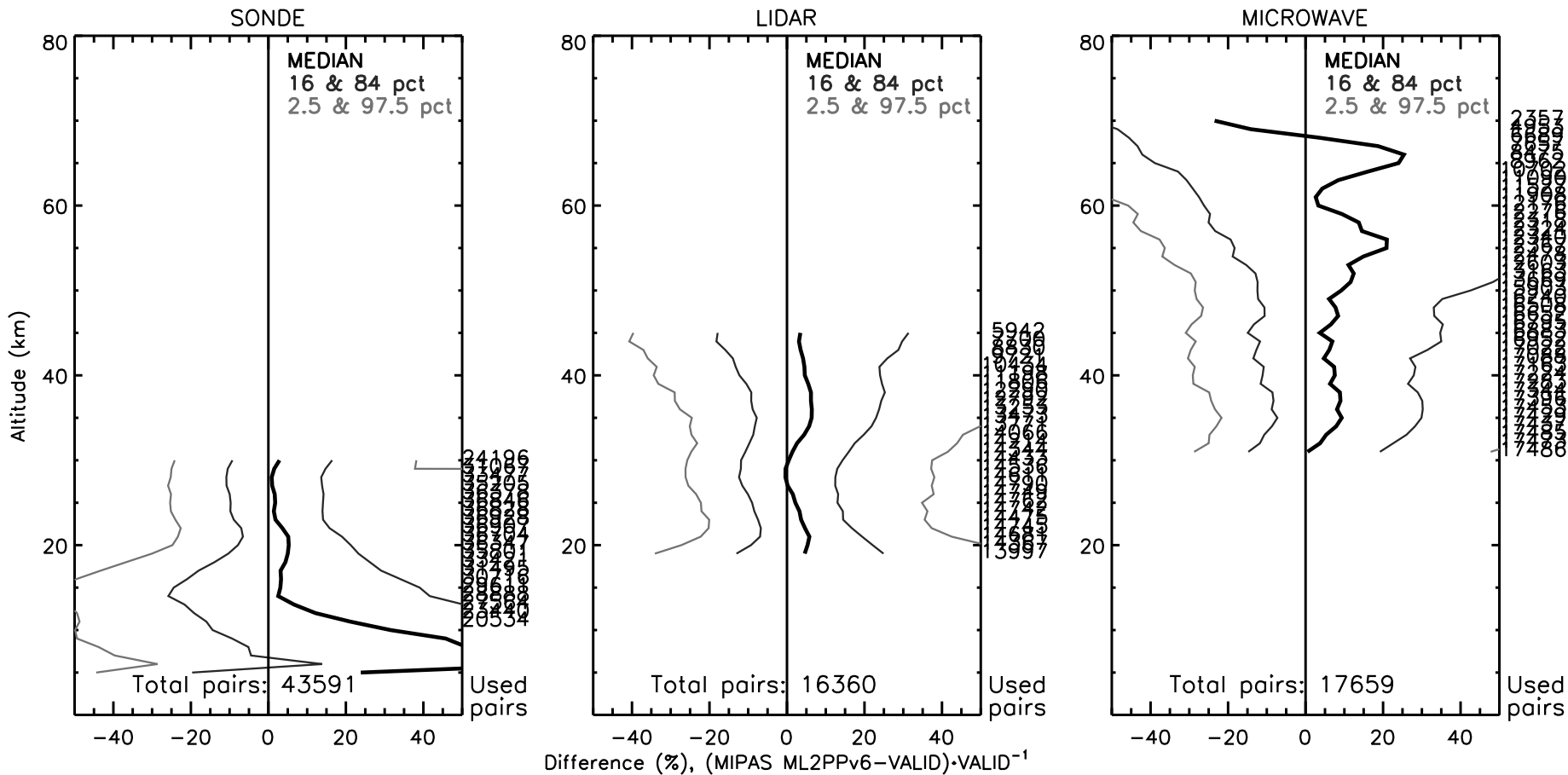


GOMOS HRTP v6.01 versus lidar and sonde





MIPAS ML2PP v6 ozone profiles



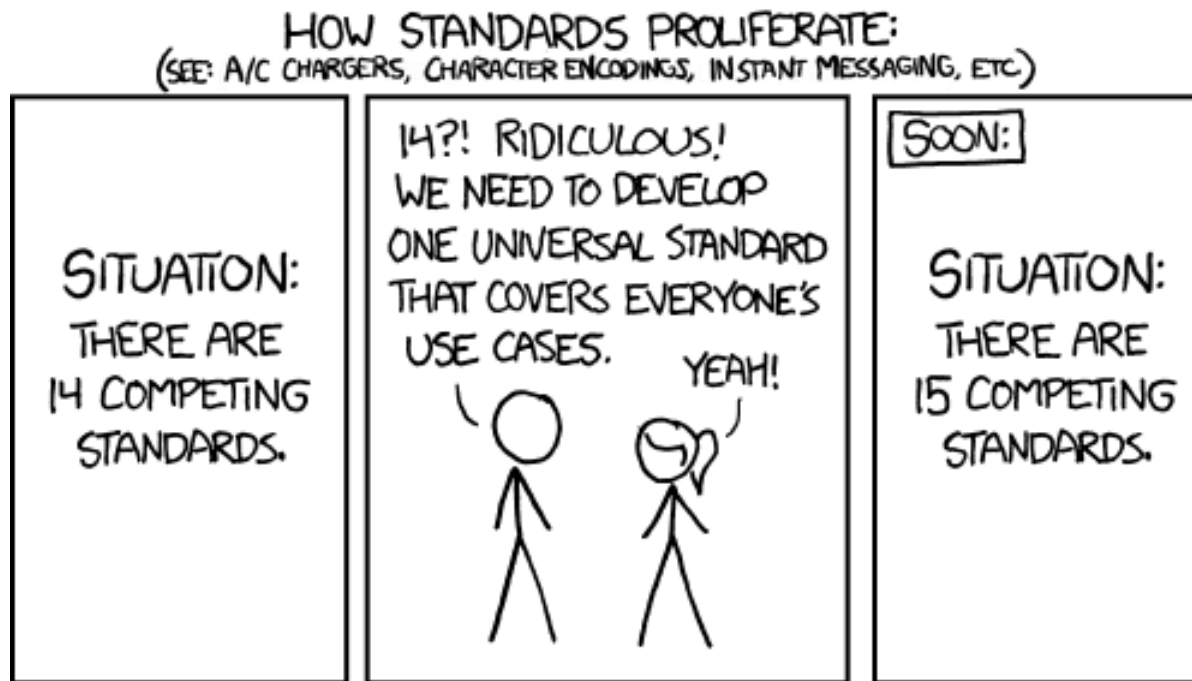


Wish list

Available, accurate and updated documentation

Communication across disciplines

Standardised approaches: use of common constants, assumptions, ancillary models/data, algorithms, definitions



Source: xkcd.com/927

Have an efficient meeting!