

Ground based measurements of total ozone

WG Report on cross sections

- BP cross sections are not any more recommended for total ozone measurements.
- They are not used in satellite retrievals (noise in residuals, restricted spectral range, temperature dependence).
- Results shown below for DBM and UIP cross sections are for -45°C
(* the UIP XS are interpolated to -45°C)

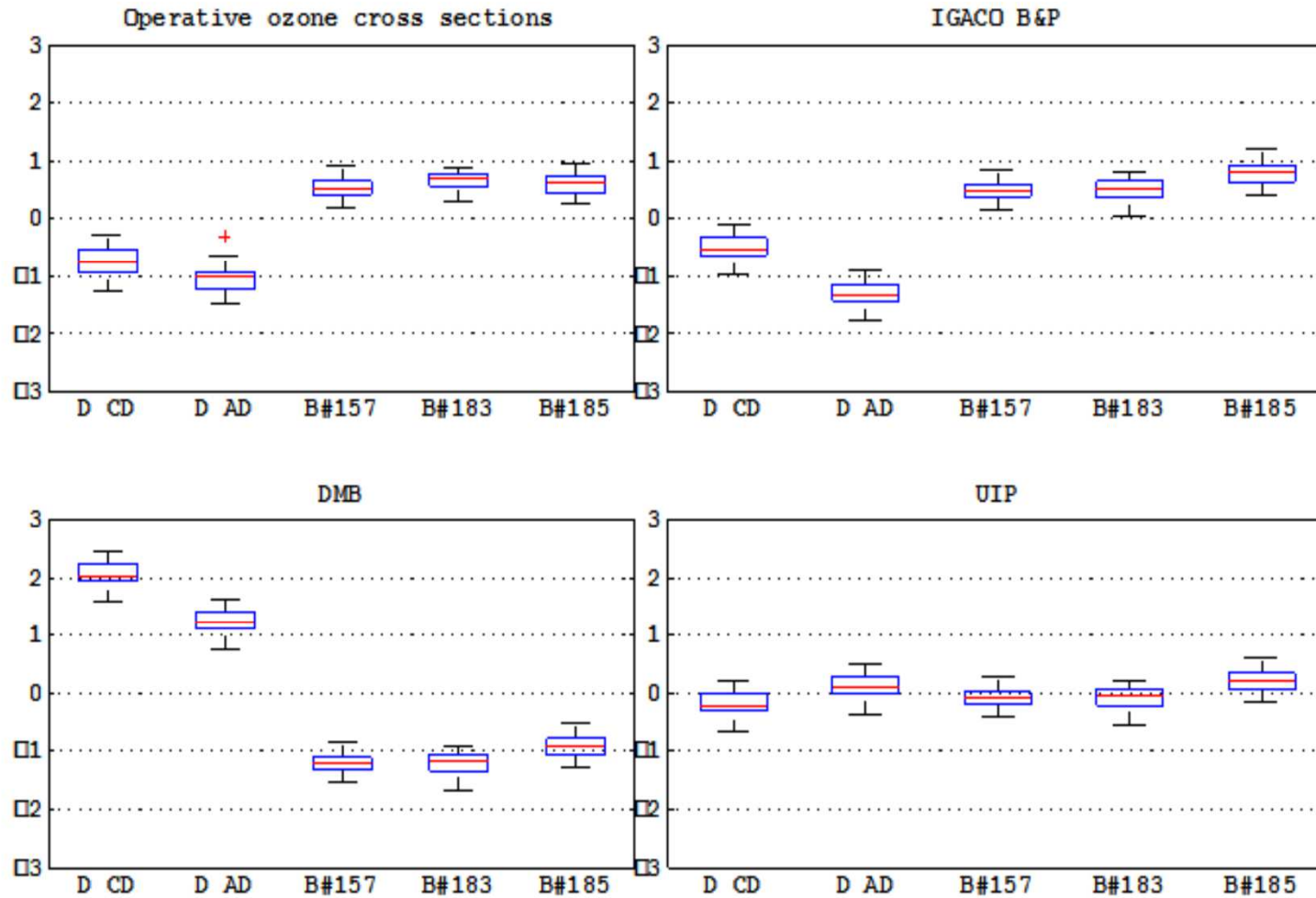
- **Dobson:**

- Ozone retrieval is almost independent of XS, with absolute differences of the order of 1% or less
- IUP XS improve the agreement between CD and AD pair ozone
- Probably it is not worth to reprocess the whole ozone database for such small changes, unless temperature dependent XS are taken into account.

