Comparison of the Serdyuchenko and BDM cross-sections in the Huggins bands.

Impact on GODFIT total ozone retrievals

Christophe Lerot and Michel Van Roozendael

Belgian Institute for Space Aeronomy (BIRA-IASB)

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Outline

- The total ozone algorithm GODFIT
- Intercomparison of the cross-section data sets
- Impact on total ozone retrievals
- Summary

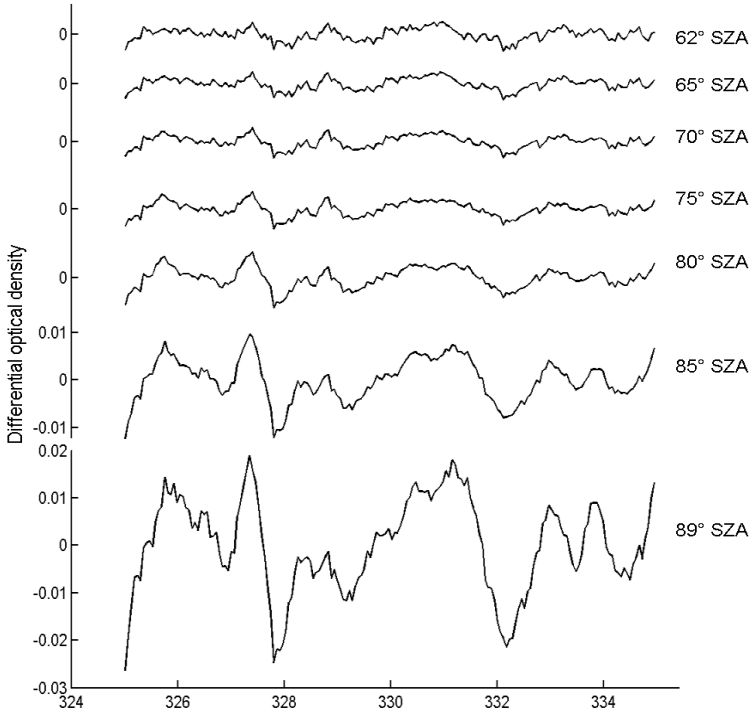
The total ozone algorithm GODFIT

- Total ozone retrievals from nadir hyperspectral instruments in the **Huggins bands (325-335 nm)**.

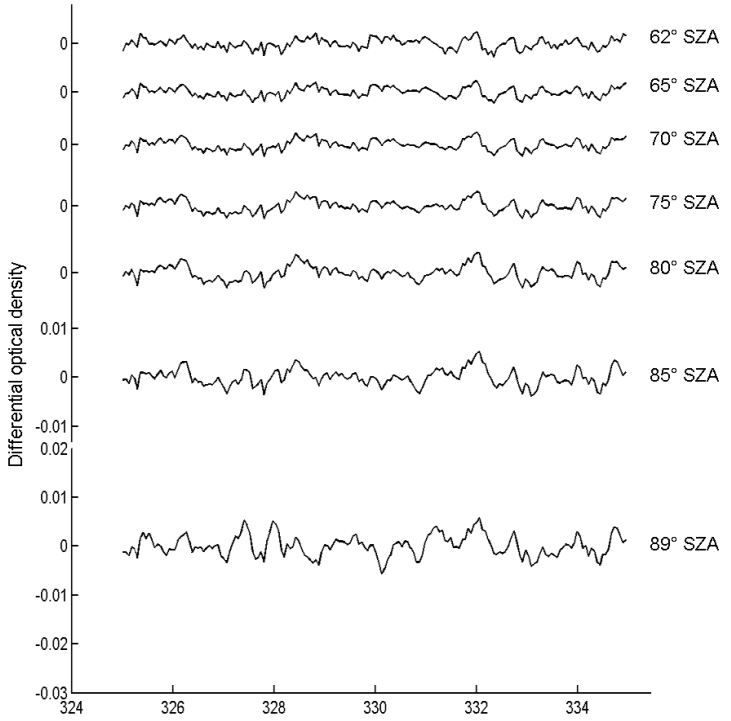
Focus only on this fitting window !

