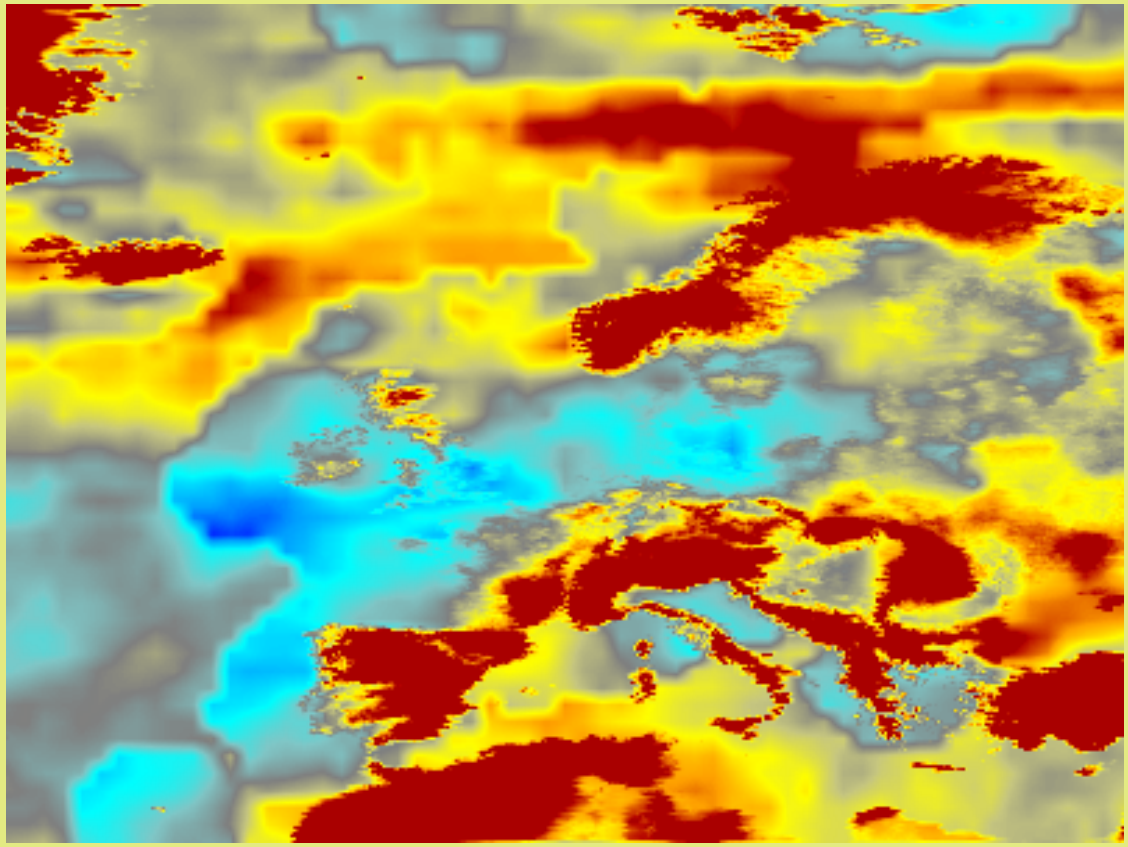

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Reconstruction of effective UV: comparing various input sources and weighted UV from seven wavelength bands

H. Slaper, P.N. den Outer, A. van Dijk

Content

- Selection of wavelength bands for reconstruction of effective UV
- Comparing UV reconstruction in relation to input data
- UV-maps ..
- Conclusions

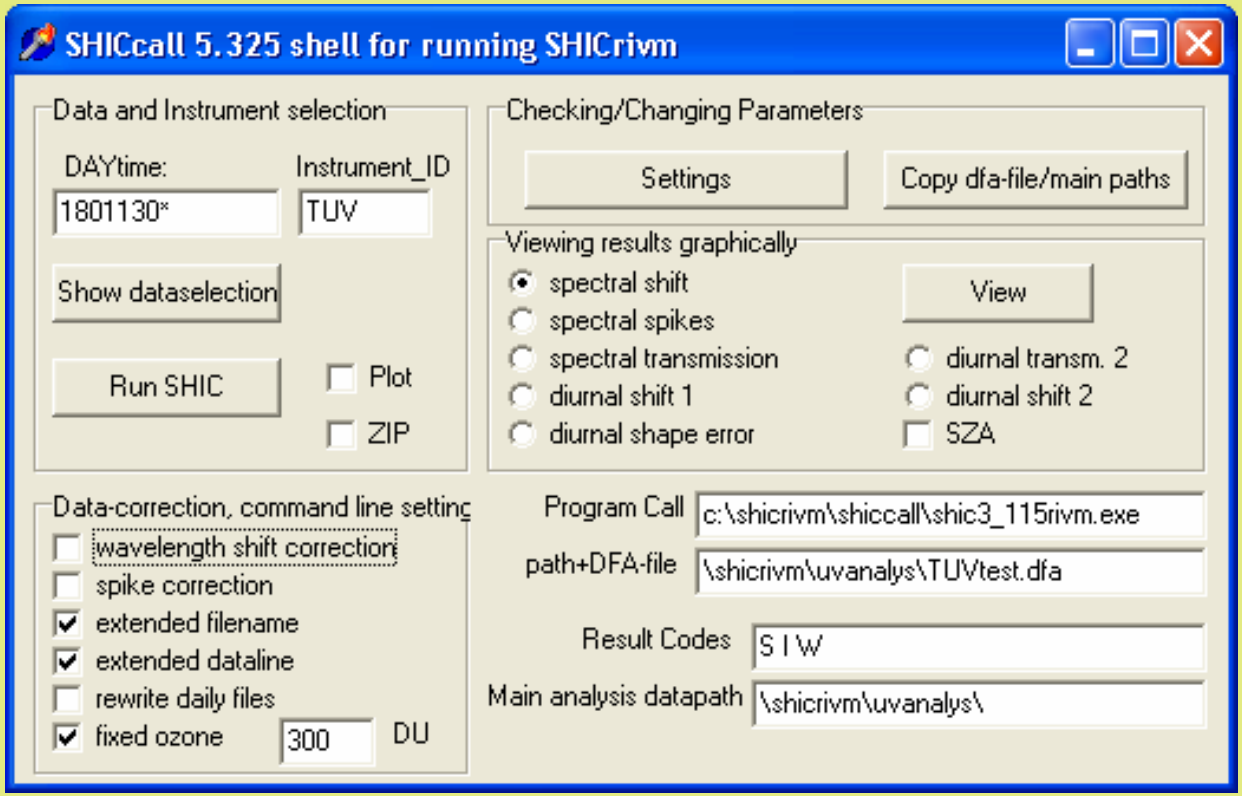
Reconstruction of effective UV (and full UV spectrum) from 7 bands

- Selection of wavelength bands (wavelength and width)
- Construct example cases with high and low sun and for various ozone values; check influence of high albedo)
  - Thessaloniki; summer day 185 (ozone 200, 330 and 500 DU)
  - Bilthoven: winter day 355 (ozone 200, 330 and 500 DU)
- Construction of examples (Jean Verdebout); single spectra and daily summed spectra, using a variety of interpolation schemes
- Run (single) and daily spectra through SHIC-algorithm to construct full spectrum and effective UV

Example of seven bands spectrum (daily sum for Bilthoven case (day 355))

- ! Values at the 7 selected wavelengths,
- ! 5 nm triangular slit function,
- ! using apm_0_5nm at 0.5 nm solar flux
- ! spectrum interpolated in a denser LUT.
- ! integrated irradiance in J/(m2.nm)
- 295.00 7.63167e-03
- 300.00 2.78748e-01
- 305.00 5.11022e+00
- 310.00 4.46709e+01
- 315.00 1.80616e+02
- 330.00 1.20397e+03
- 360.00 1.55600e+03

