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Reconstruction of UV-radiation doses for the past four decades using models and measurements

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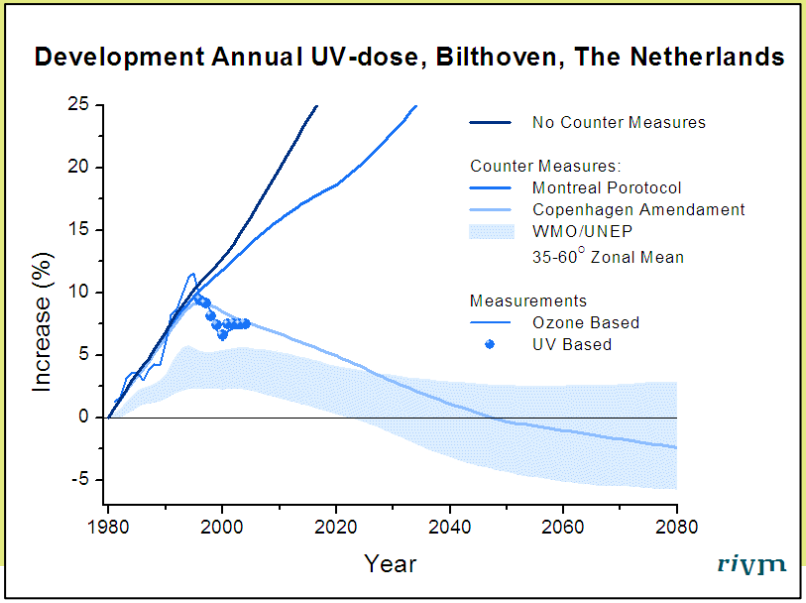
M Janouch, and W Josefsson

Ground-based modelling

- RIVM-model: UV = $UV_0(O_3,AOD,albedo)\ F(CMF_{GSI})$
- 8 sites
- Local measured Ozone
  & Global Solar Irradiation
- Ancillary data on:
  aerosols, snow cover, ground-albedo

- European coverage
- History
- Future Scenario



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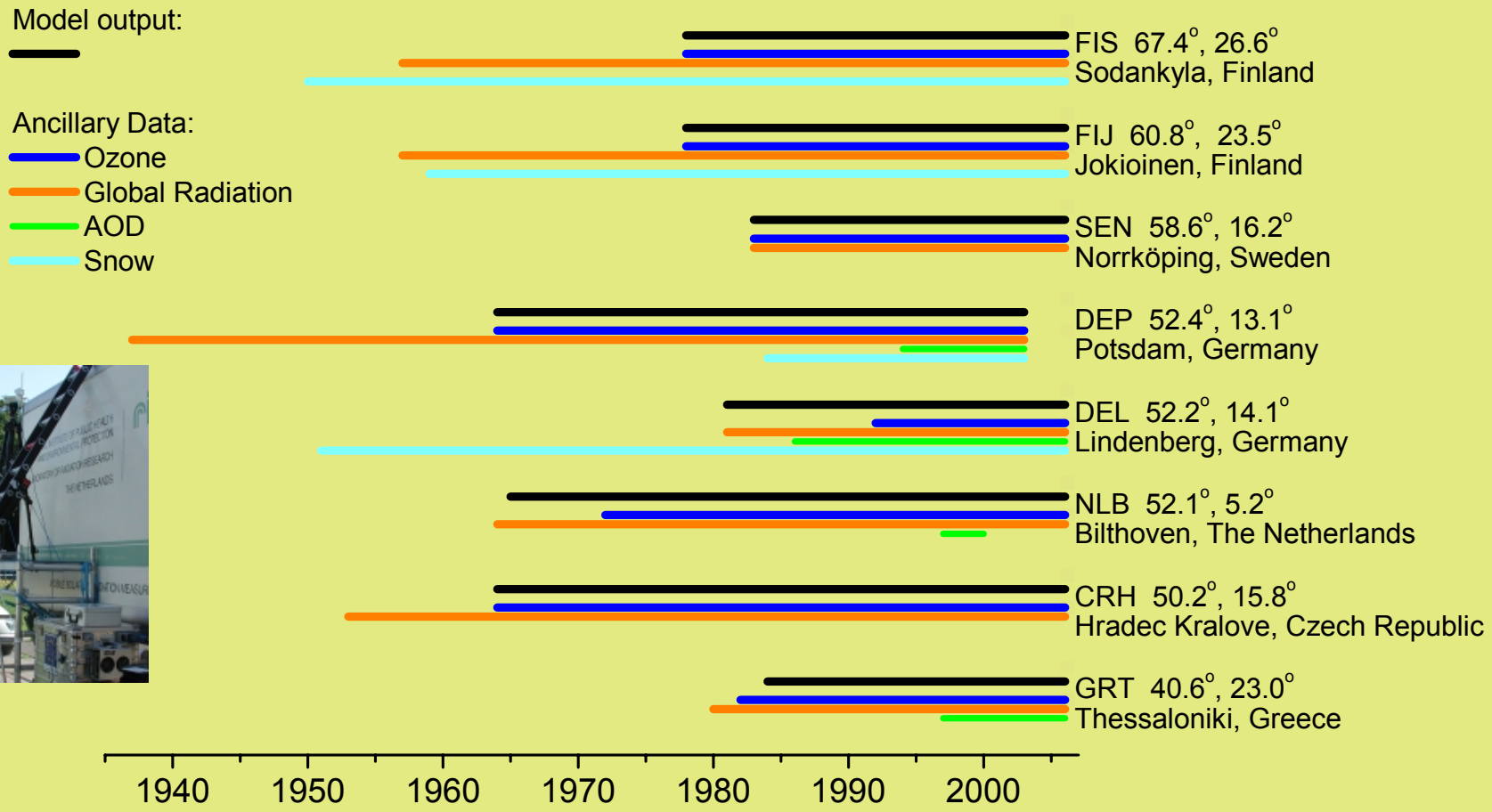
Available data



