

Hourly Resolved Cloud Modification Factors in the Ultraviolet

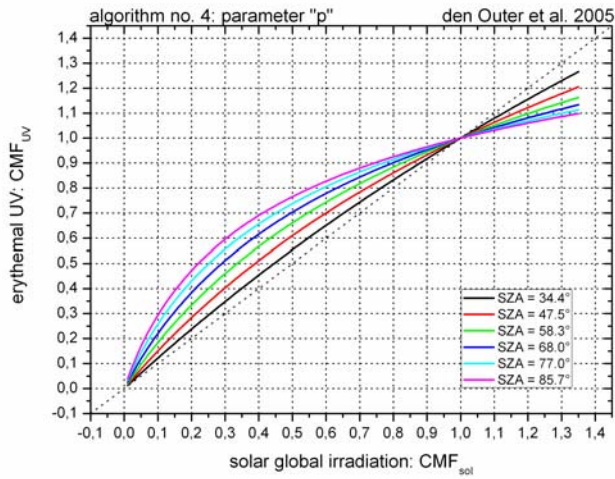
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- RIVM algorithm to derive CMF in the UV for daily doses.
- Motivation to apply the RIVM daily algorithm to hourly resolved UV-CMF.
- Sensitivity study modelled compared to measured hourly UV Index
- Performance at sites outside Europe: Everglades (USA), Lauder (NZL).
- Factor adjusting daily UV-CMF for hourly resolved application.

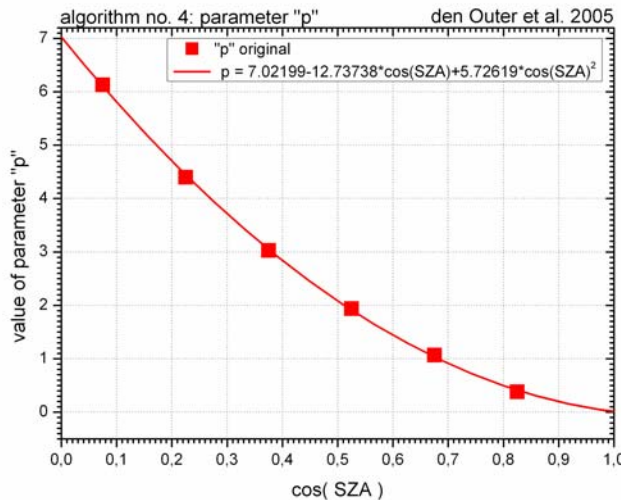


UV Cloud Modification Factor (CMF_{UV})

$$CMF_{UV,d} = \frac{UV_{cloudy,d}}{UV_{clear,d}} = \frac{1 - (1 + p_{sza,noon} \cdot CMF_{sol,d})^{-0.27}}{1 - (1 + p_{sza,noon})^{-0.27}}$$

$$p_{sza,noon} = 7.02199 - 12.73738 \cdot \mu_{z,noon} + 5.72619 \cdot \mu_{z,noon}^2$$