From seven bands to spectra and effective UV using SHICrivm



No wavelength shift or spike corrections possible

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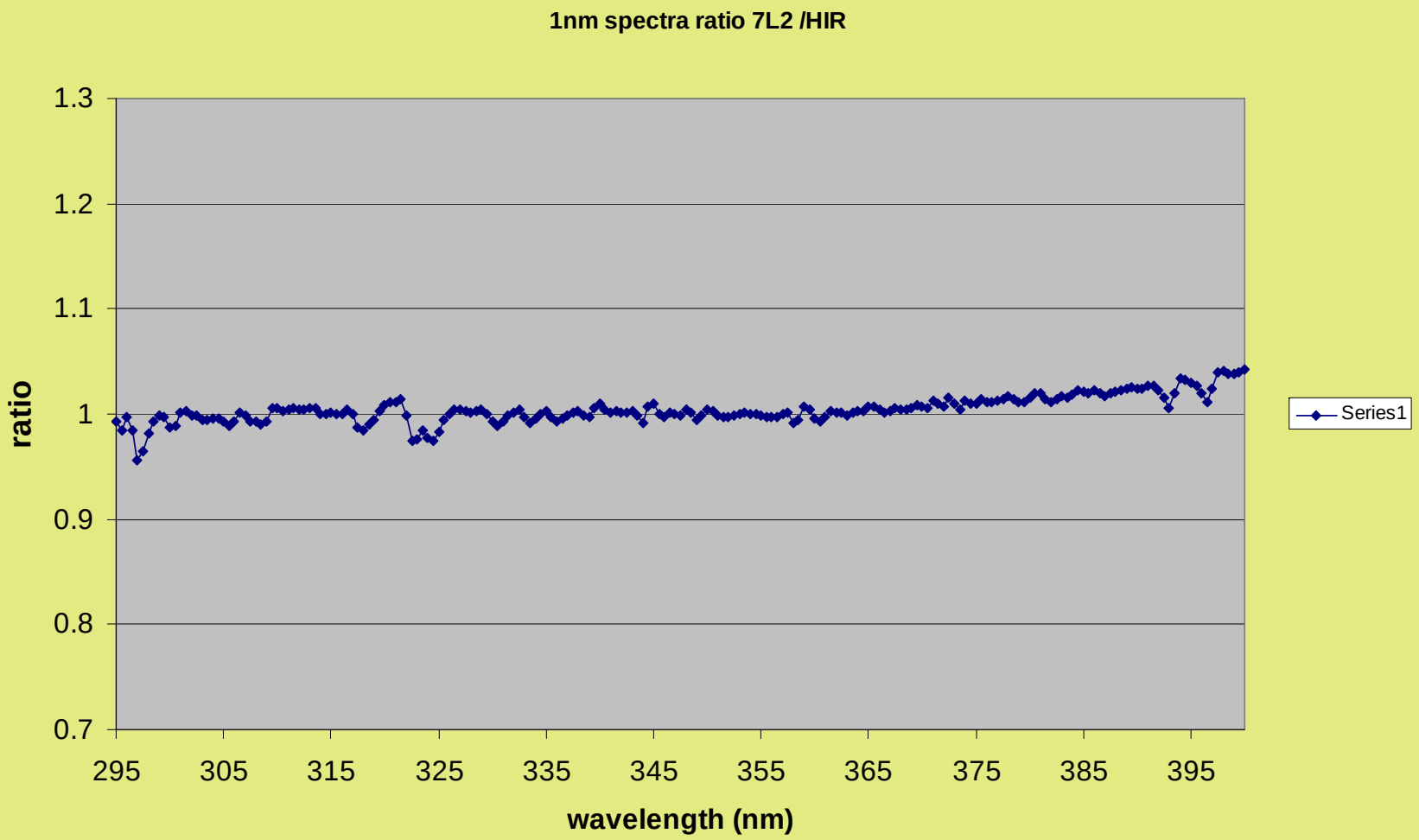
Example of reconstructed spectrum (0.5 nm step, 1 nm FWHM) from seven bands (ratio versus high resolution) Thessaloniki case SZA17.6



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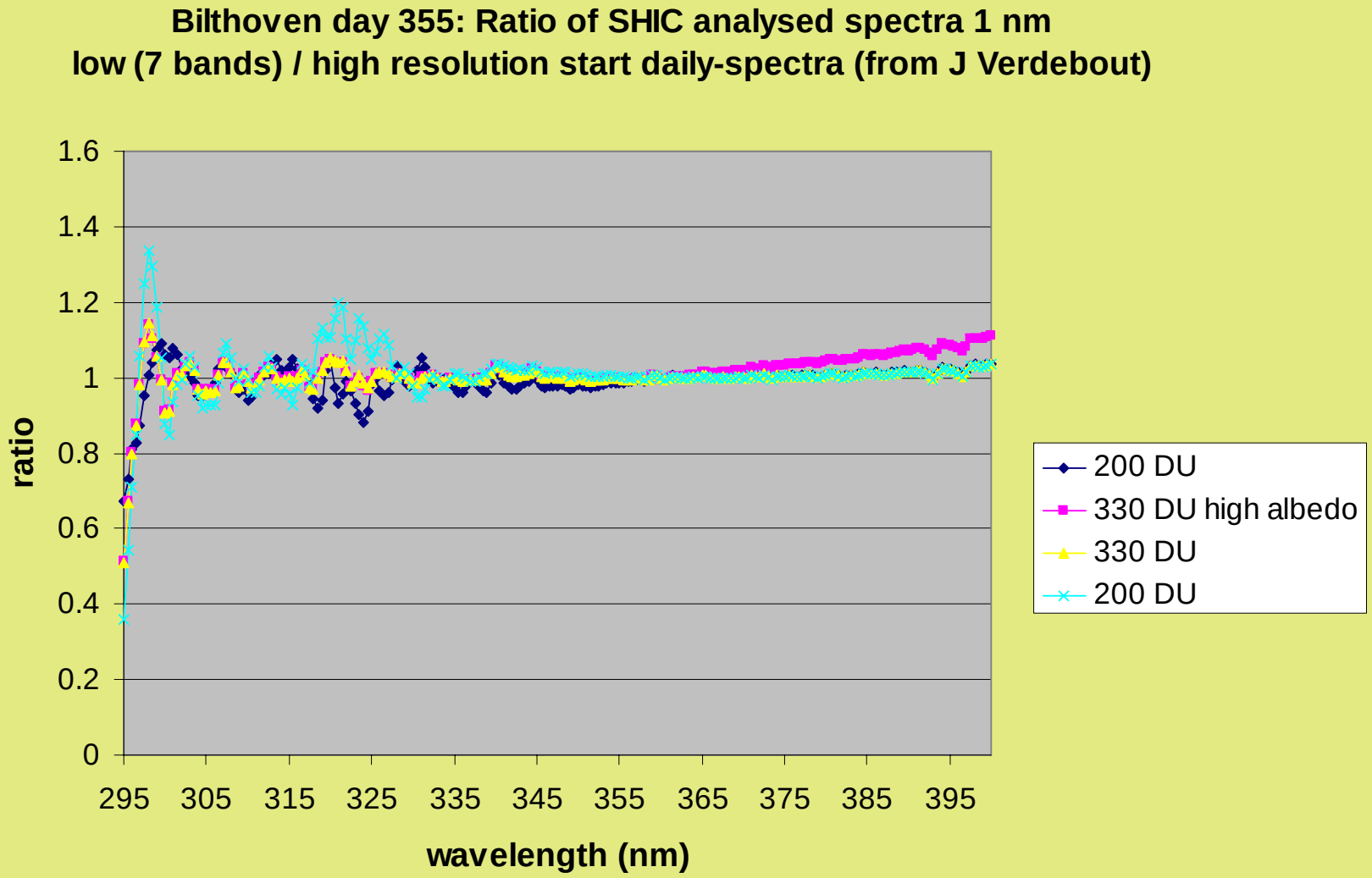
Reconstruction of daily integrated spectra from 7 wavelength bands using SHIC