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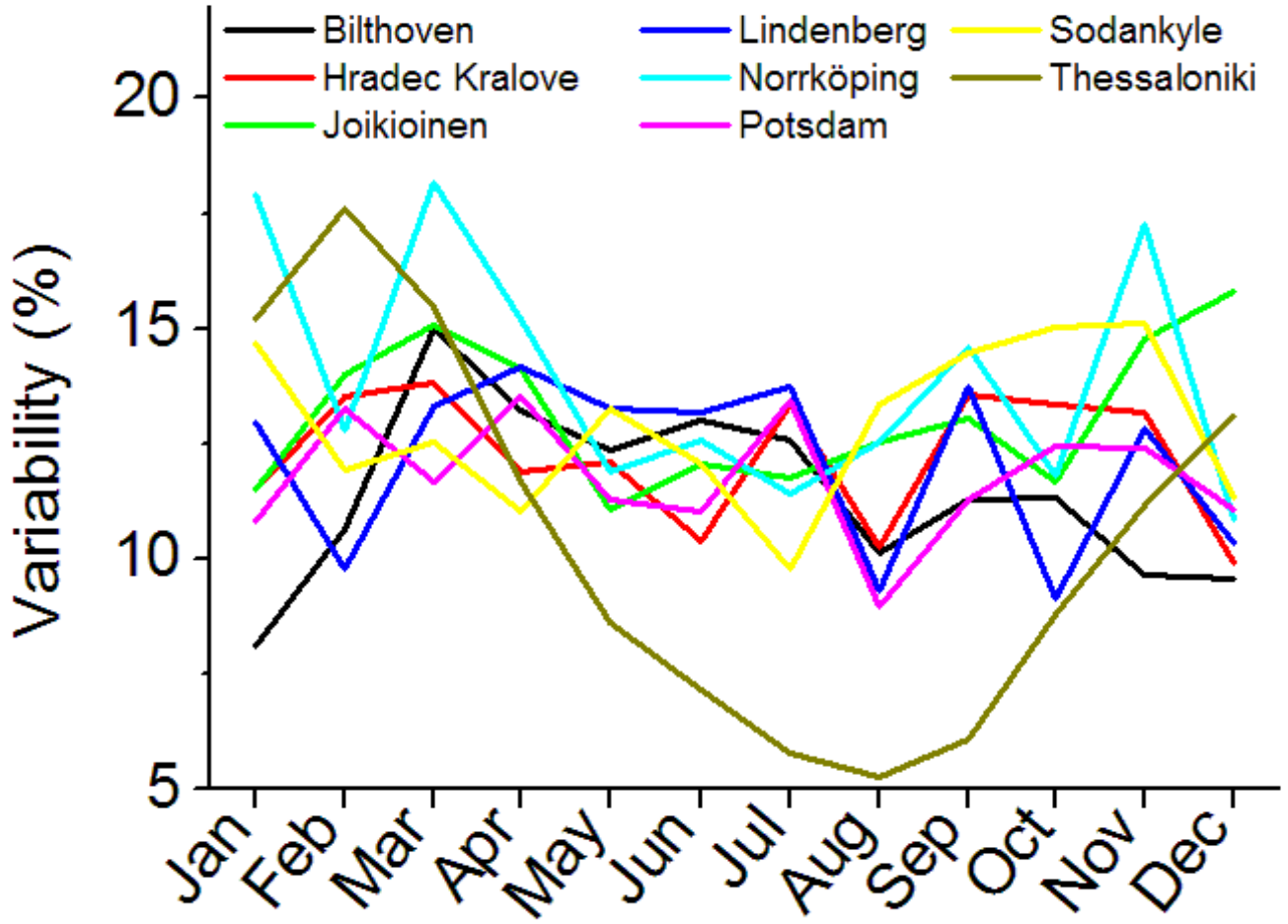