- **Direct fitting** approach – closer to the physics than DOAS; leads to smaller SZA and seasonal dependences.

DOAS residuals



Direct-fitting residuals



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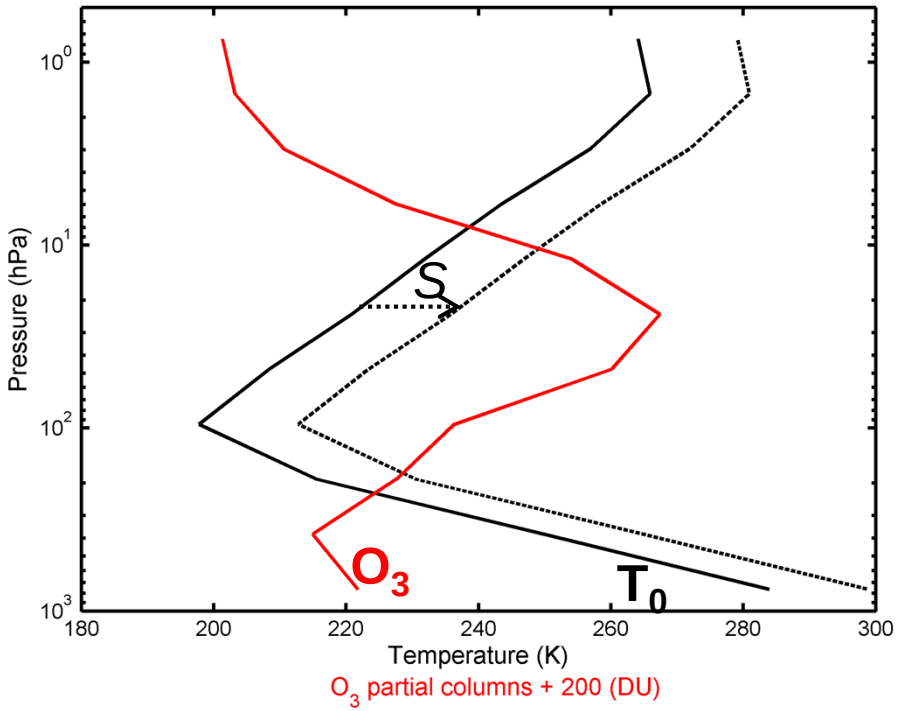
The total ozone algorithm GODFIT

- A-priori O_3 profile: **TOMSv8** (stratosphere) + **OMI/MLS** (troposphere).
- **Improved Ring correction**
- Observed scene treated as **an effective scene**. An effective **albedo** is **fitted** simultaneously to the ozone column.
- A-priori **T°-profile shifted** in the retrieval. This adjustment is driven by the temperature dependence of the measured ozone absorption structures. An estimate of the effective temperature T^{eff} is computed a posteriori.