- **Brewer:**

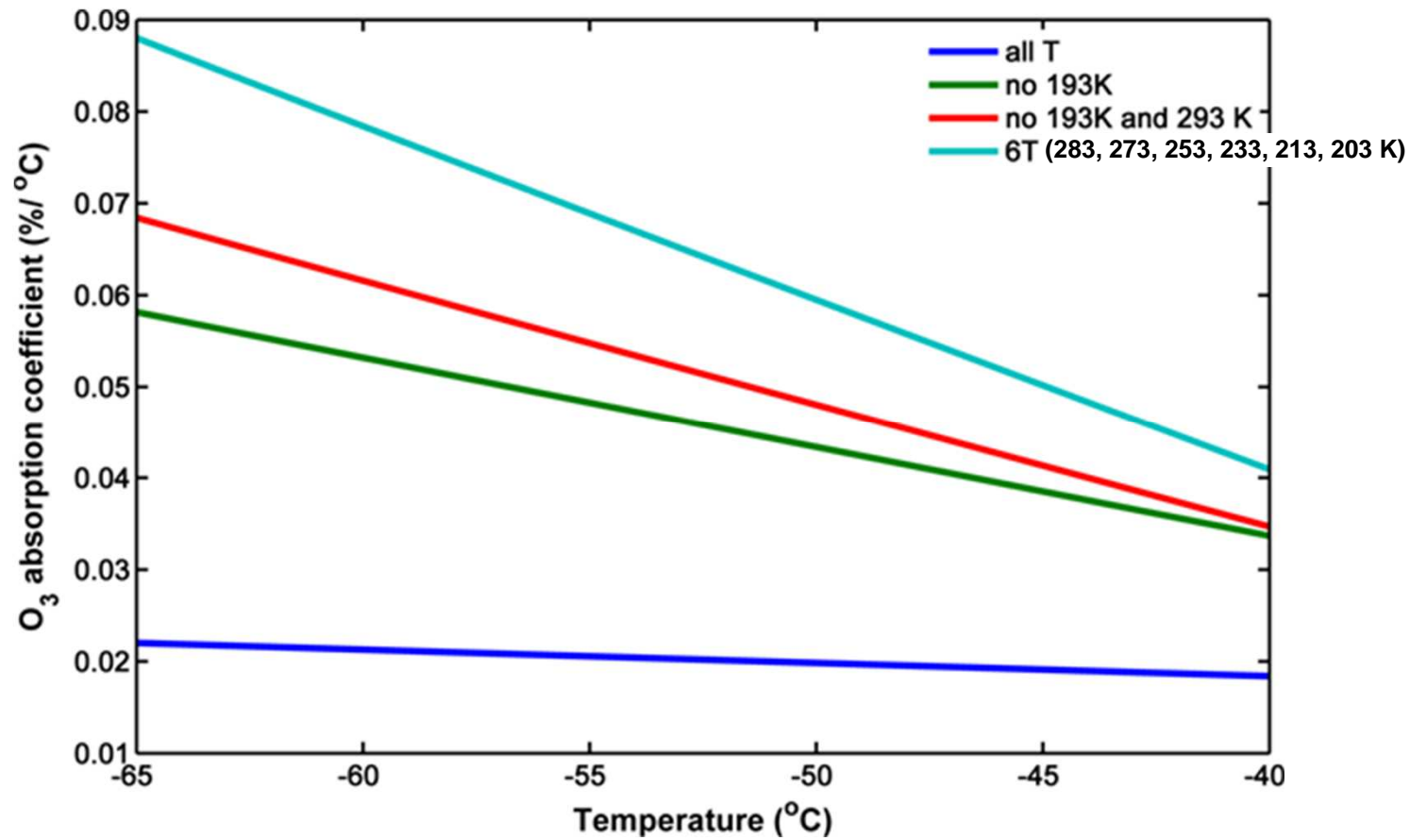
- DBM produces differences of up to 3%
- UIP has a small effect (~1%) on ozone and leads to smaller differences with the Dobson
- DBM and IUP reduce the seasonality between Dobson and Brewer

CEOS Izana Absolute Campaign (Spain), 20 Sep. - 20 Oct., 2012
 Ozone percentage difference using different ozone cross sections



- **Lidar:**
 - Same as for Dobson
- **Umkehr:**
 - Results are inconclusive mainly because the true ozone profile is unknown.
 - Measurements of profiles have uncertainties that are larger than those produced by the cross sections. The Umkehr algorithm uses T-dependent XS but the TOC does not.
- **Other instruments:**
- BDM produces an offset with ozonesondes and FTIR measurements.
- It is unknown how the SAOZ measurements behave with the XS
- **Action item:** Compare Brewer Dobson and SAOZ with the new cross sections.