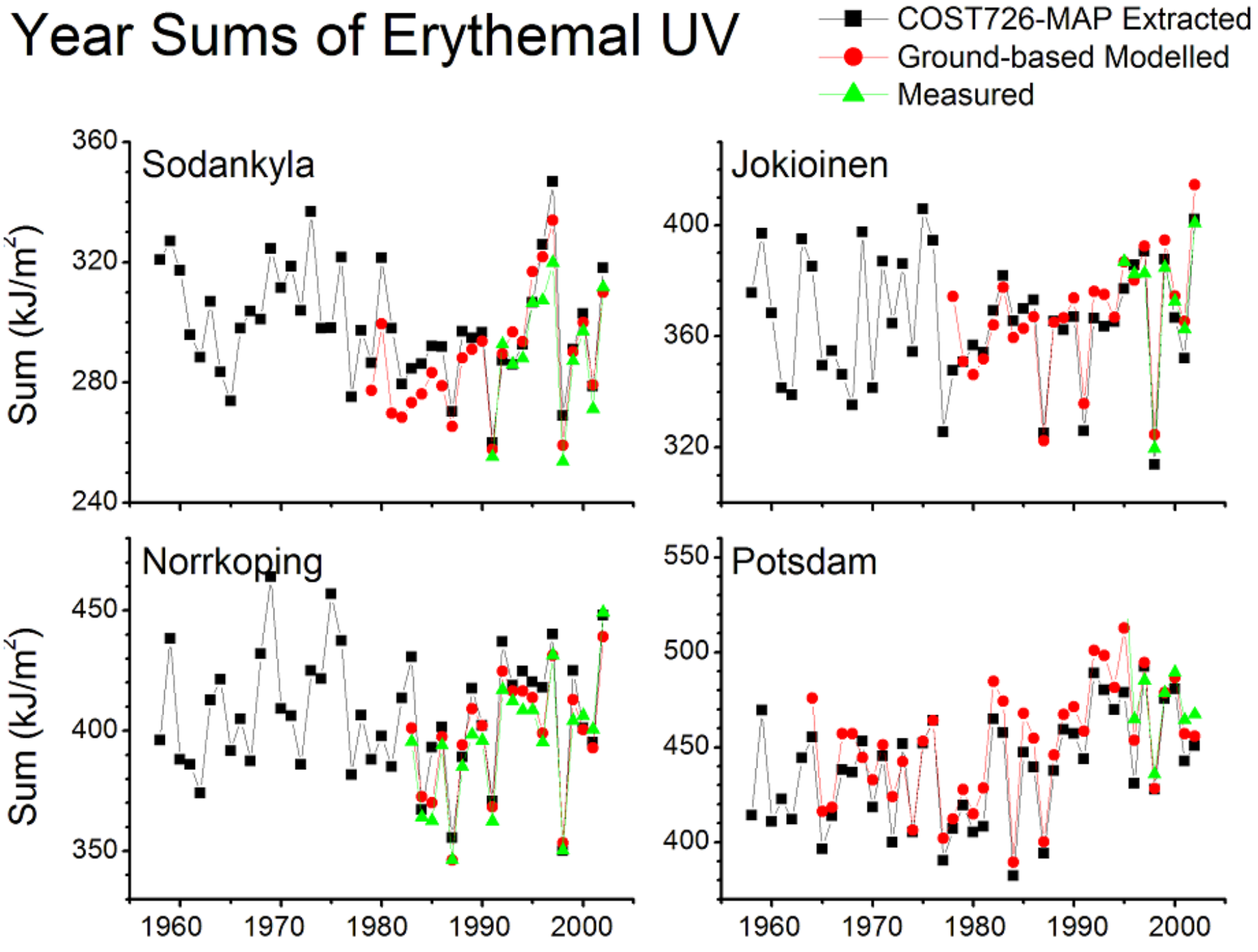
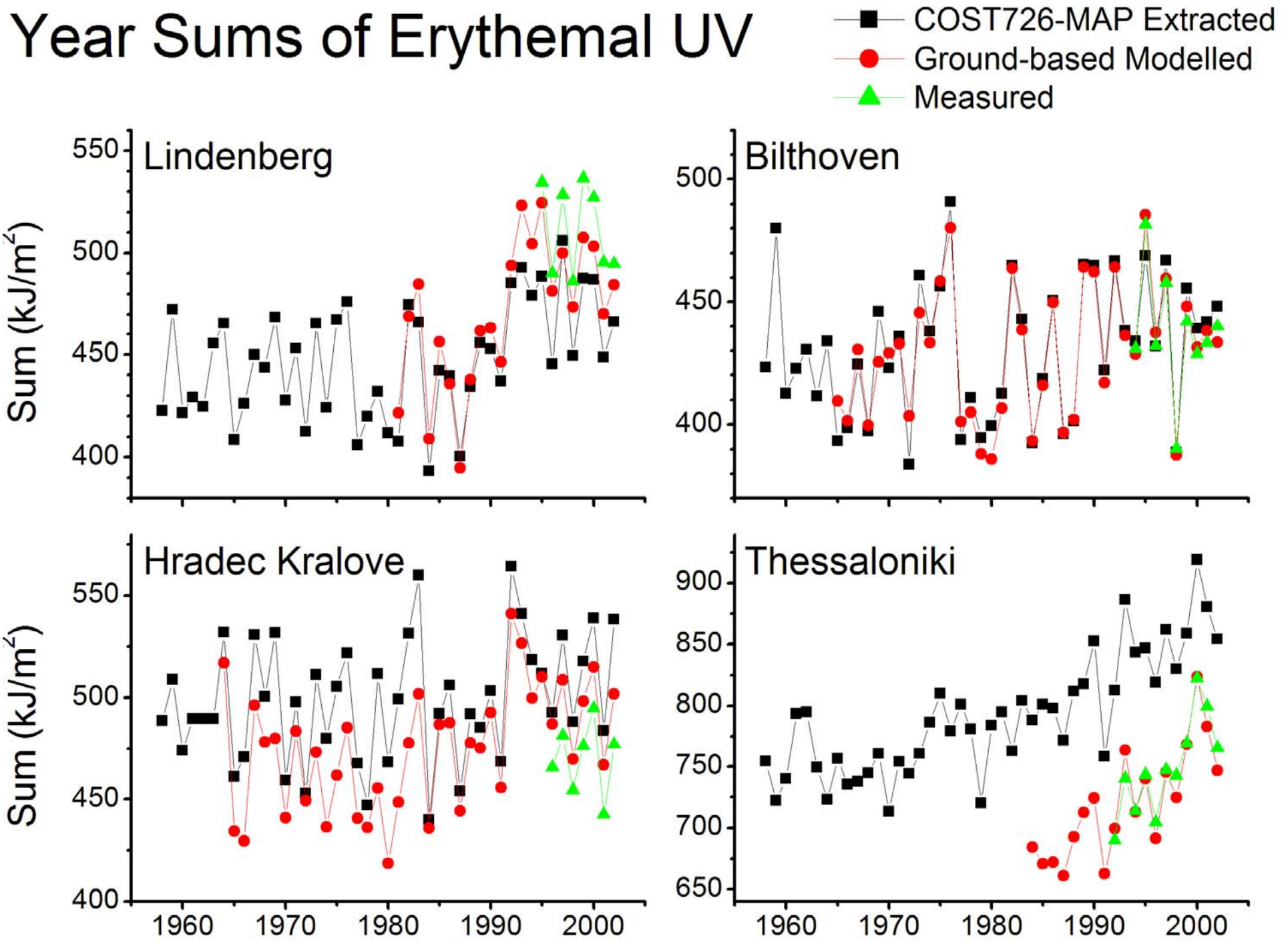
Variability of the monthly UV sums