$$\mu_z = \cos(SZA)$$



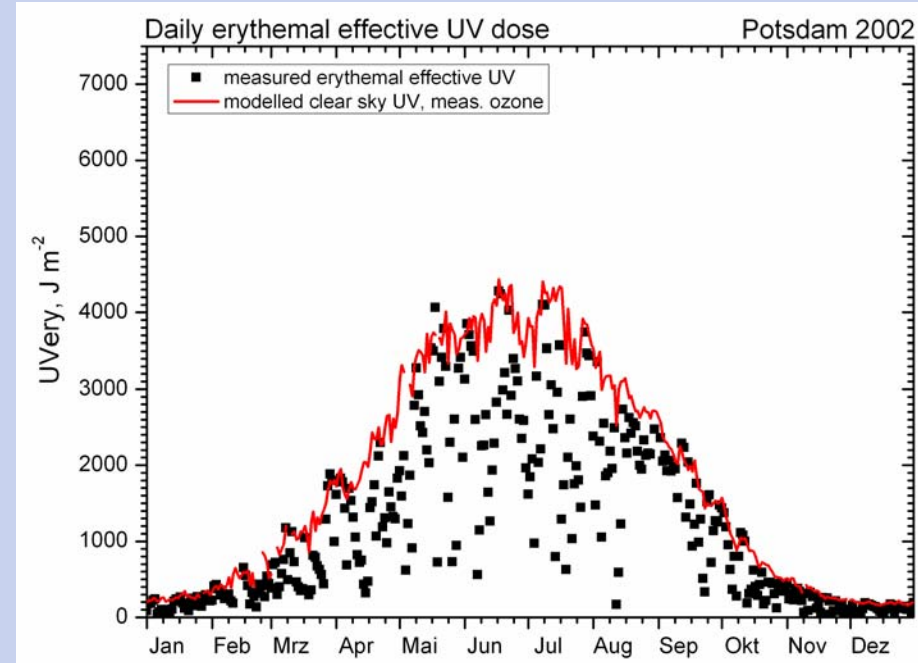
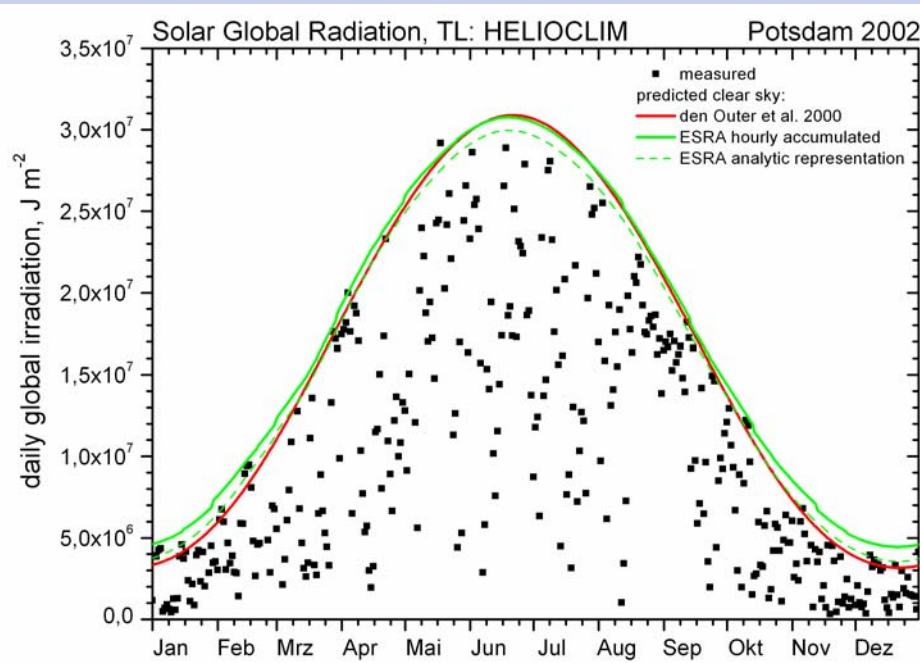
$$CMF_{sol,d} = GR_{meas,d} / GR_{clear(predicted),d}$$

$$GR_{clear,\mu_z} [W \cdot m^{-2}] = 1120 \cdot (\mu_z + 0.15) \cdot$$

$$\exp \left\{ -0.213 \cdot \left(\sqrt{\left(\frac{6370}{60} \cdot \mu_z \right)^2 + 2 \cdot \frac{6370}{60} + 1} - \frac{6370}{60} \cdot \mu_z \right) \right\}$$

Potsdam, DEU:

52.355°N, 13.077°E, 107 m a.s.l.