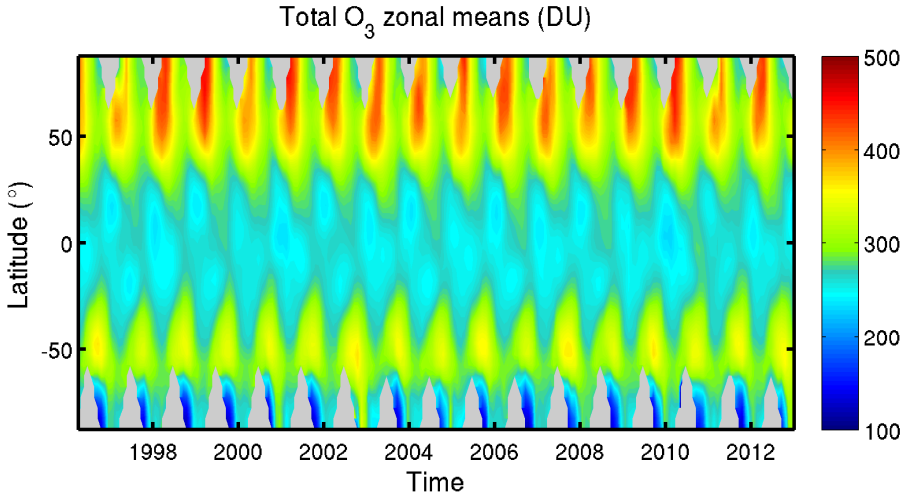


$$T^{\text{eff}} = \frac{\sum_n (T(n) + S) \times O_3(n)}{\sum_n O_3(n)}$$

Level-2 total Ozone data sets in O_3-CCI

Reprocessed data sets with GODFIT

GOME/ERS-2	Mar 96 – Jun 11
SCIAMACHY/Envisat	Aug 02 – Mar 12
GOME-2/Metop-A	Jan 07 – Dec 12



Output available for each sensor on the CCI ftp site:

- Orbit files: one NetCDF file per orbit
- Overpass files: One ASCII file per station (overpass radius: 150 km – 322 stations)
- Gridded data: one ASCII file per day
- Zonal means: one ASCII file providing daily 5°-latitude band means.

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O_3 cross-sections

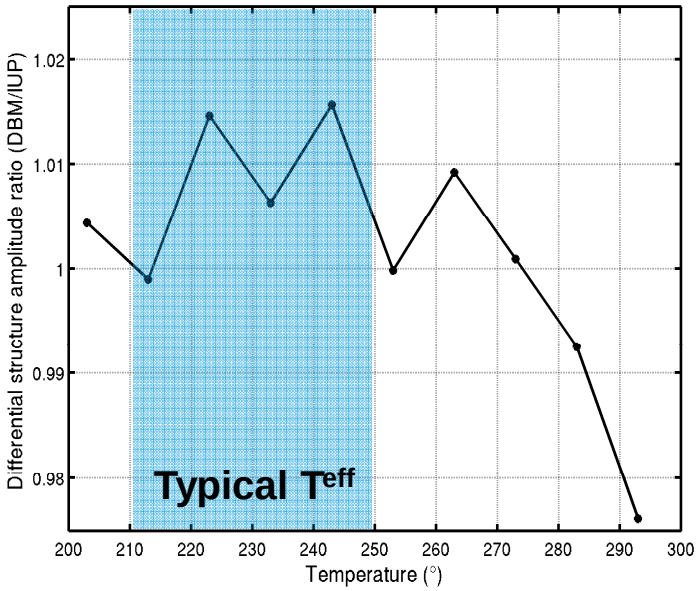
- **Current baseline**: Brion, Daumont and Malicet.
- This data set has been previously compared to Bass-Paur, GOME FM and Bogumil.
- BDM has been selected as it has:
  - Good signal-to-noise ratio
  - Accurate wavelength registration
  - Reliable temperature dependence (with 273K excluded).

➔ Only Serdyuchenko (IUP) and BDM (with parameterization of the T°-dependence) data are intercompared.