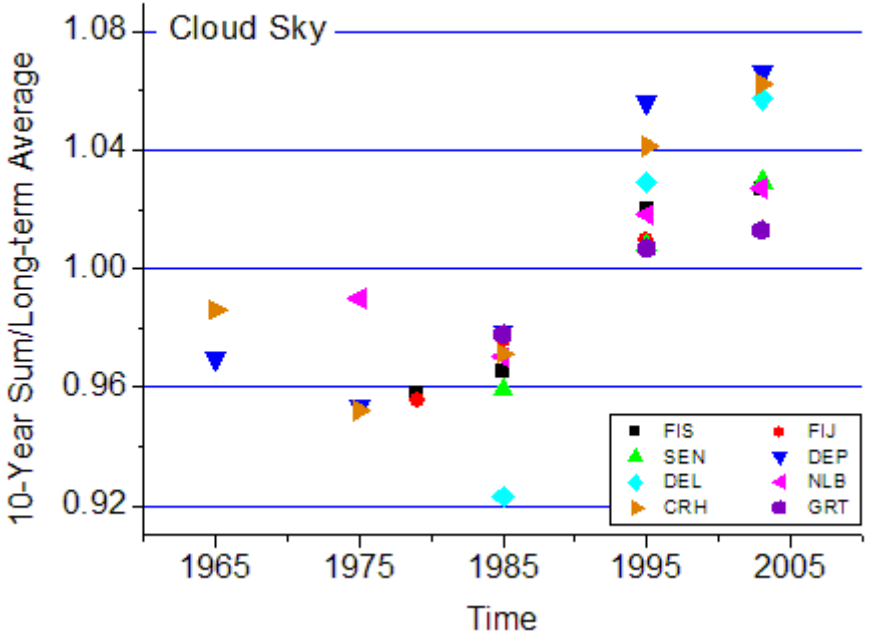

Year Sums of Erythemal UV
COST726-MAP Extracted
Ground-based Modelled
Measured
Sodankyla
Jokioinen
Norrkoping
Potsdam
Sum (kJ/m²)
Sum (kJ/m²)
360
320
280
240
400
360
320
450
400
350
550
500
450
400
1960
1970
1980
1990
2000
1960
1970
1980
1990
2000