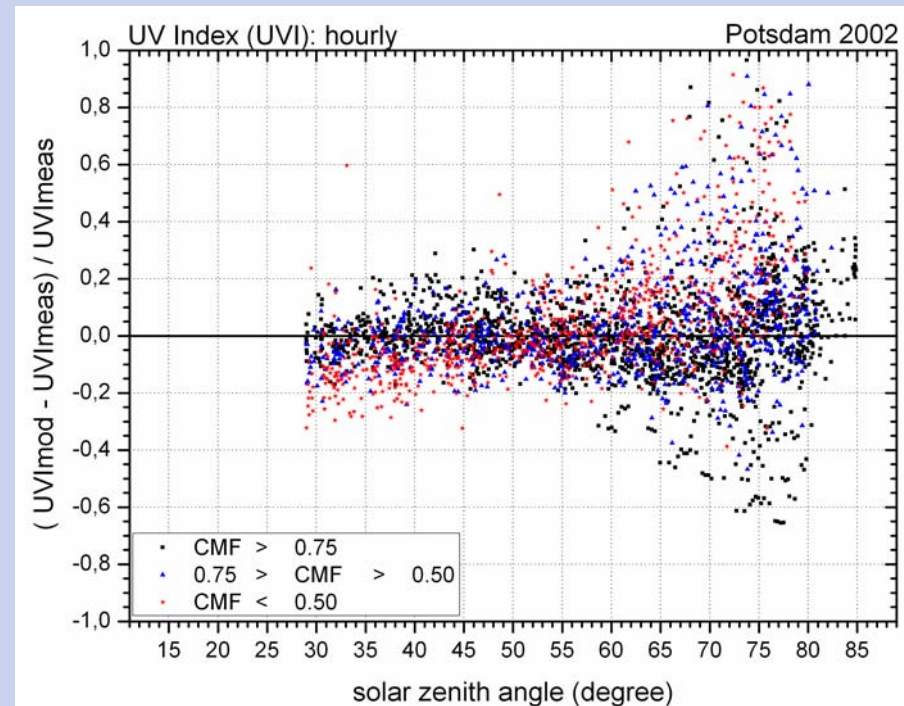
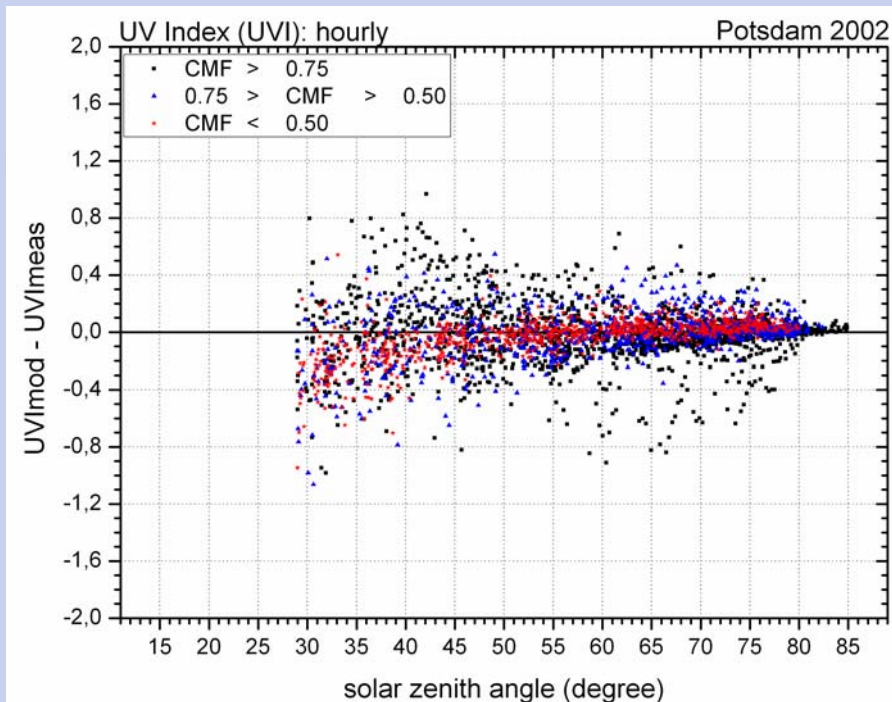
measured data: COST-726 database

Potsdam, DEU:

52.355°N, 13.077°E, 107 m a.s.l.