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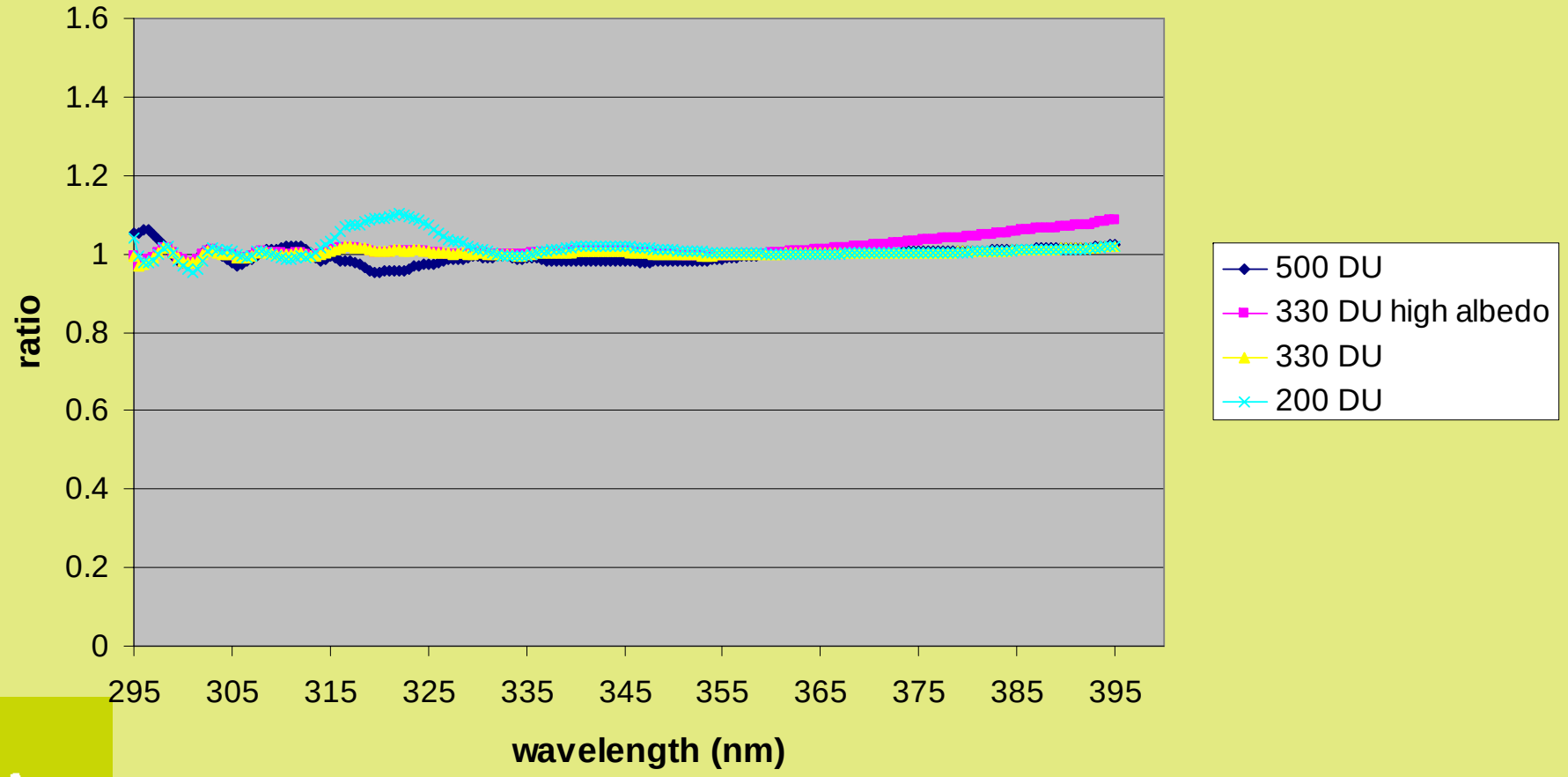
Reconstruction of daily integrated spectra from 7 wavelength bands using SHIC

Bilthoven day 355: Ratio of SHIC analysed spectra 10 nm summ low (7 bands) / high resolution start daily-spectra (from J Verdebout)



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Comparing 7 bands analysis with high resolution spectrum: Bilthoven day 355 (LOW sun case sza >75) CIE-erythemally weighted

J/m2	200 DU	330 DU	330 DU HA	500 DU
BIL_7h1	222.6	136.6	193.2	98.33
BIL_7h2	210.9	130.1	183.8	94.65
BIL_7he	207.2	128	180.9	93.41
BIL_7l1	222.3	136.6	193.1	98.26
BIL_7l2	210.7	130	183.7	95.58
BIL_7le	207	128	180.8	93.35
BIL_hir	203.4	127.56	179.6	94.53
7L2/HIR	1.0358899	1.0191283	1.0228285	1.0111076
7HE/HIR	1.0186824	1.0034494	1.0072383	0.9881519

Comparing 7 bands analysis with high resolution spectrum: Thessaloniki day 185 (HIGH sun case; daily integrals); CIE-erythemally weighted

J/m2	200 DU	330 DU	500 DU
THE_7h1	9692	5328	3280
THE_7h2	9669	5300	3279
THE_7he	9661	5296	3277
THE_7l1	9674	5318	3275
THE_7l2	9652	5290	3274
THE_7le	9644	5286	3272
THE_hir	9665	5302	3294
7L2/HIR	0.9986549	0.9977367	0.9939284
7HE/HIR	0.9995861	0.9988684	0.9948391

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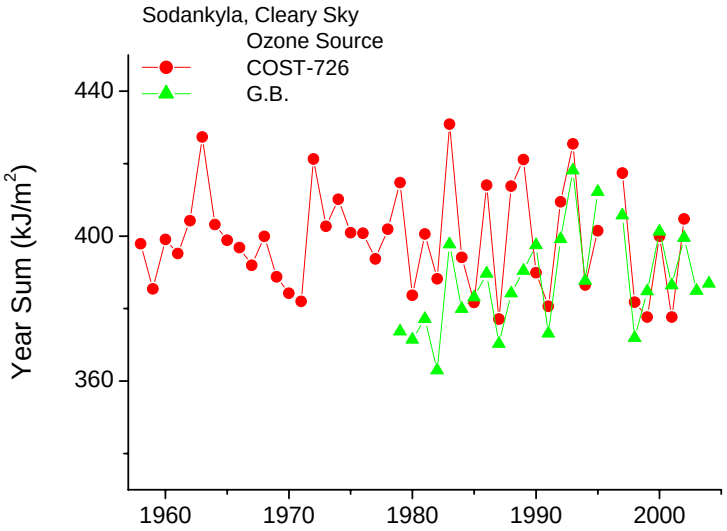
Conclusion on the use of 7 bands to reconstruct effective UV

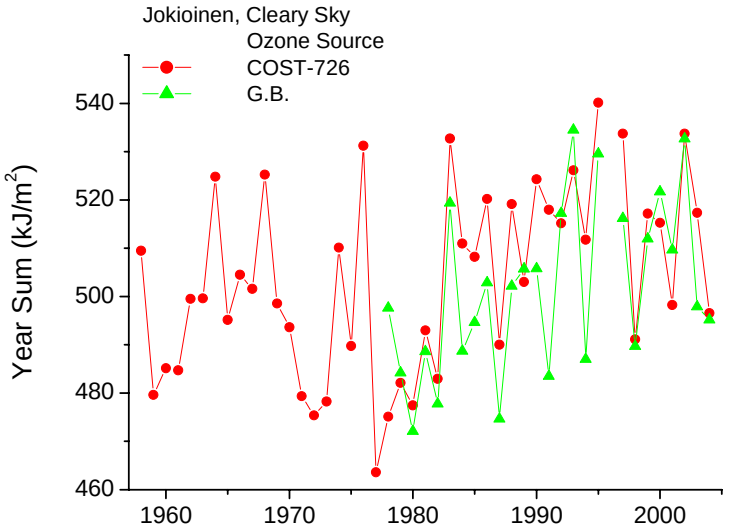
- Seven band spectra at: 295 nm, 300 nm, 305 nm, 310 nm, 315 nm, 330 nm, 360 nm with 5 nm FWHM bands, can be used to reconstruct daily effective UV using the SHIC algorithm
- accuracy usually < 1%
  - winter case 0.3 - 1.9 %
  - summer case 0.05 - 0.52 %
- uncertainty due to interpolation methods somewhat larger; for selected method of interpolation (7L2):
  - winter case: 1.1 - 3.6 %
  - summer case: 0.14 - 0.61 %

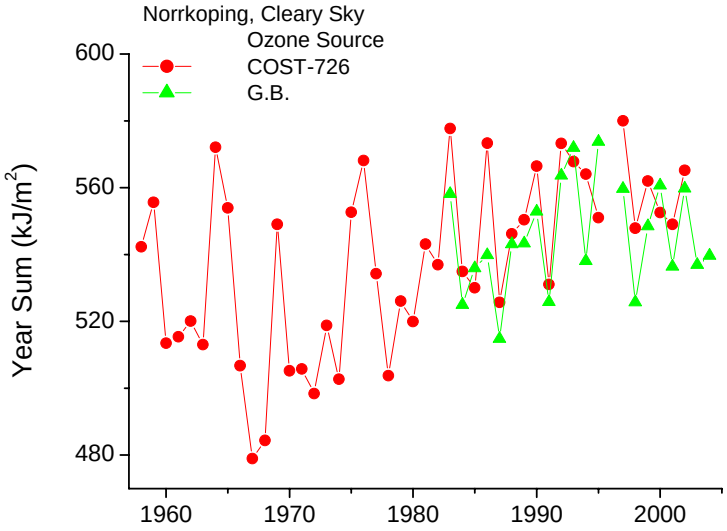
Comparing ground based modelling and satellite based data in reconstruction