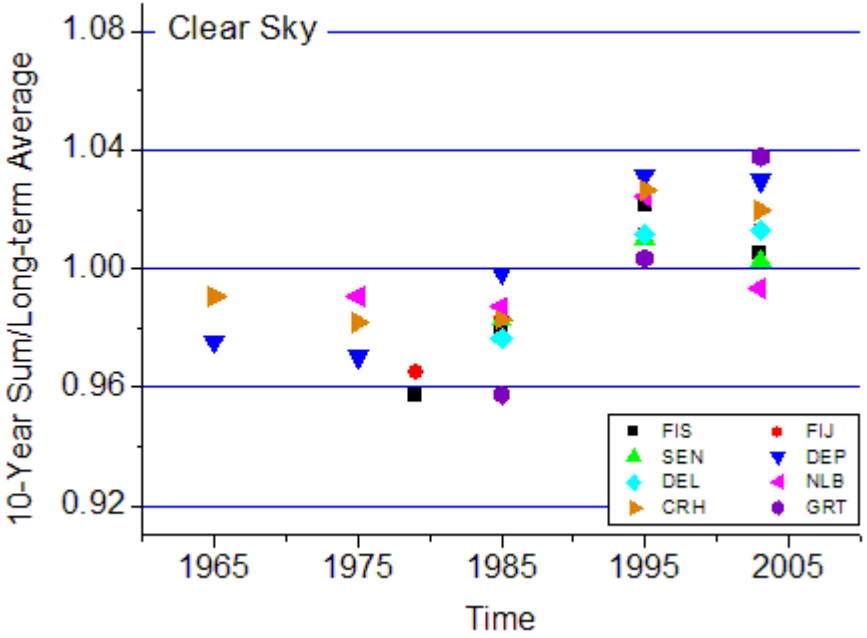

Year Sums of Erythemal UV
COST726-MAP Extracted
Ground-based Modelled
Measured
Lindenberg
Bilthoven
Hradec Kralove
Thessaloniki
Sum (kJ/m²)
550
500
450
400
900
850
800
750
700
650
1960
1970
1980
1990
2000

Averaged year sums and % variability

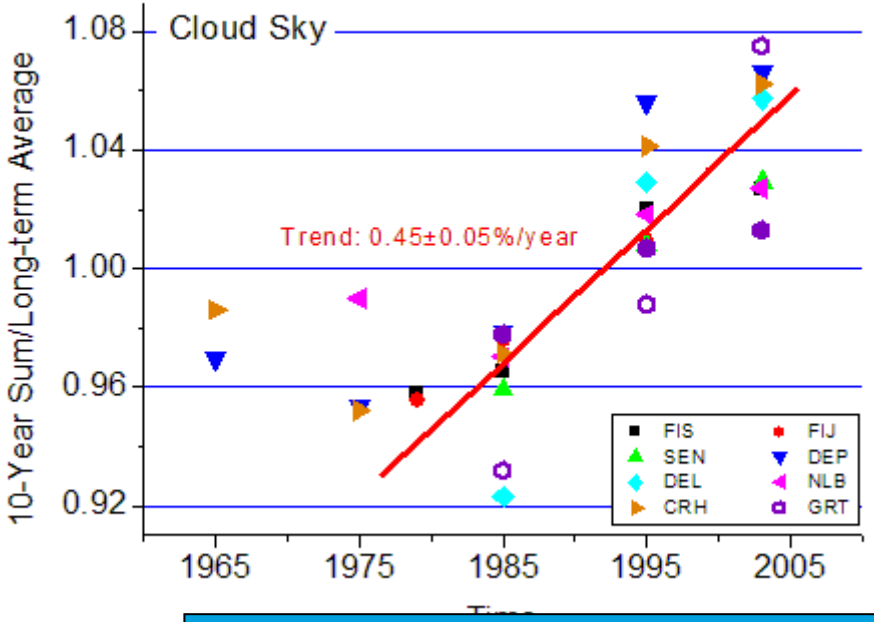
Code	Site	Lat. (Deg.dec)	$\overline{\text{Year Sum}}$ (kJ/m^2) GB	Cost	% Variability GB	Cost
FIS	Sodankylä	67.36	288.1	294.3	6.7	6.5
FIJ	Jokioinen	60.81	366.8	363.4	5.7	5.6
SEN	Norrköping	58.58	398.1	405.3	6.3	6.9
DEP	Potdsam	52.36	451.0	440.0	6.8	6.7
DEL	Lindenberg	52.21	470.3	456.3	7.5	6.7
NLB	Bilthoven	52.12	428.6	430.4	6.3	6.7
CRH	Hradec Kralove	50.18	475.0	500.1	6.3	6.3
GRT	Thessaloniki	40.63	720.0	832.2	6.2	4.9