absolute difference: -0.02 ± 0.19 UVI

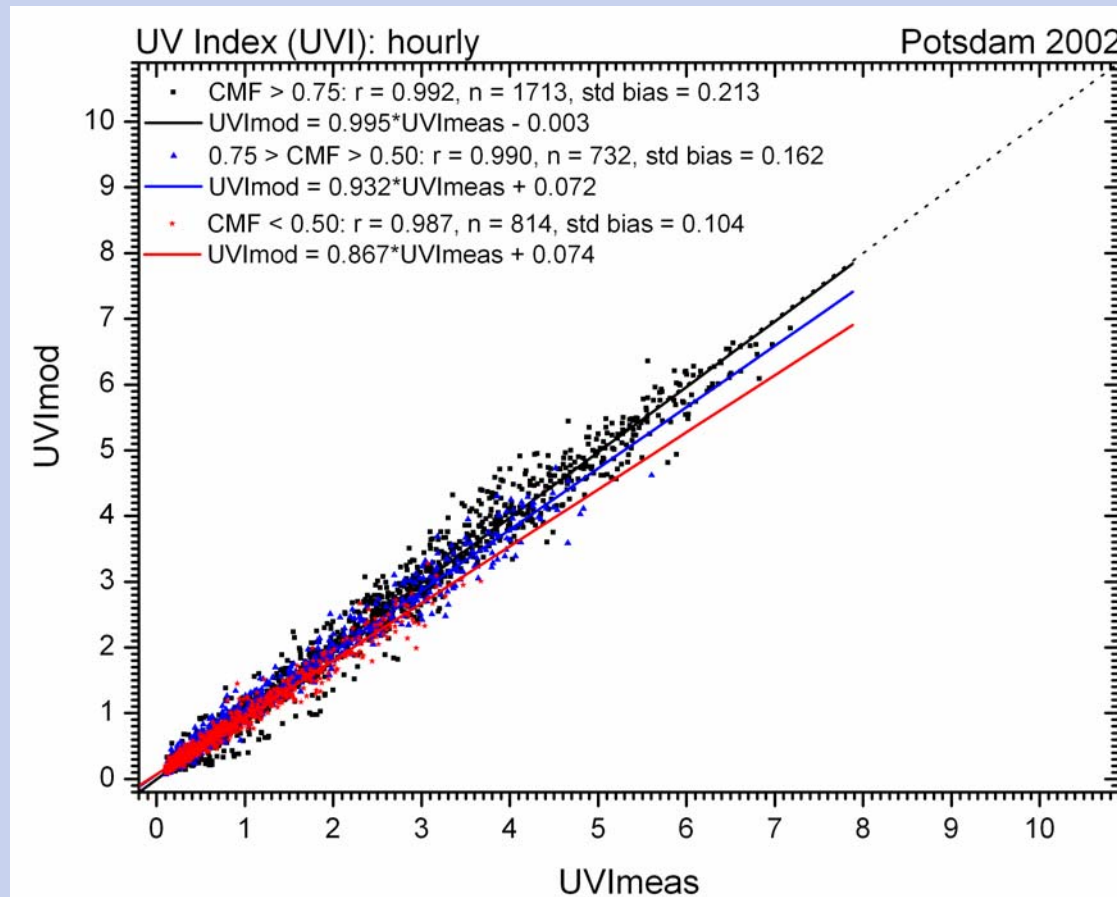
relative difference: $+0.03 \pm 0.21$



measured data: COST-726 database

Potsdam, DEU:

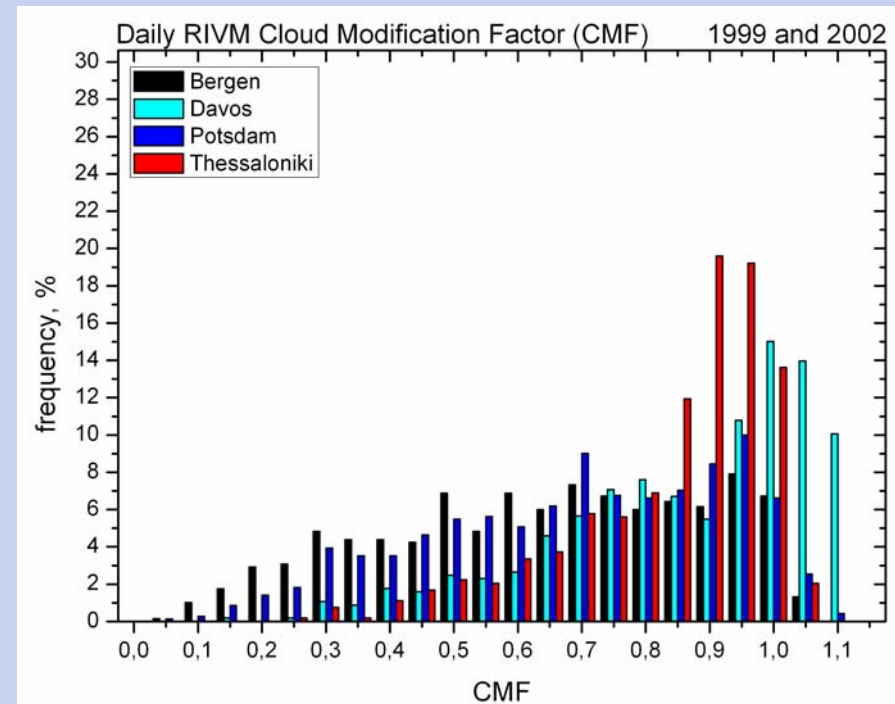
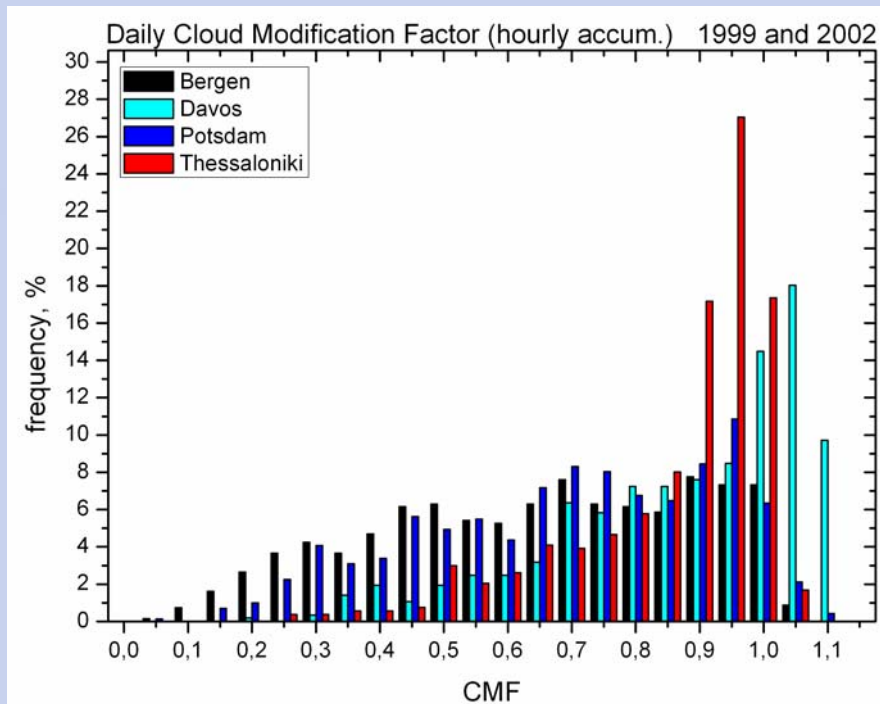
52.355°N, 13.077°E, 107 m a.s.l.