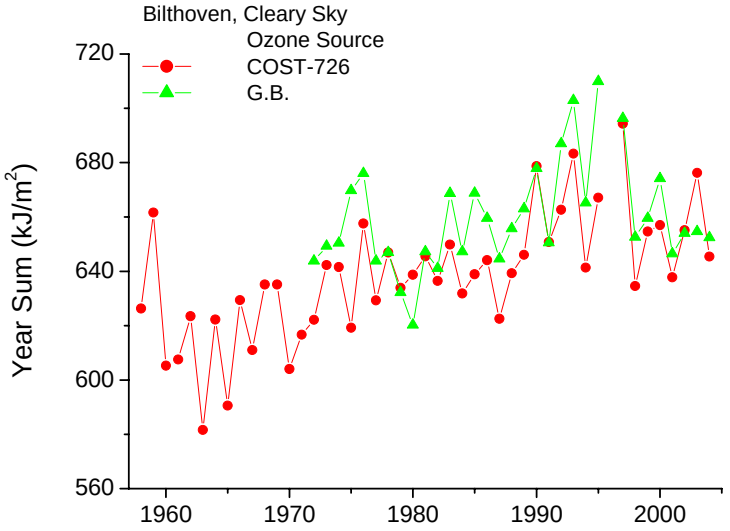
- Data-sources:
  - Ground based ozone and pyranometer in combination with CMF-algorithm from den Outer etal
  - Satellite based ozone from COST-726
  - ERA-40 CMF (as previously provide Kaurola)
  - ERA-40 CMF-global modified by H Staiger
- (CMF-global transferred to CMF-UV (den Outer); comparison with TOMS-reflectivity derived CMF-UV)
- Creating maps for full 1958-2004 period
- extract local values for 8 sites (for detailed comparison)
  - cloudless
  - cloudy

Cloudless sky. CIE UV, O_3: COST-726 v.s. Ground-Based









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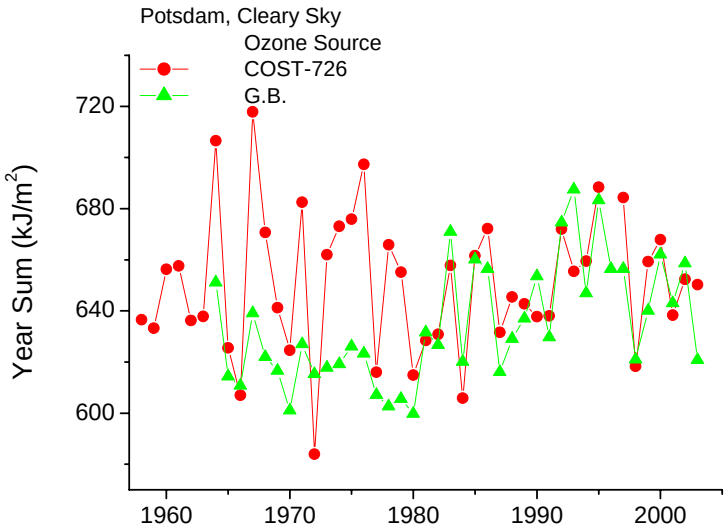
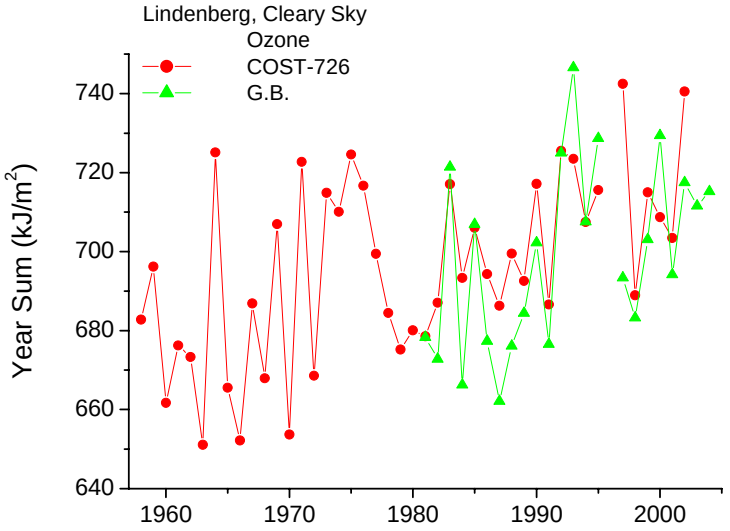
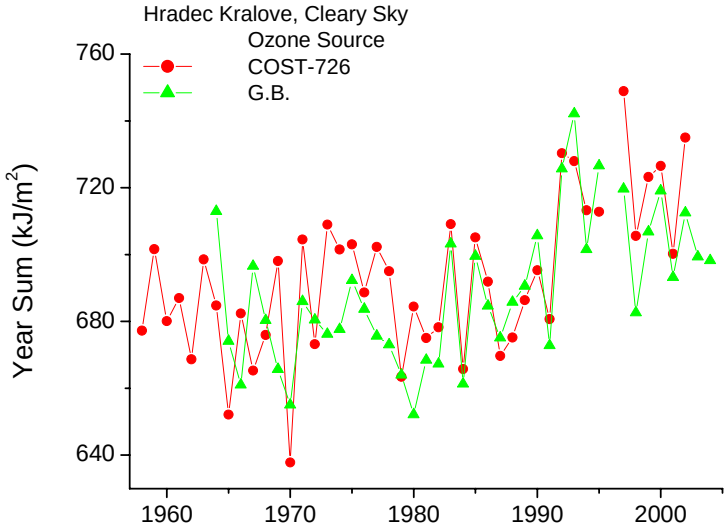
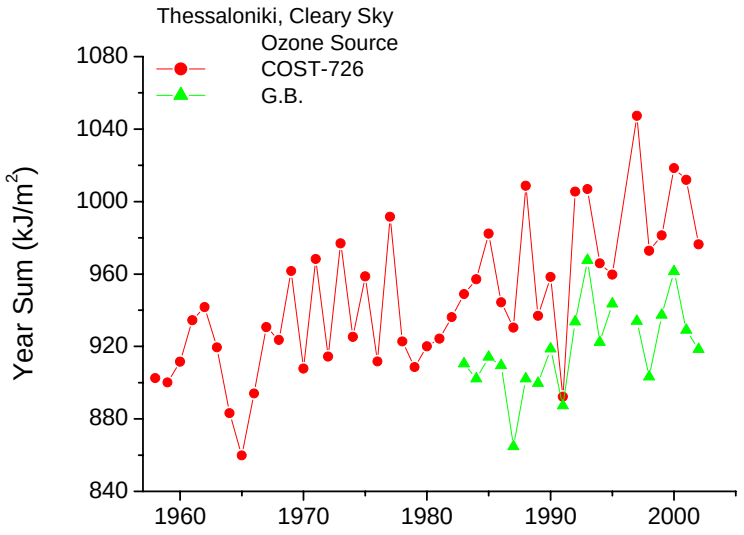
Cloudless sky. CIE UV, O_3: COST-726 v.s. Ground-Based