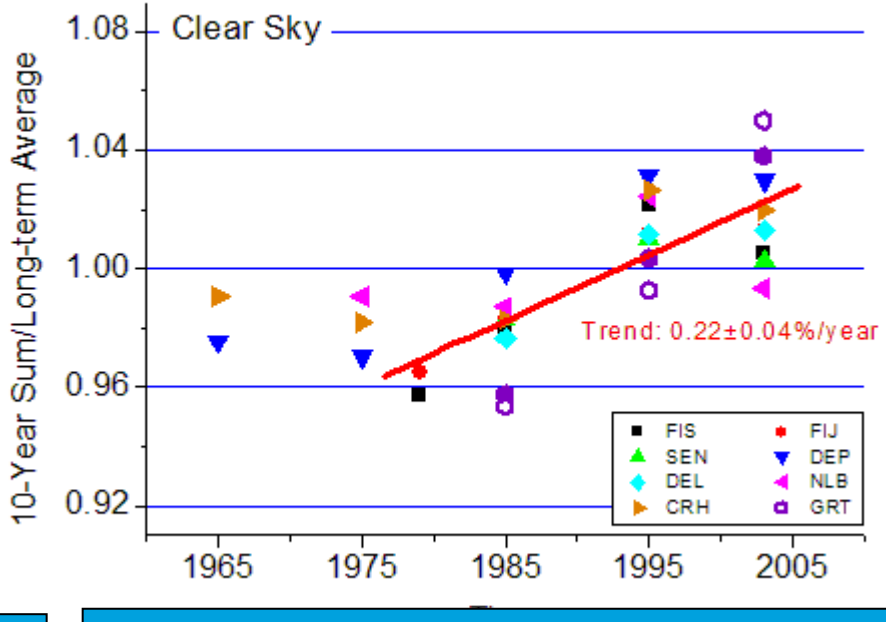
10-year averages





10-year averages





Average: 0.96 ± 0.02 (yrs <1980)

1.03 ± 0.03 (yrs>1980)

Average: 0.98 ± 0.02 (yrs <1980)

1.02 ± 0.02 (yrs>1980)

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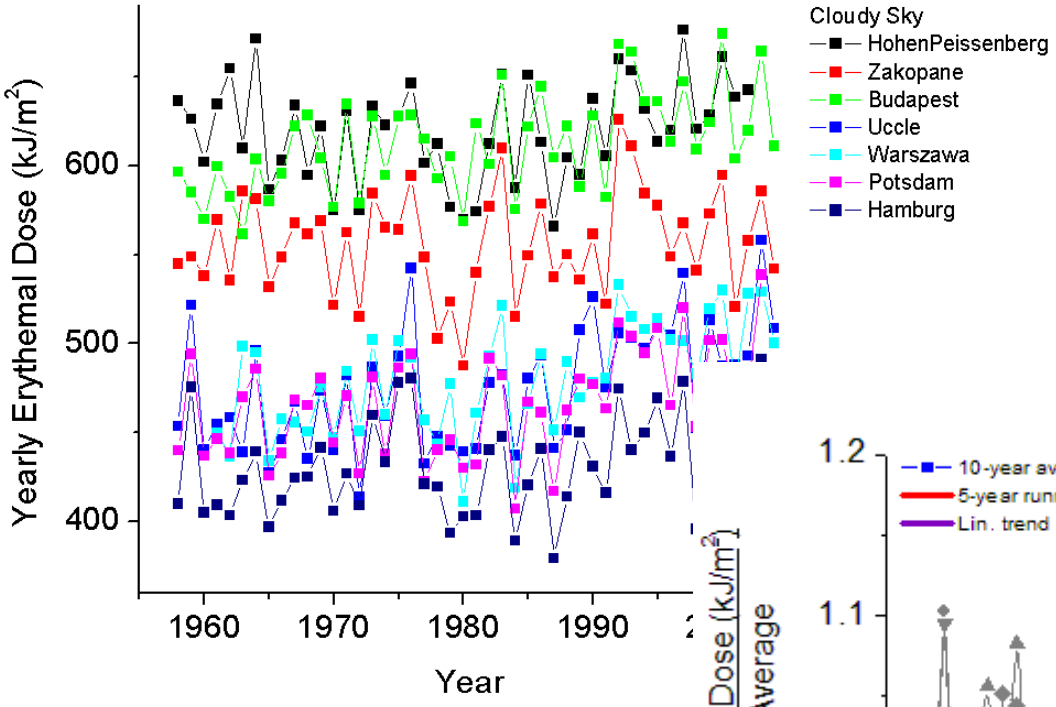
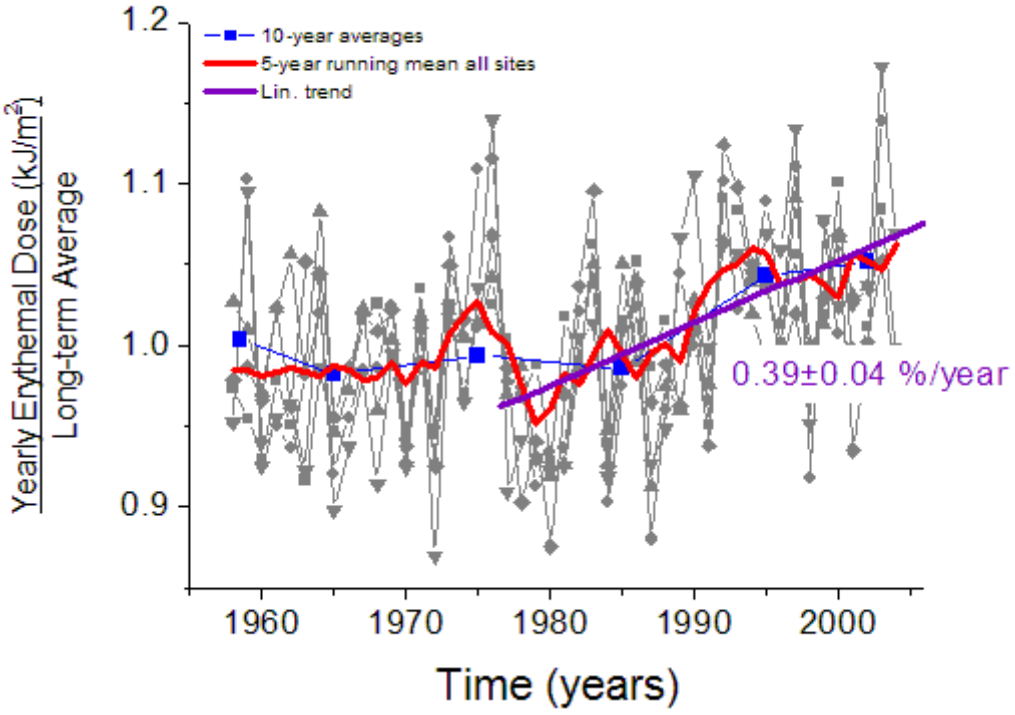
COST Ozone

