Cloud Information derived from NCAR/NOAA Reanalysis-1 Data Base: Comparison with the Real Data

Janusz W. Krzyścin

Institute of Geophysics, Polish Academy of Sciences

WG 1 & WG2 Core Group Meeting, Brussels, 29-30 January 2007

Institute of Geophysics
Polish Academy of Sciences
Warsaw, Poland

CONTENT of NCAR/NOAA DATA BASE
for the purpose of COST-726 Action

- Resolution: 2.5° x 2.5° over the globe
- Time: Start - January 1948 ; End - one month lag present month
- Surface Global Irradiance mean for:

  0-6 hr, 6-12 hr, 12-18 hr, 18-24 hr GMT
- Cloud Cover for High-, Mid-, and Low- level Clouds:

  0-6 hr, 6-12 hr, 12-18 hr, 18-24 hr GMT
- Data format: originally .grib

  converted to .txt for the COST-726 grid (1.25° x 1.0°) since Jan. 1950

Institute of Geophysics
Polish Academy of Sciences
Warsaw, Poland

Cloud Modification Factor (CMF)
from the data base and observations (Belsk, Potsdam, Bergen)

CMF_{UV} = function (CMF_{TOTAL} , ...)

CMF_{TOTAL} = Glob_Irradiance/Global_Irradiance_Clear

CMF_{TOTAL} Comparison

- Interpolation from the data base to the station sites
- Time: January 1966 – October 2006, Belsk
  January 1950 – December 2003, Potsdam
  April 1965 – December 2003, Bergen
- Calculation of clear-sky value of daily irradiance:
  smoothed yearly profile from daily extremes
- CMF= daily sum of global irradiance/clear-sky representative

Two ways of calculation of CMF from the data base

1- directly from the data base

2- recalculation of CMF using regression of observed CMF on the data base cloud cover at various levels

Institute of Geophysics
Polish Academy of Sciences
Warsaw, Poland

Cloud Modification Factor (CMF)
from the data base and observations (Belsk, Potsdam, Bergen)