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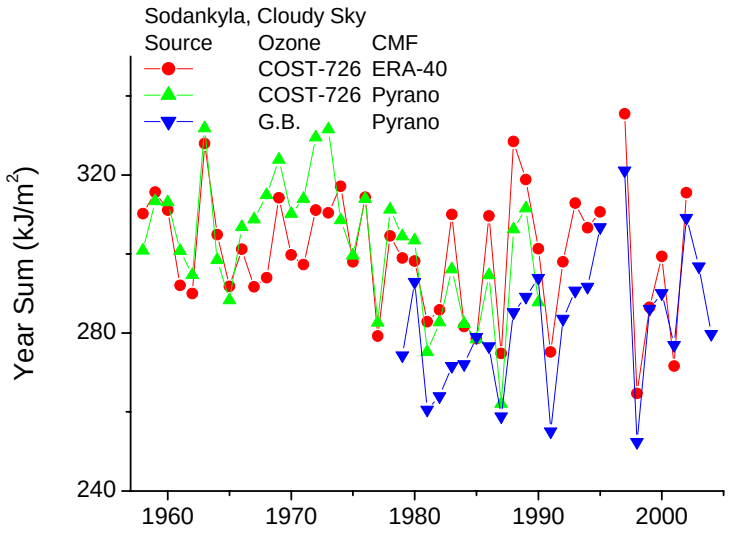
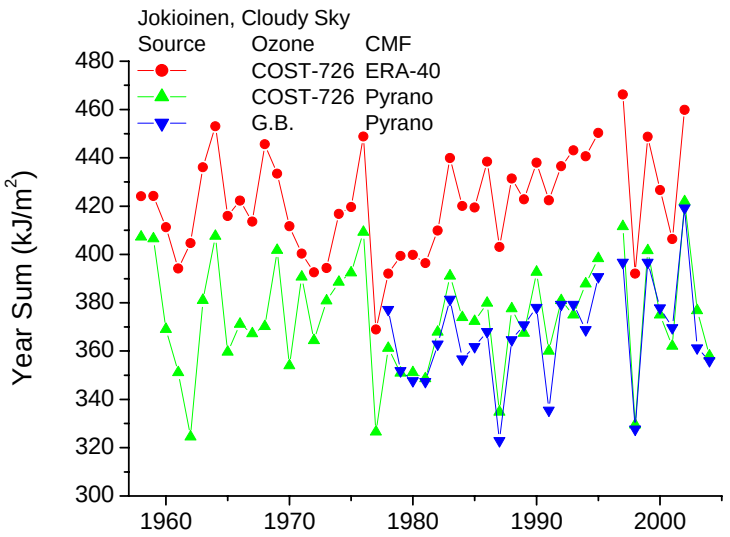
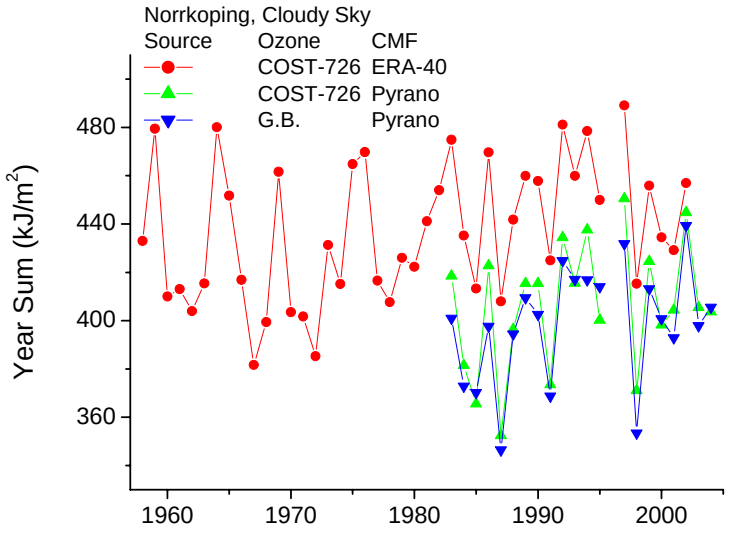
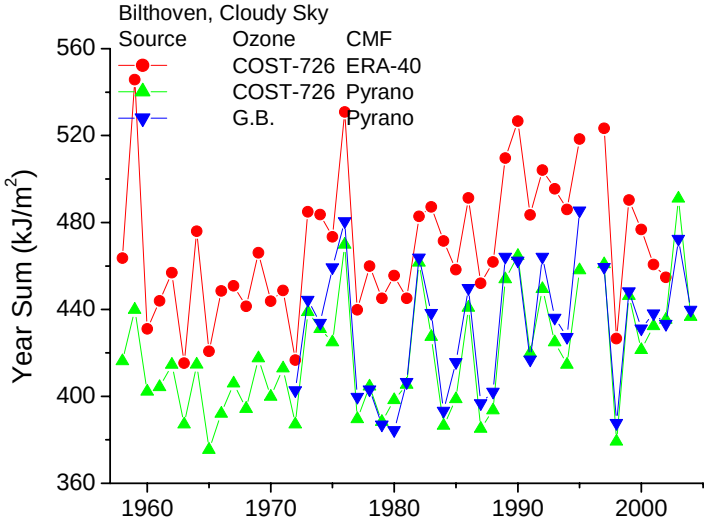
Cloudy sky. O_3: COST-726 v.s. g.b. | CMF: ERA40_V1 v.s. Pyranometer









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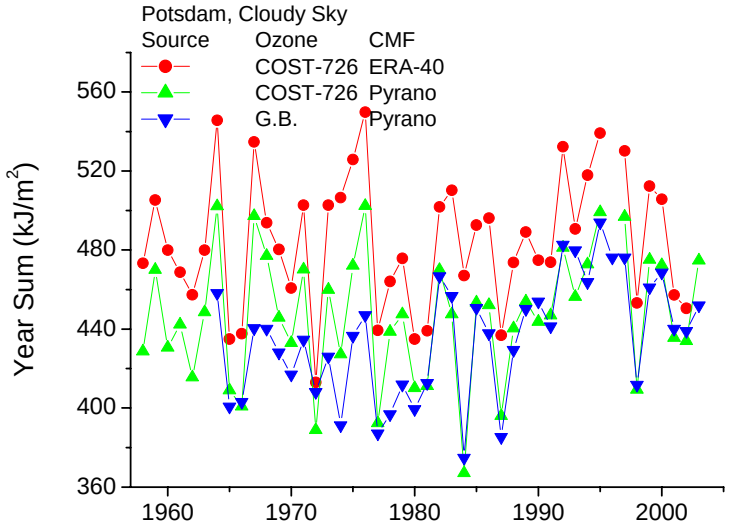
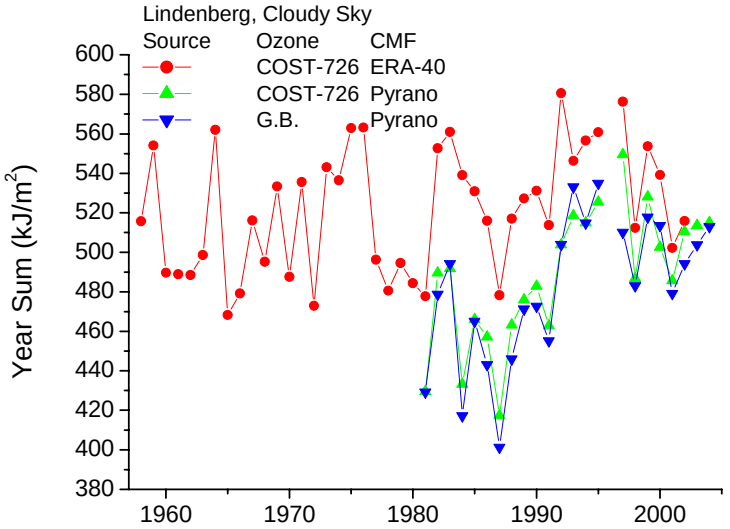
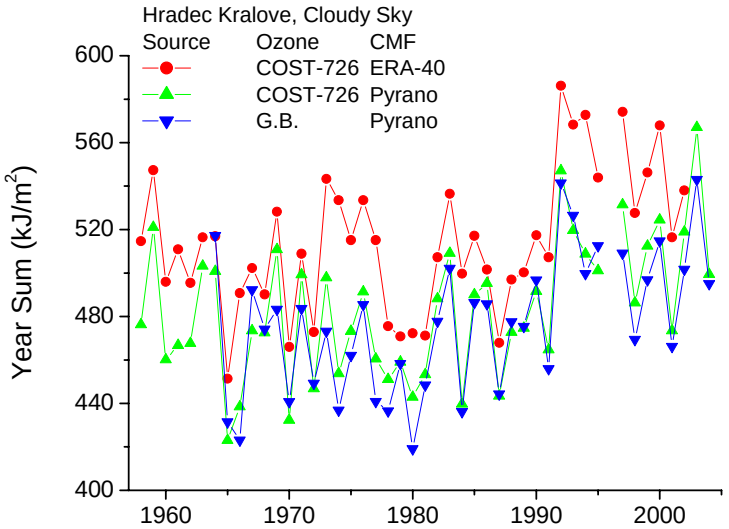
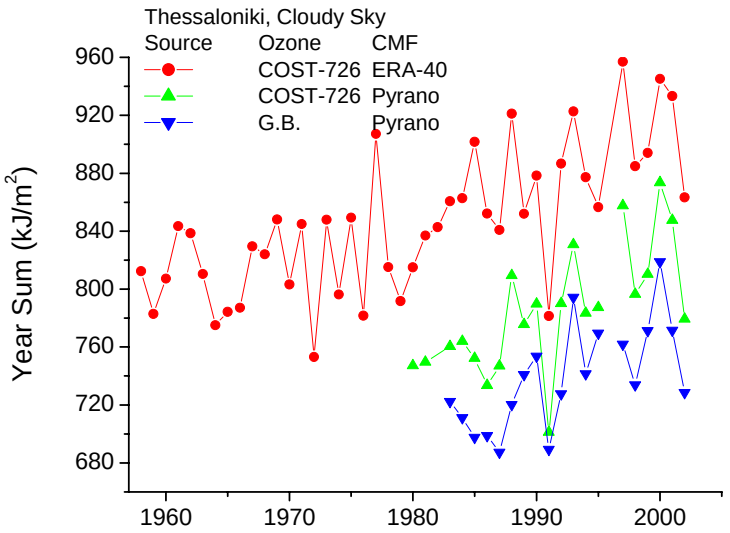
Cloudy sky. O_3: COST-726 v.s. g.b. | CMF: ERA40_V1 v.s. Pyranometer