COST CMF

Reconstruction for a number of central European sites





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Averaged year sums and % variability

Site	Lat. North (Deg.dec)	Year Sum (kJ/m2)	Variability %
Sodankylä	67.36	286.5	6.0
Jokioinen	60.81	374.7	5.3
Norrköping	58.58	410.9	5.6
Potdsam	52.36	461.5	6.2
Hamburg	52.36	461.5	6.2
Warszawa	52.30	480.5	6.4
Lindenberg	52.21	476.8	5.9
Bilthoven	52.12	434.2	6.3
Uccle	50.80	475.9	7.2
Hradec Kralove	50.18	484.9	5.4
Zakapone	49.30	556.5	5.2
Hohenpeisenberg	47.80	619.7	4.6
Budapest	47.40	612.5	4.5
Thessaloniki	40.63	751.7	5.0

OZONE

CMF_{UV}

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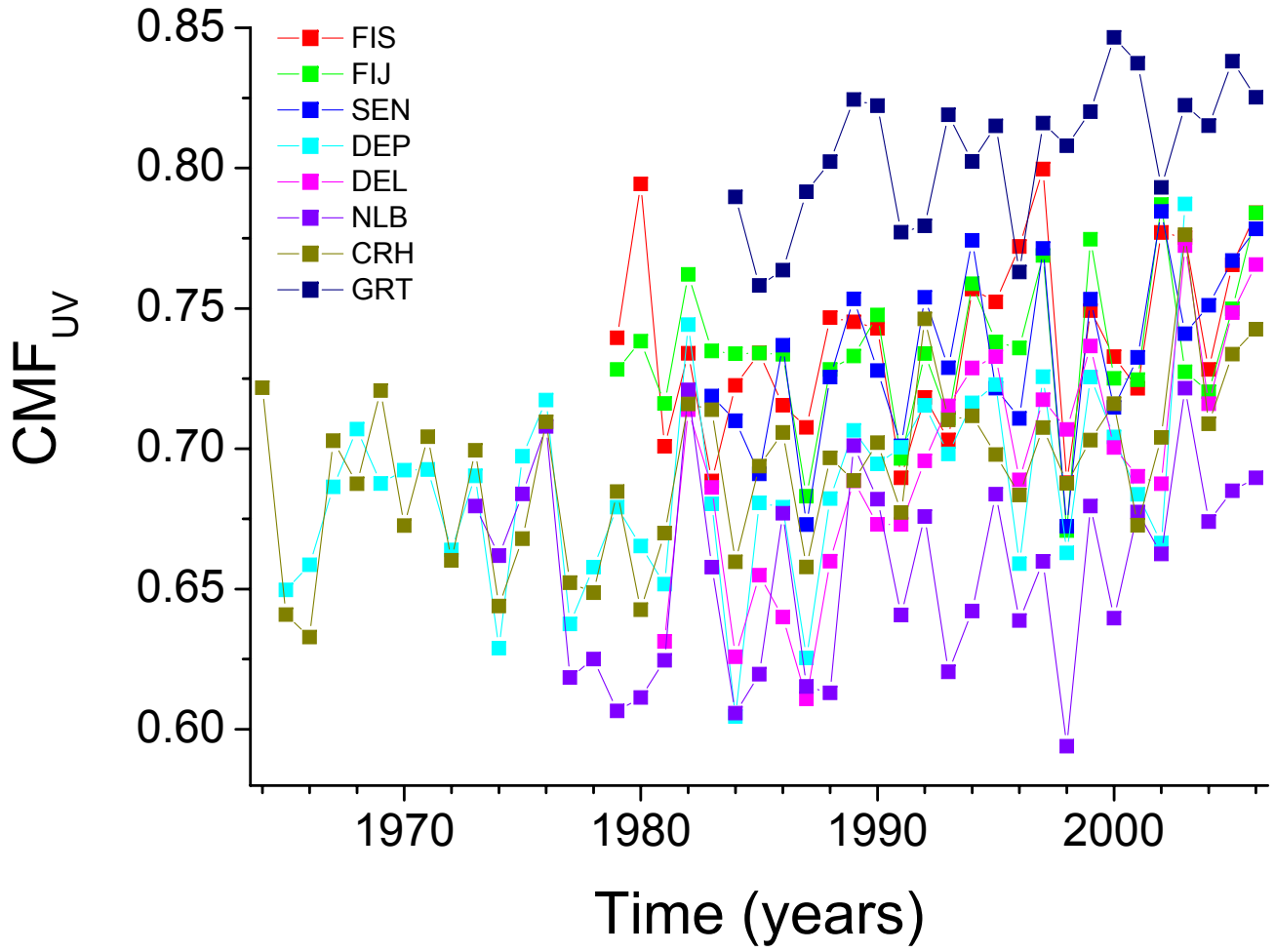
Cloud impact on yearly erythemal UV sum