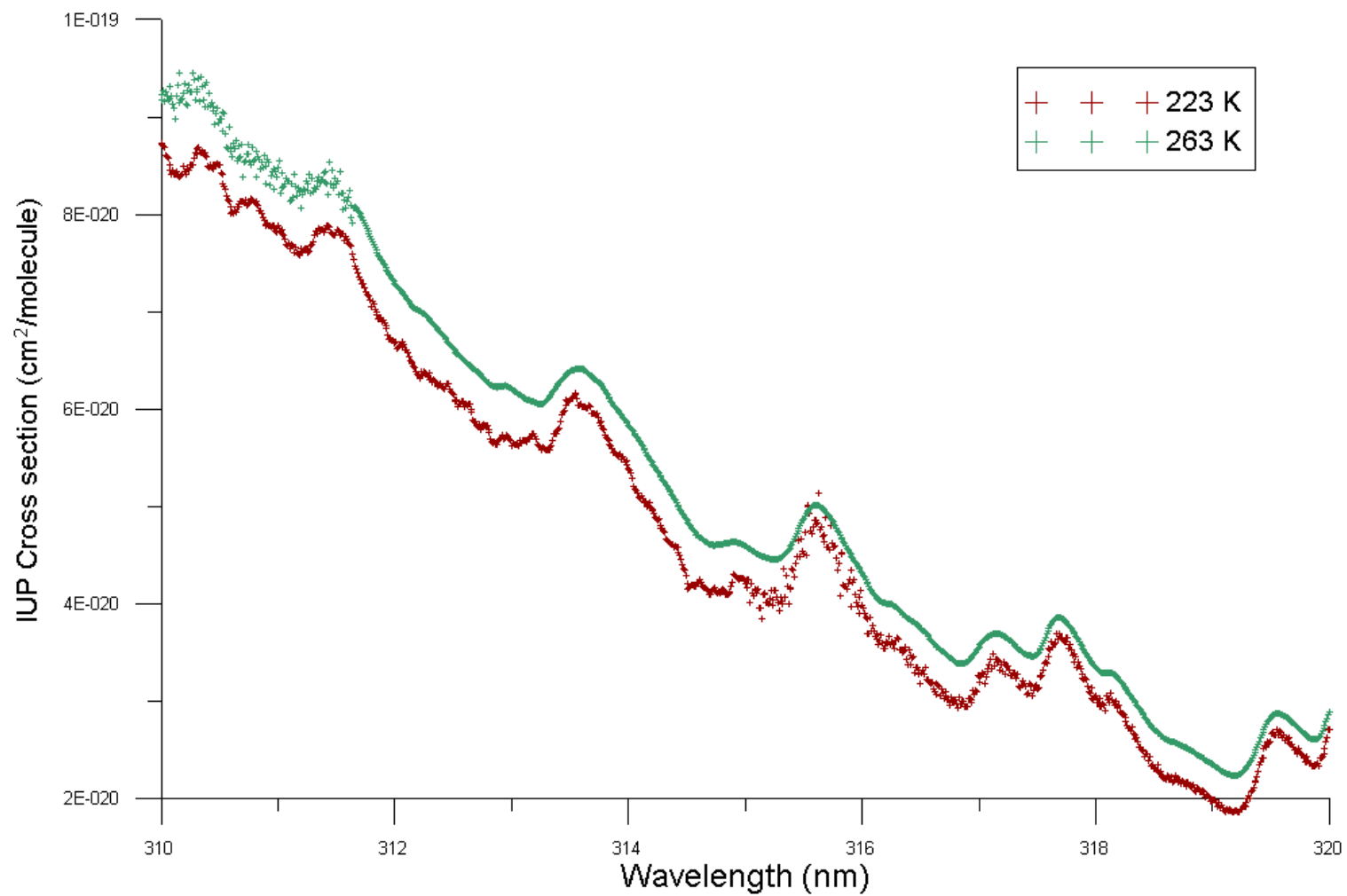
Temperature dependence of IUP

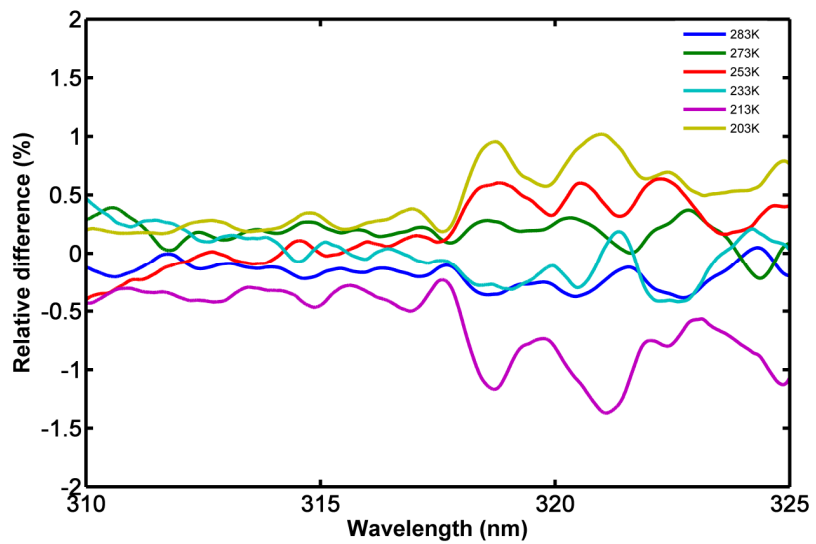