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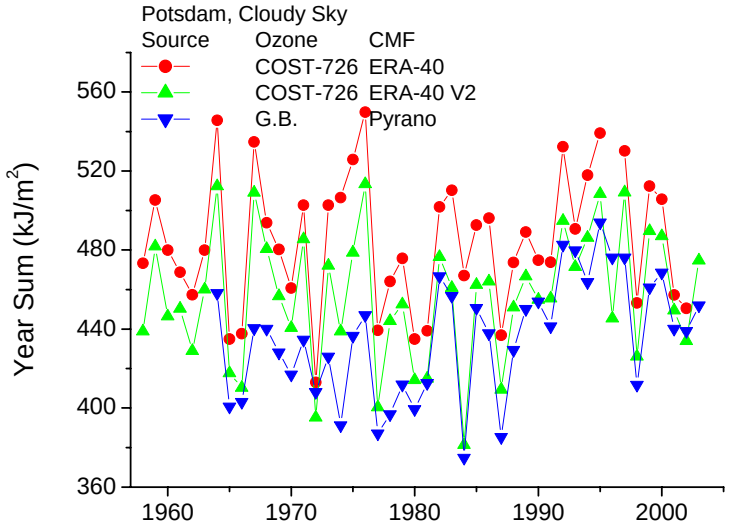
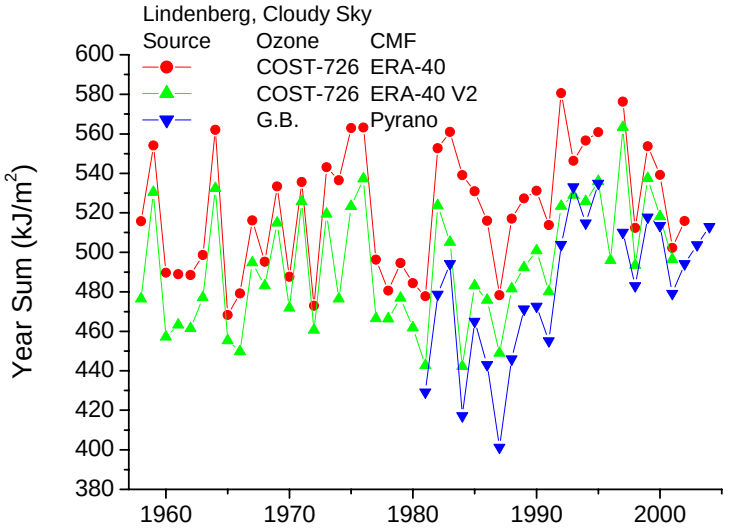
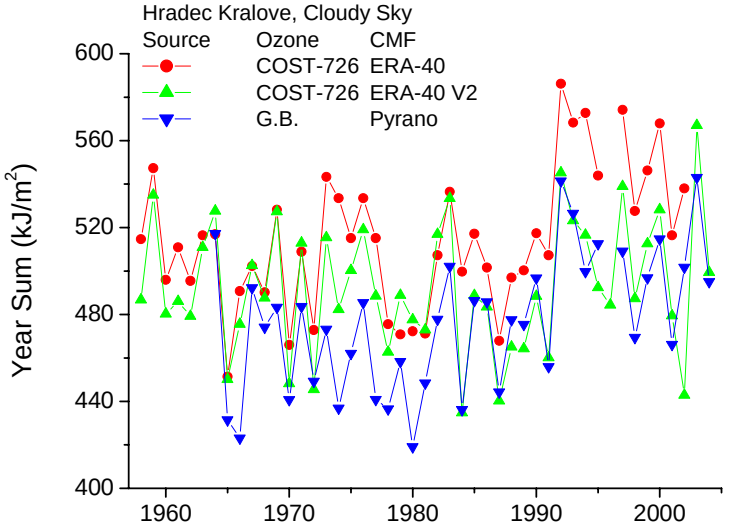
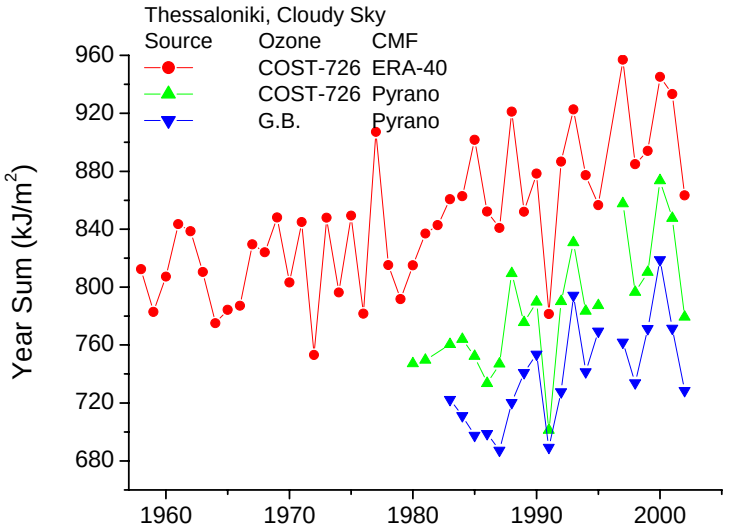
Cloudy sky. O_3: COST-726 | CMF: ERA40_V**1** v.s. ERA40_V**2**