Site	ave.	Sigma
GRT	0.806	± 0.025
FIS	0.739	± 0.032
FIJ	0.735	± 0.027
SEN	0.733	± 0.031
DEL	0.695	± 0.041
CRH	0.692	± 0.031
DEP	0.685	± 0.035
NLB	0.656	± 0.035

Conclusions

- Yearly UV erythemal dose range from 300kJ/m^2 @lat. 67^o to 700 kJ/m^2 @lat. 41^o, with year-to-year variability of 6-8%, variability determined by COST-data somewhat lower.
- Ground-based modelling show increase of UV since eighties of 0.4-0.5%/year. COST-data set and G.B. modelled
- Cloud impact on yearly UV largest in NL ($\overline{CMF}$=0.66), and smallest in GR ($\overline{CMF}$=0.81).
  Cloud impact diminishing found for years>1979, CMF increases with approx. 0.020 ± 0.008/decade.

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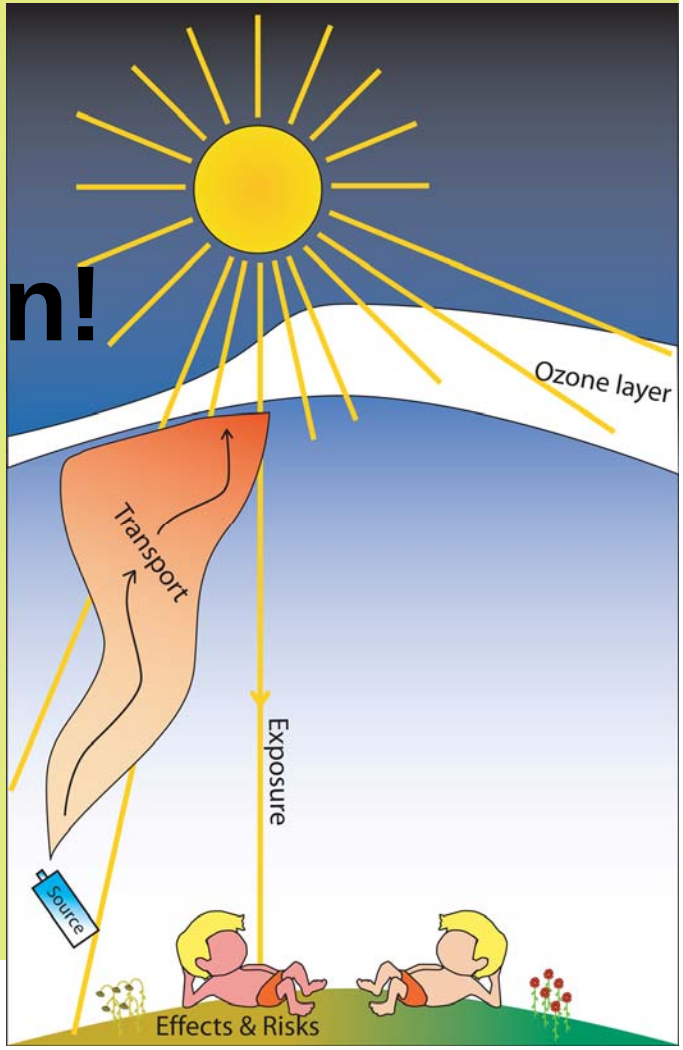
Thanks for the attention!



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