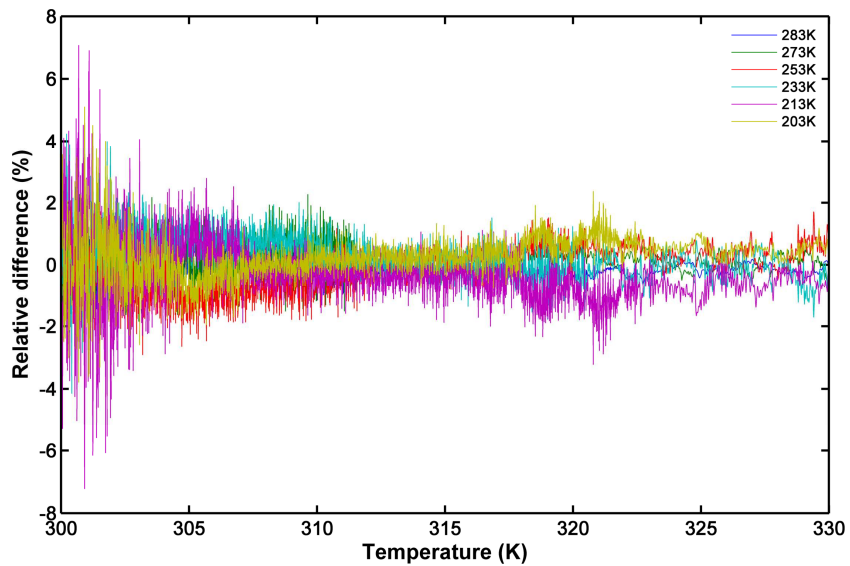
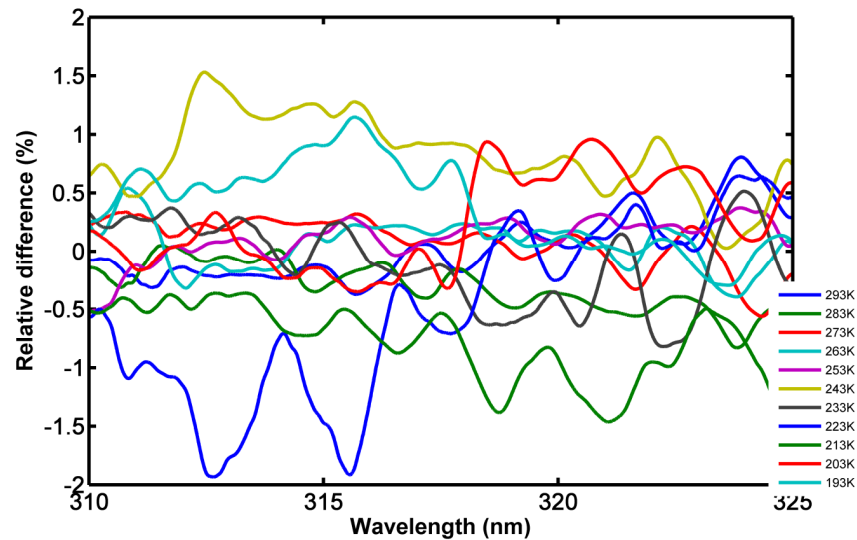
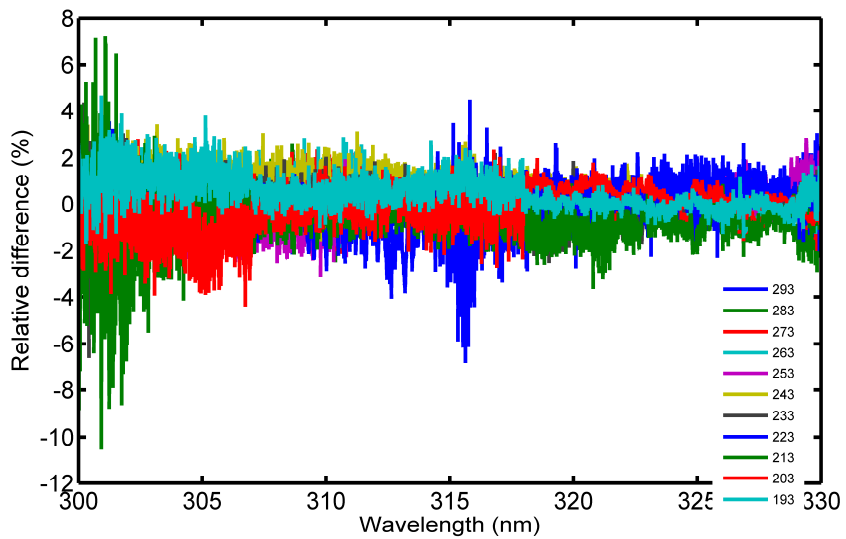