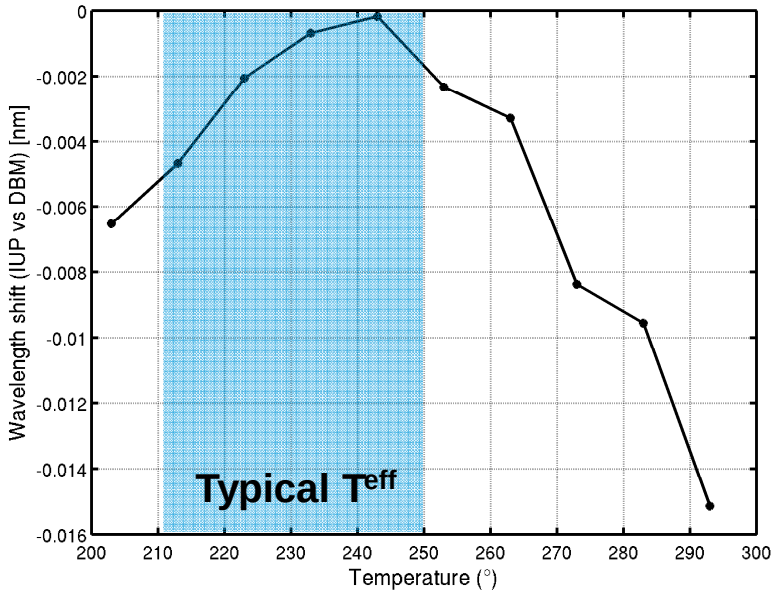
Cross-section intercomparison

- Differential structures are intercompared at 10 temperatures between 203 and 293 K.
- One scale factor and one wavelength shift representative of the 325-335 nm interval are derived at each temperature.

Scale factor



Shift



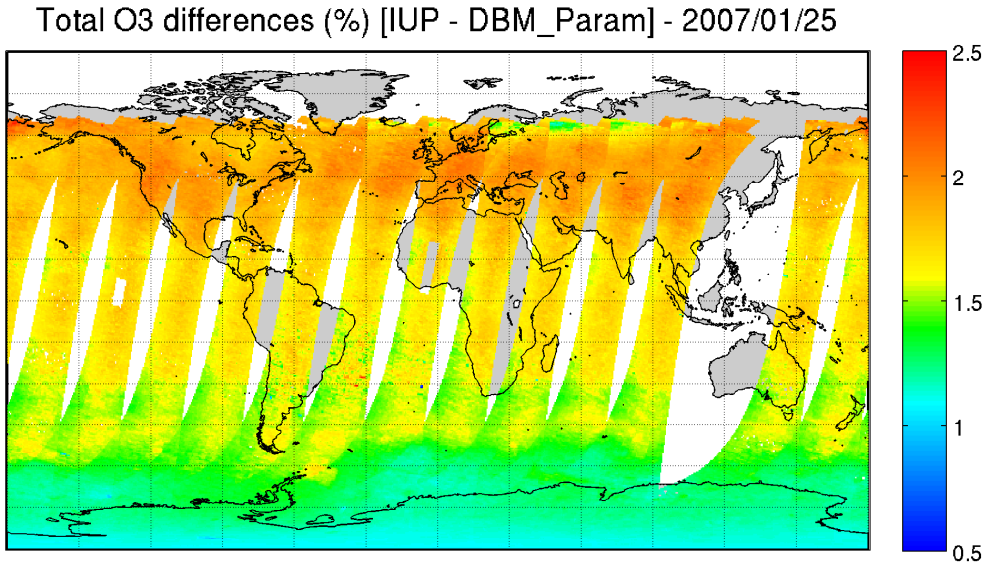
- The amplitude of the IUP differential structures:
  - is ~1% smaller than BDM between 220 and 240 K.
  - agrees at lower temperatures with BDM.
  - is larger at high temperatures (not relevant for O_3 retrievals)