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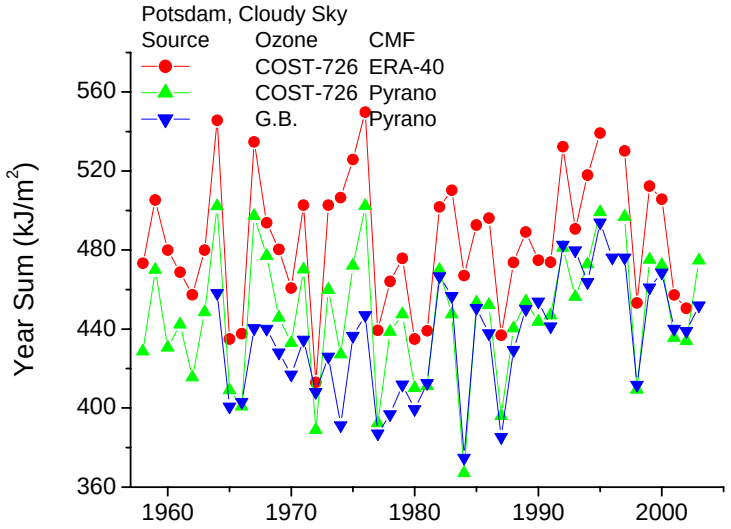
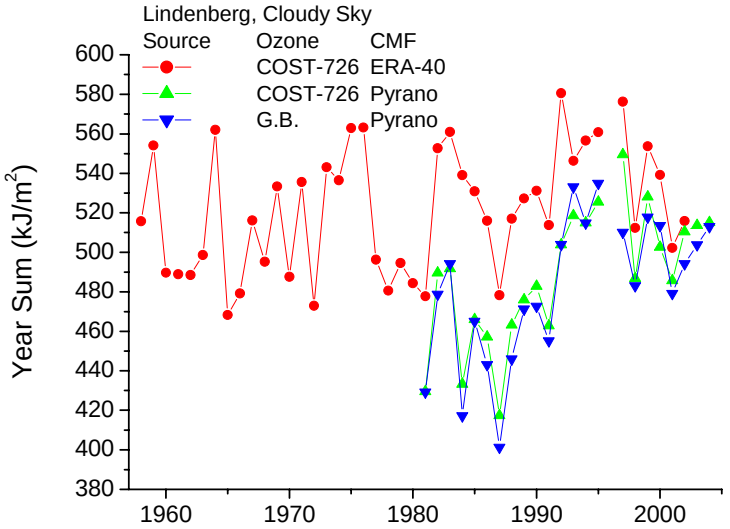
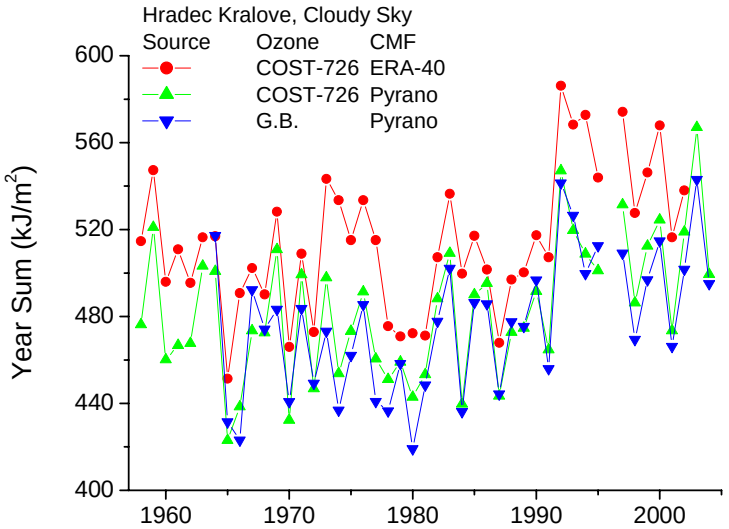
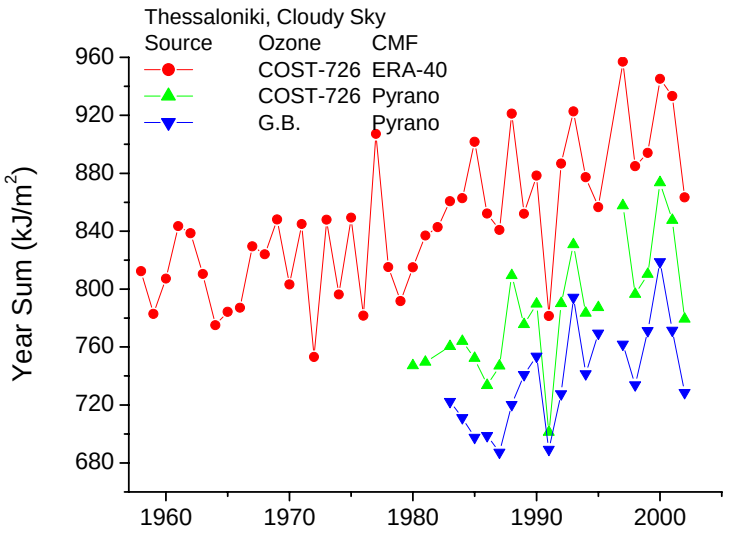
Cloudy sky. O_3: COST-726 | CMF: ERA40_V**1** v.s. ERA40_V**2**









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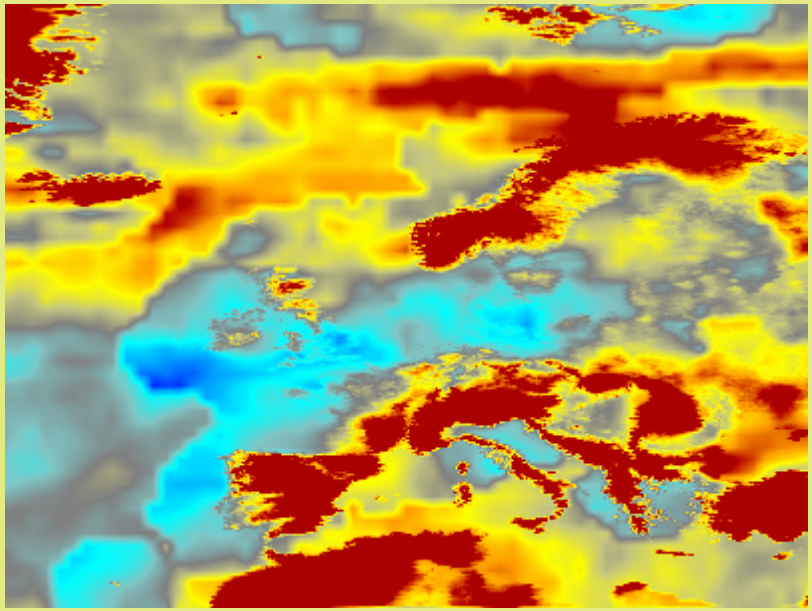
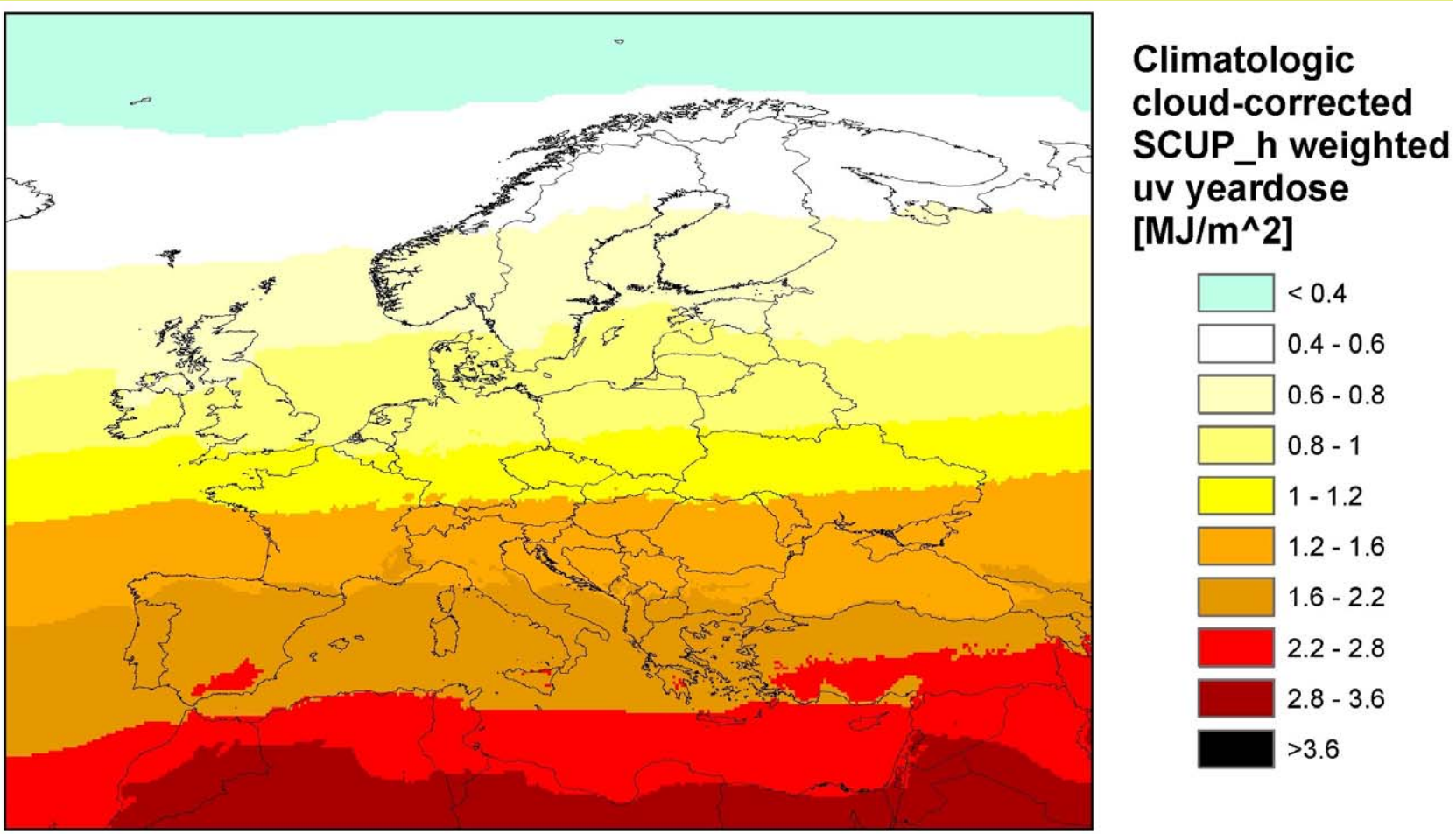
And now some MAPPING…
sorry Murphy's law applied….