- **Temperature dependence of IUP cross sections:**
 - Quadratic approximations that are used to derive T-dependent XS spectra introduce uncertainties.
 - The Temperature dependence of the XS changes when different combinations of temperatures are used.
 - These quadratic approximations are used also as inputs in models (indirect effects through the use of modeling results in the retrievals).

Conclusion: The IUP XS at least in the spectral region used by the GB instruments must be **standardized**.

Spectral noise (temperature dependent)





- **Action item:** Look closer to the temperature dependence of IUP. The laboratory groups must provide a “clean” dataset at least for the spectral regions of interest (e.g. 300-330 nm).
- **Recommendations:**
 - T-dependence could be checked “on line” when measurements are done in the lab to resolve any discrepancies.
 - Provide XS data of lower resolution but less noisy.
- **Action Item:** An error budget should be produced for the ozone retrieval taking into account the uncertainties reported from the lab groups (spectroscopic data, parameterizations, etc.)
 - Similar studies have done in the past by: a) Basher for the Dobson (WMO report), and b) Cede for the Brewer(unpublished)
 - Possibility this action item to be accomplished in the framework of the COST action EUBREWNET

- **Effective temperature dependent IUP cross sections**
 - Implementation in Dobson will remove the seasonality.
 - Seems not very important for Brewers (with current quadratic fits)
- **Action item:** What kind of accuracy is needed for the calculation of the effective temperature?
 - Different sources of ozone and temperature profiles. Climatology, NCEP, ECMWF, radiosondes, etc.
- **Implications:** Difficulties in reprocessing the whole ozone database.
- In some cases other factors are more important in ozone retrievals than the choice of the XS. (e.g. large airmass factors at high latitudes in conjunctions with spatial variability of stratospheric ozone)

IUP is recommended because:

- Dobson absorption coefficients will remain the same
- Brewer absorption coefficient will change by a small amount and towards the proper direction to improve the comparison of with and Dobson
- Including T-dependent coefficients increases the accuracy of the ozone retrieval
- **Implementation will be decided by SAG Ozone**