Summary Sensitivity Study

site	year	abs. difference, UVI		rel. difference, %	
		bias	std dev	bias	std dev
Bergen	1999	-0.013	0.138	3.72	15.41
	2002	0.091	0.176	12.27	15.44
Davos	1999	-0.006	0.243	6.72	15.85
	2002	0.025	0.207	6.33	14.60
Potsdam	2002	-0.019	0.191	2.86	20.81
Thessaloniki	1999	0.189	0.243	10.16	13.35
	2002	0.185	0.237	8.61	12.70

Frequency Distribution over Classes of UV-CMF



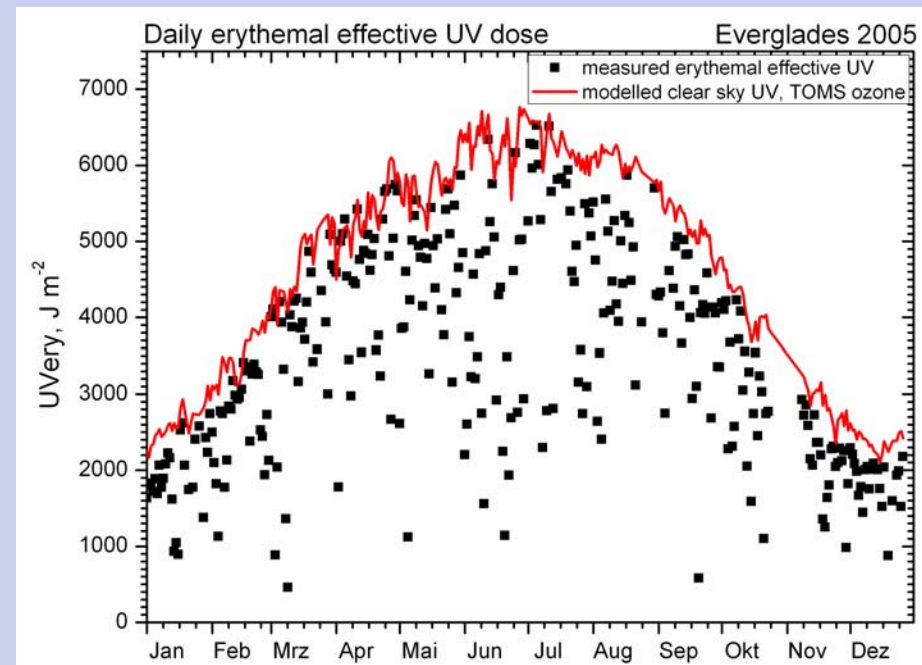
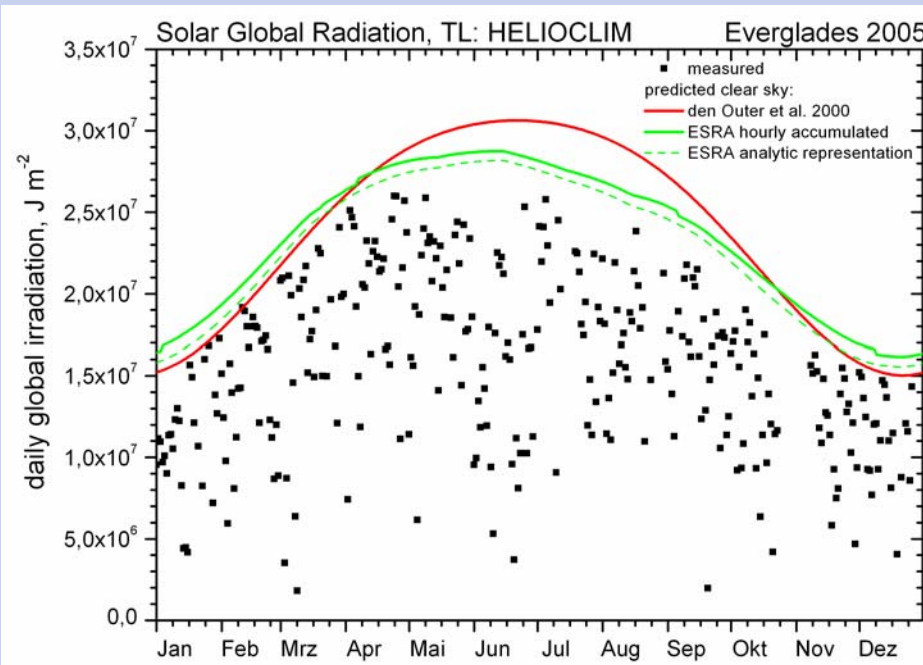
daily by hourly
accumulation