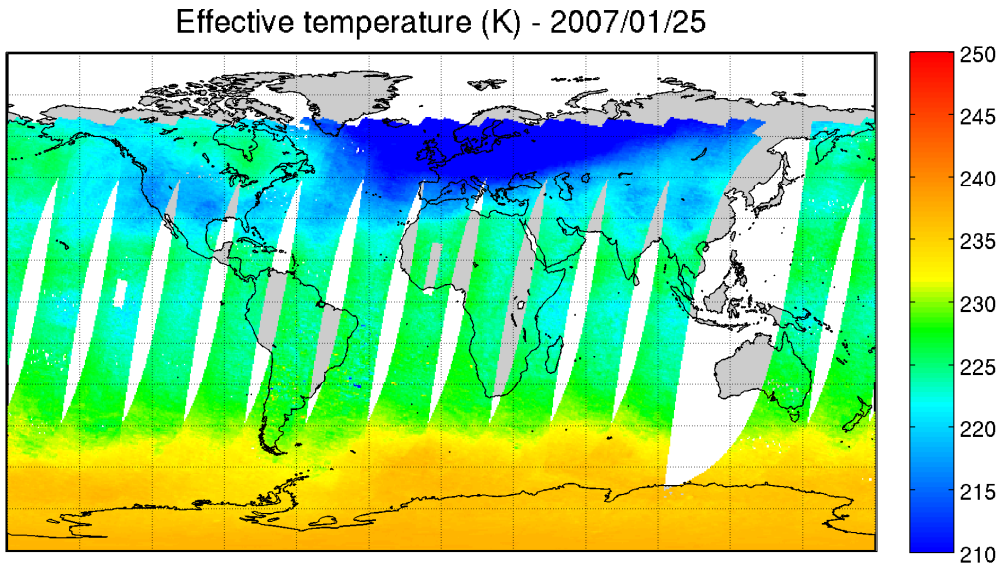
→ **Columns retrieved with IUP expected larger than with BDM**

- Consistent wavelength registrations, except at high temperatures (not relevant for O_3 retrievals).

Impact on total ozone retrievals

One day of GOME-2 data

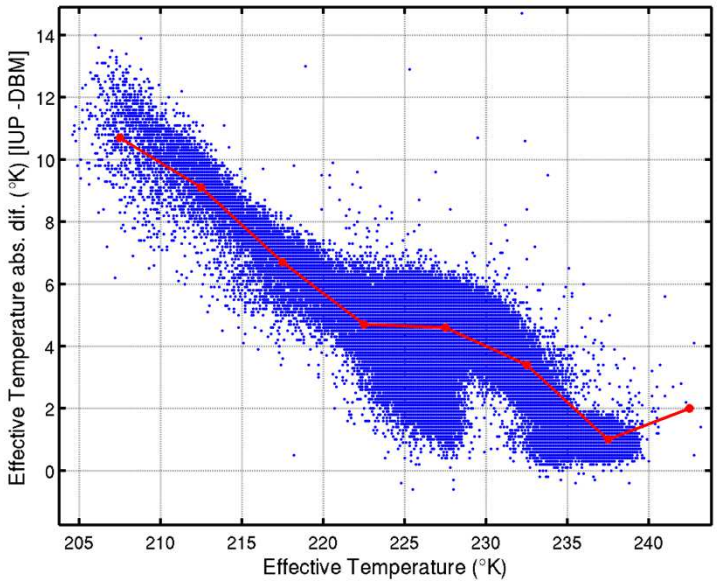




- The retrieved O_3 columns with IUP are **1 to 2.5 %** larger.
- Smaller differences at the largest temperatures. Seems in contradiction with the previous results.
- What about the temperature dependence of the two data sets?