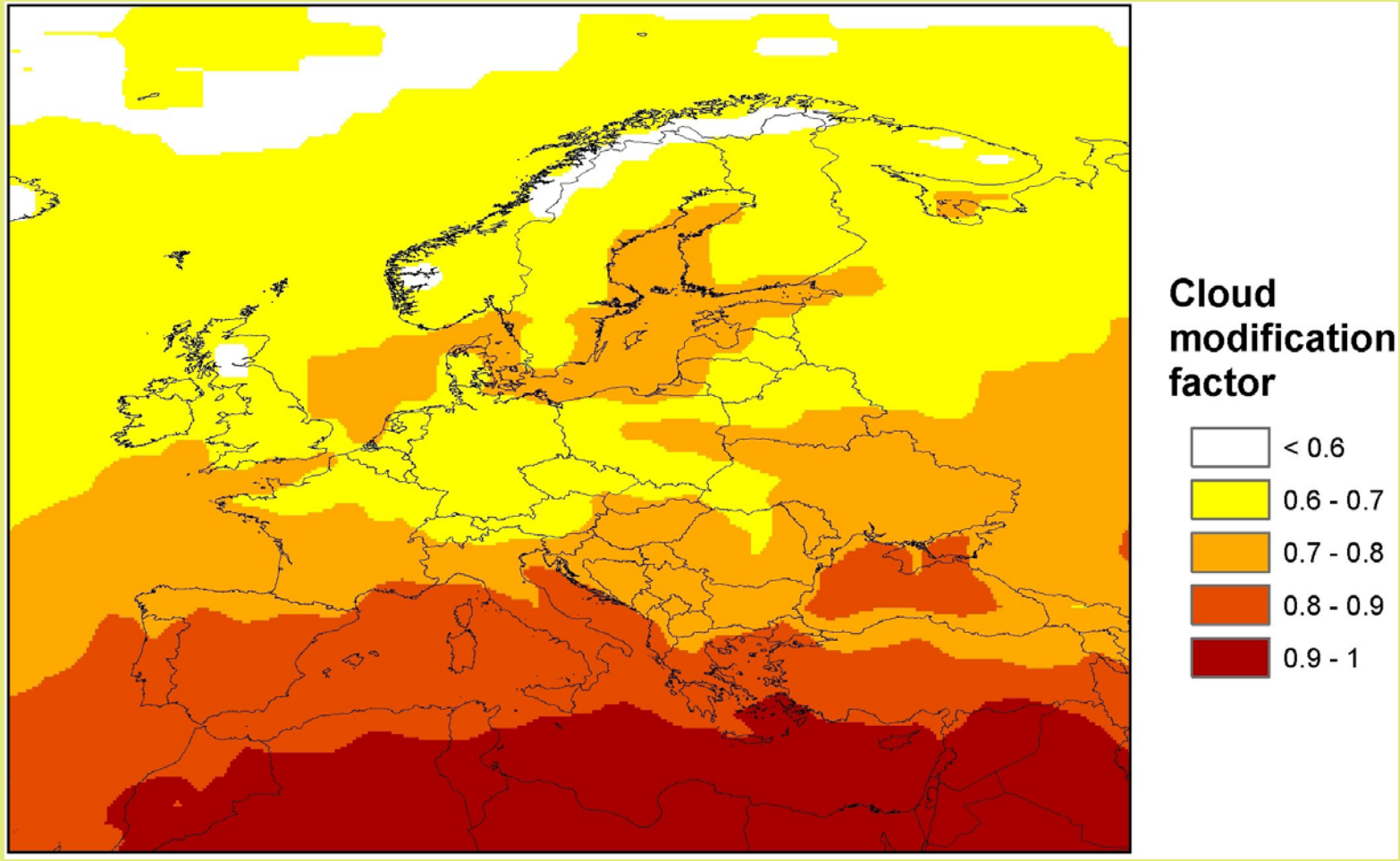


1958 compared to full data-period 1958 -2004

European UV-climatology (skin cancer weighted)



UV Cloud Modification Factors in Europe



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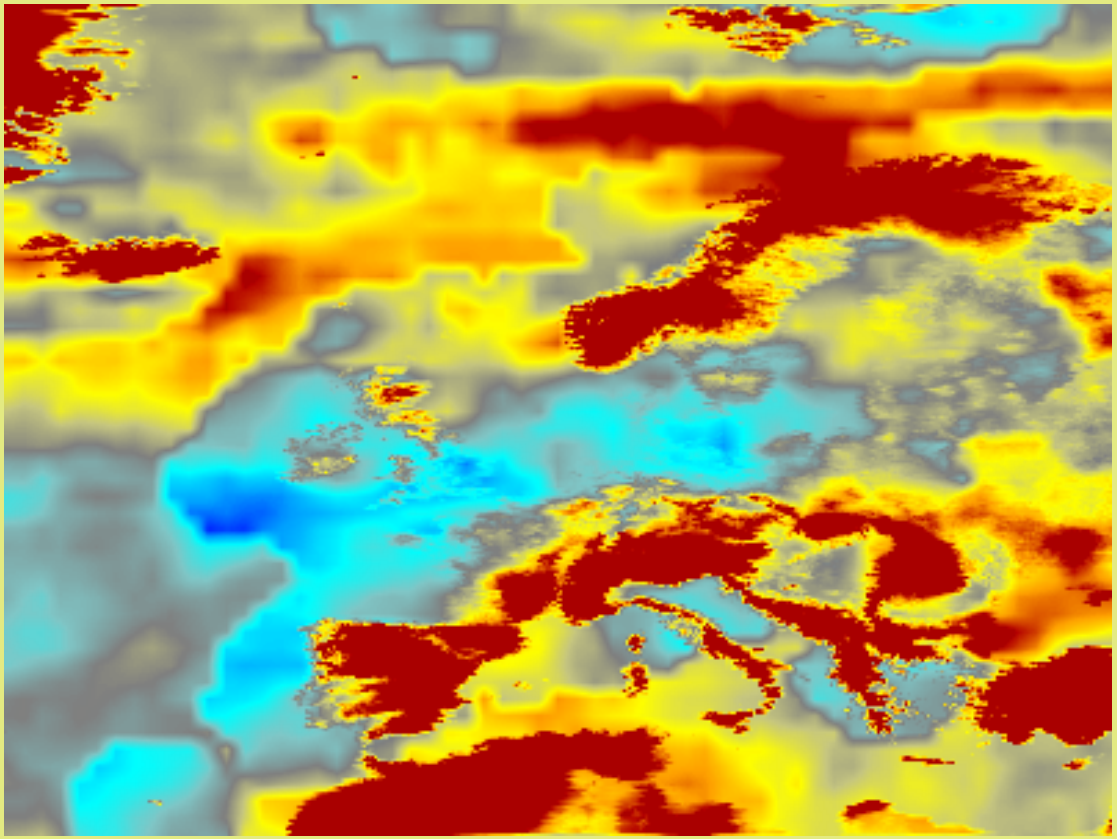
Conclusions

- Seven bands in the UV can be used to reconstruct full spectra for the calculation of effective UV (within 1-2% accuracy)
- ERA40 correction for solar radiation SMFsol applied by Henning Staiger, following a transfer to CMF_UV (method den Outer) performs well:
  - in good agreement with reflectivity derived CMF-UV over TOMS-data period
  - the corrected ERA-40 data are in far better agreement with ground based analysis for the 8 locations shown



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Thanks for the attention

Harry Slaper, Peter den Outer, Arjan van Dijk