differences not significant

daily RIVM UV-CMF

Everglades / FL, USA:

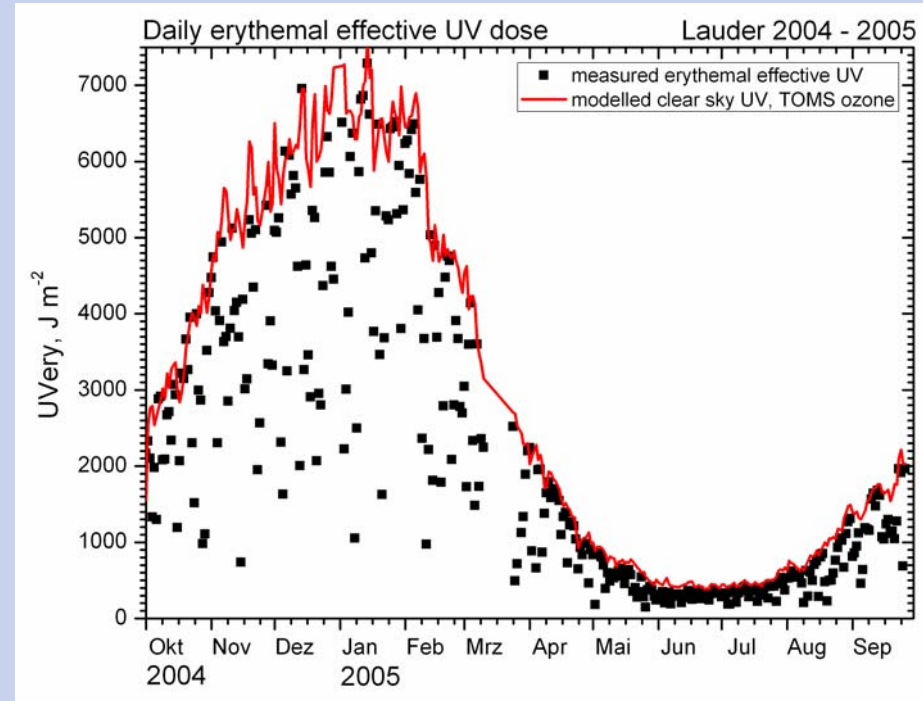
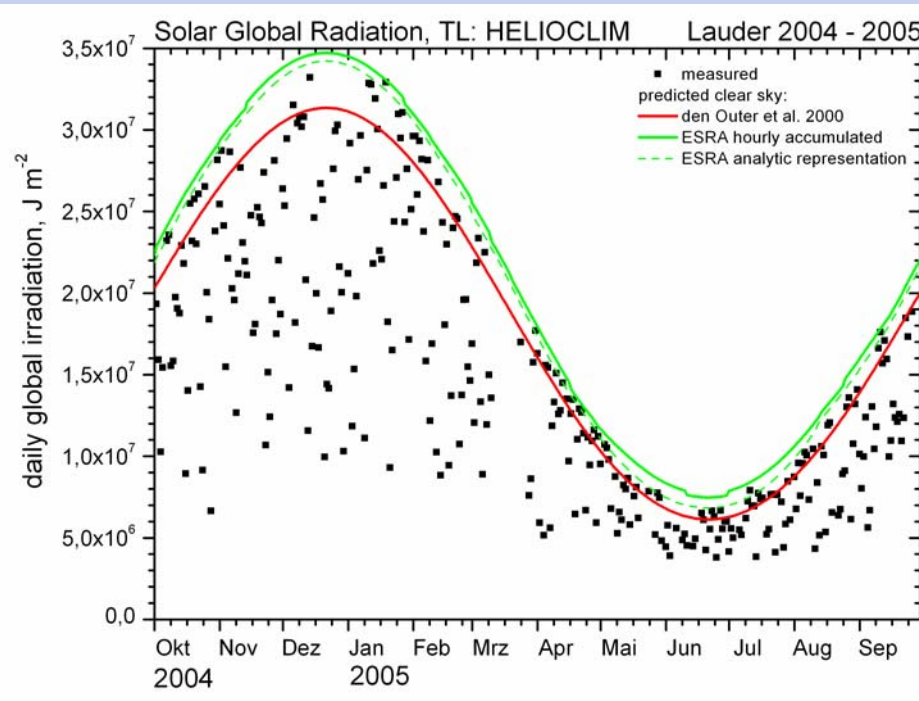
25.380°N, 80.680°W, 0 m a.s.l.