Impact on total ozone retrievals

One day of GOME-2 data

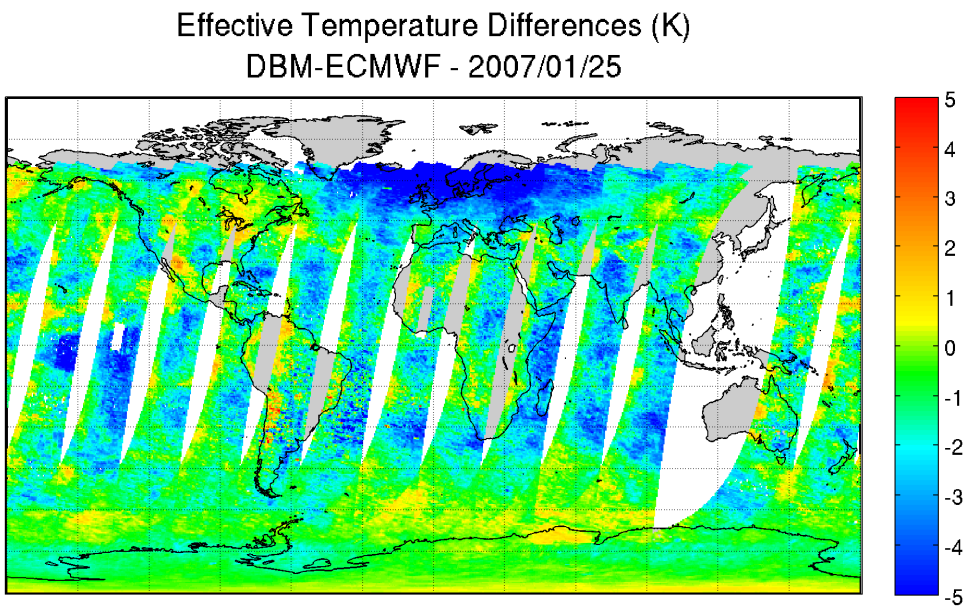


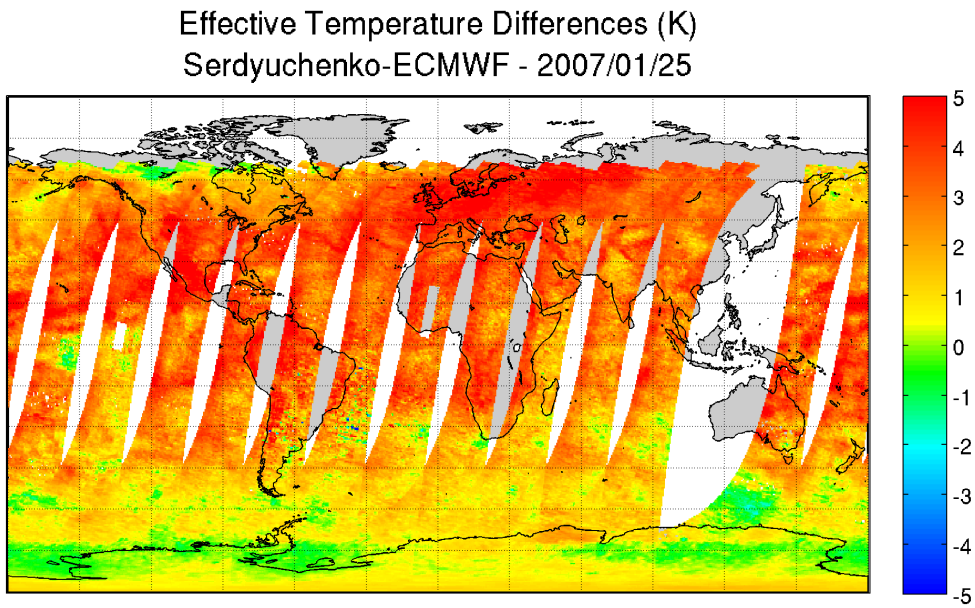
- The effective temperatures derived with the 2 data sets agree well at the largest temperatures but strongly differ at low temperatures.
- Such differences leads to significant O_3 differences ($\Delta T=10K \rightarrow \Delta O_3 = \sim 3\%$).
- Which data set has the best temperature dependence?