measured data: USDA UV-B M.R.P., TOMS gridded ozone

Lauder, NZL:

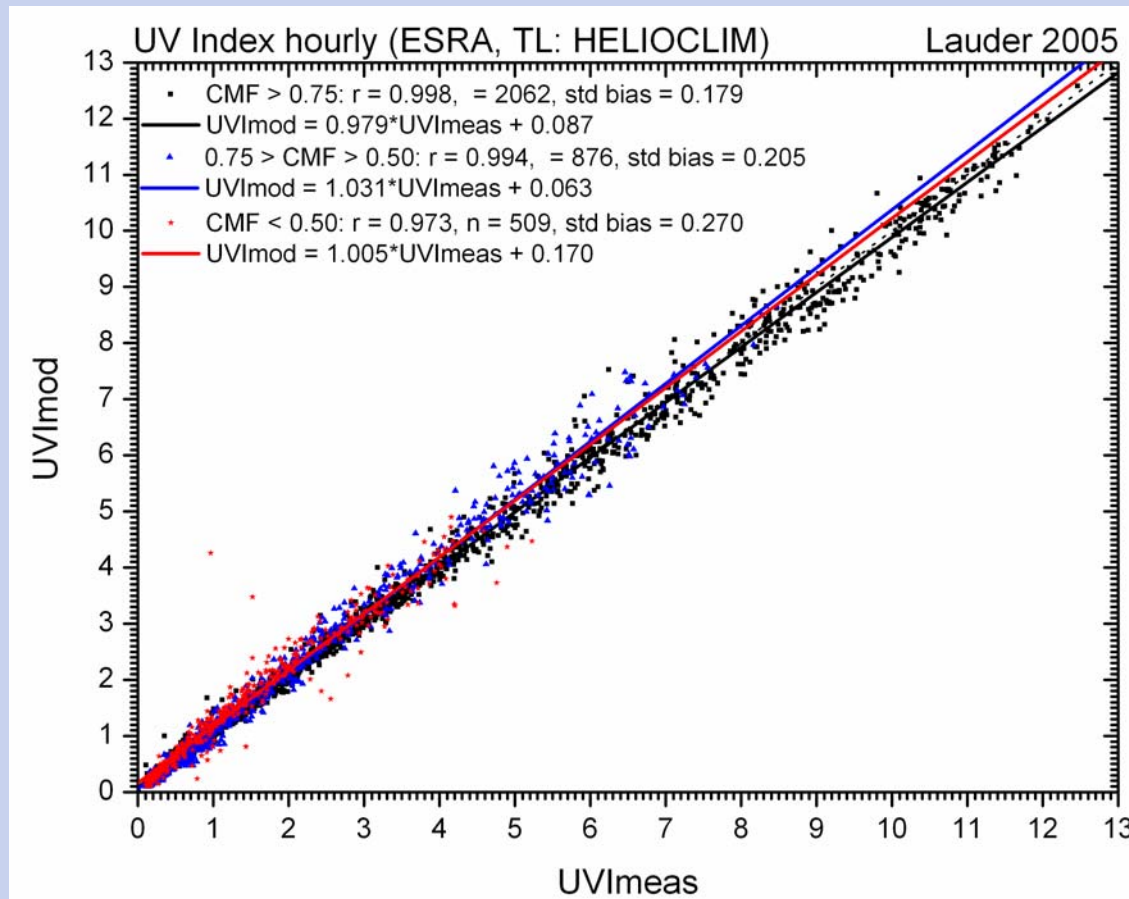
45.030°S, 169.680°E, 370 m a.s.l.