Impact on total ozone retrievals

One day of GOME-2 data

Comparison with ECMWF effective temperatures

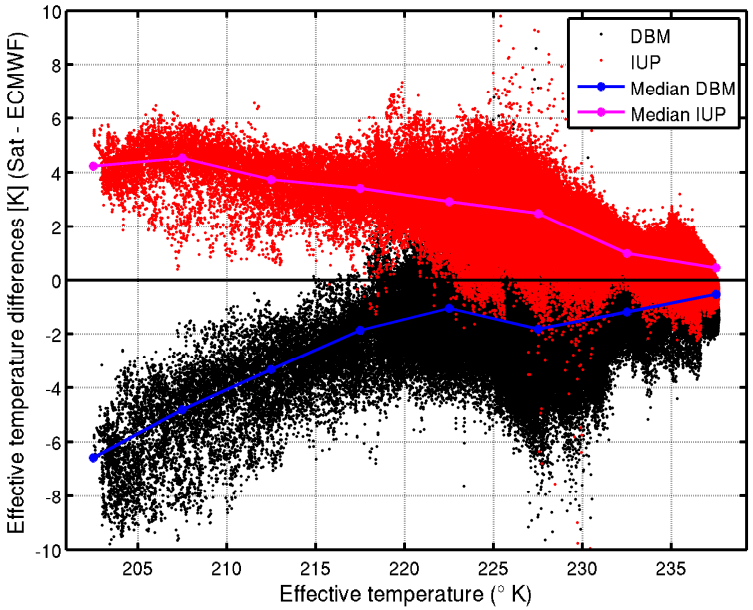




Impact on total ozone retrievals

One day of GOME-2 data

Comparison with ECMWF effective temperatures

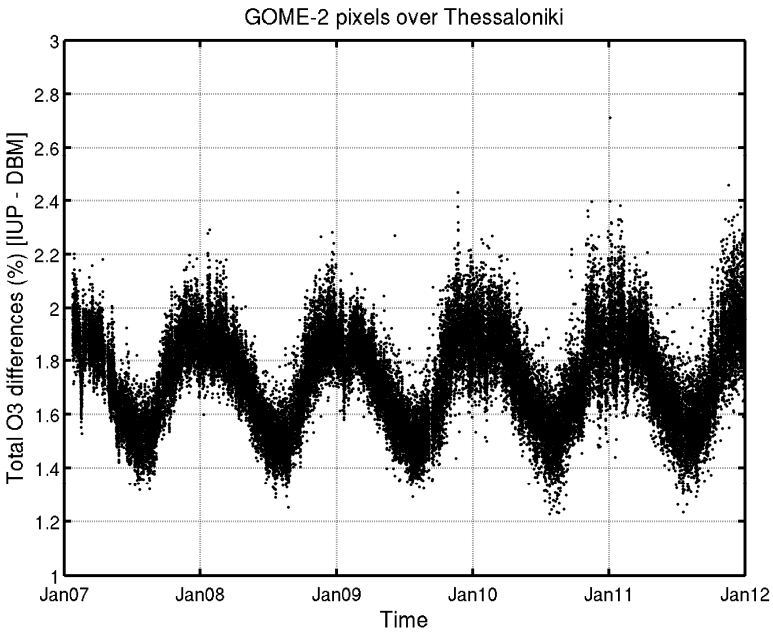


- General good consistency above 230°K.
- At low temperatures, none of the data sets is in good agreement with ECMWF. IUP T° are too large while BDM T° are too low.

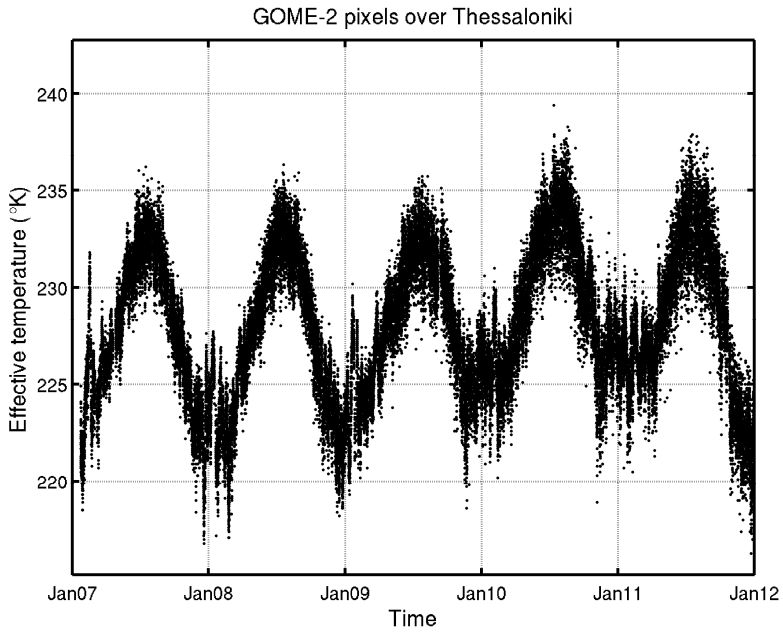
Impact on total ozone retrievals

GOME-2 time series over Thessaloniki

O_3 differences time series



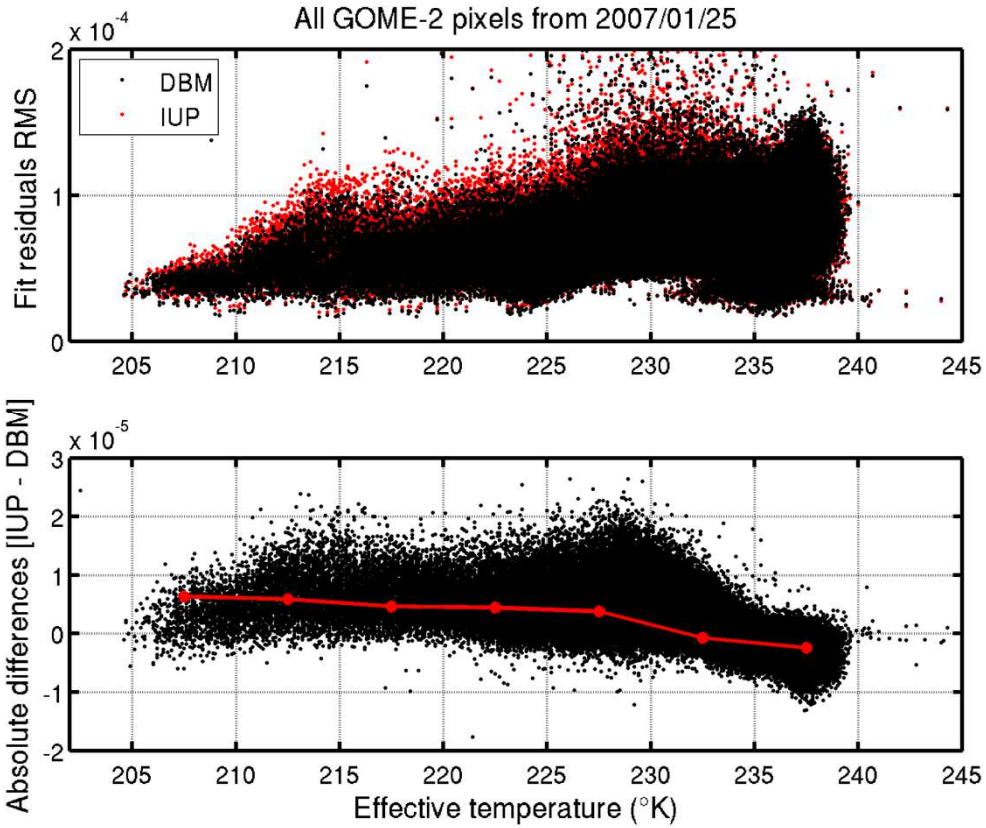
Effective temperature time series



- Previous results confirmed, i.e.:
  - O_3 columns retrieved with Serdyuchenko data 1.5-2% larger than with BDM.
  - Larger differences at lower T° and vice versa.

Impact on total ozone retrievals

Total O_3 fit quality



- Fit of high quality for both data sets.
- Small absolute differences.
- Fits slightly better with IUP above 230°K and with BDM at lower temperatures.

Summary

- BDM is the current baseline for GODFIT total O_3 retrievals in the window 325-335 nm.
- A potential switch to Serdyuchenko (IUP) would lead to columns 1 to 2.5% larger, depending on the effective temperature.
- These are explained by (1) differences in the amplitude of the differential structures of the cross-sections and (2) by different temperature dependences.
- Effective T° in good agreement with ECMWF above 230°K. At lower T°, The IUP T° overestimate ECMWF while BDM T° are too low.
- The fit quality is similar for both data sets.
- ***Difficult to select one "best" data set.***