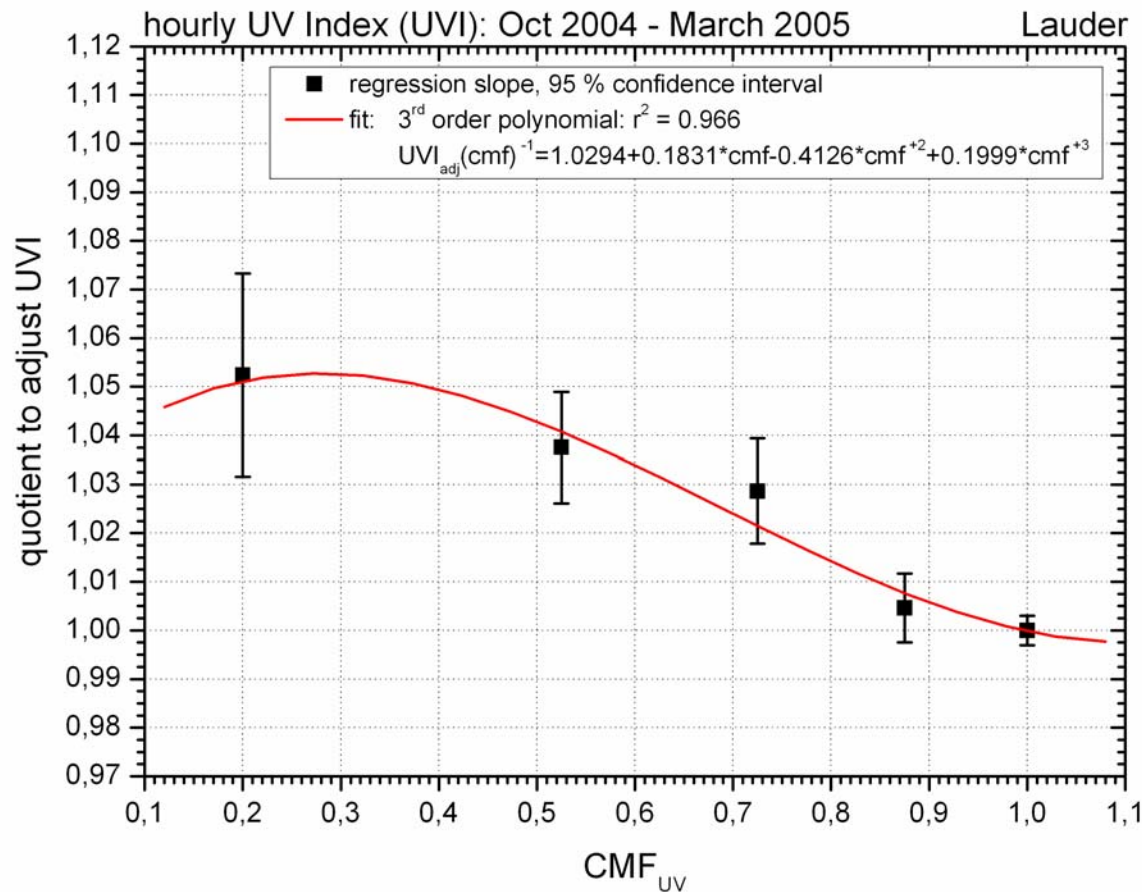


measured data: USDA UV-B M.R.P., TOMS gridded ozone

Lauder, NZL:

45.030°S, 169.680°E, 370 m a.s.l.





“Calibrating” the daily RIVM CMF_{UV} algorithm for hourly application

Summary

- The RIVM UV-CMF algorithm is applicable on an hourly base.
- A function adjusting the original daily algorithm for hourly application has been quantified.
- The algorithm is applicable globally supposed the predicted clear sky global irradiation can reproduce solar geometry and long year conditions of turbidity and its seasonal variations.

Conclusion Concerning UV Reconstruction

Modelling of clear sky global irradiation and clear sky UV should rely on comparable assumptions of mean turbidity and its seasonal variations.



Thank you for your attention