Belsk –

wide lowland

Potsdam -

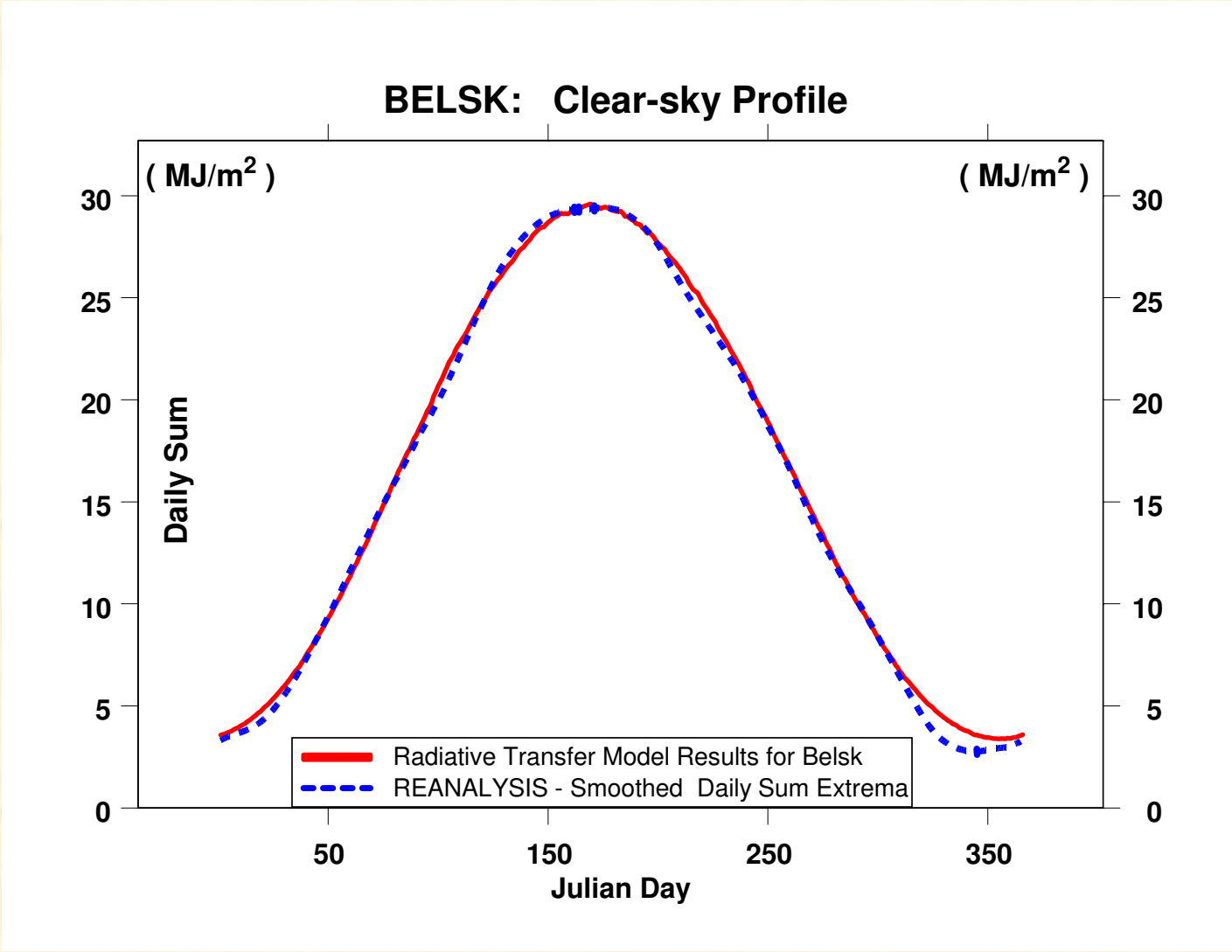
large city

Bergen –

mountains + ocean

Institute of Geophysics
Polish Academy of Sciences
Warsaw, Poland

Seasonal Clear-Sky Profie

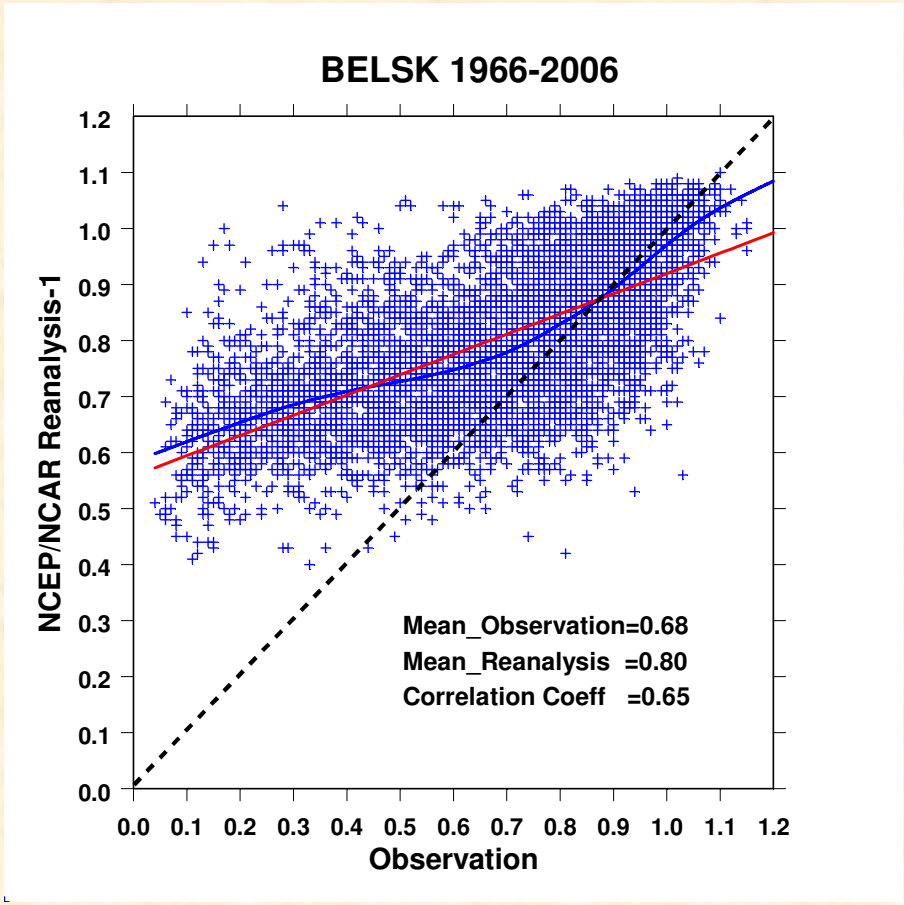


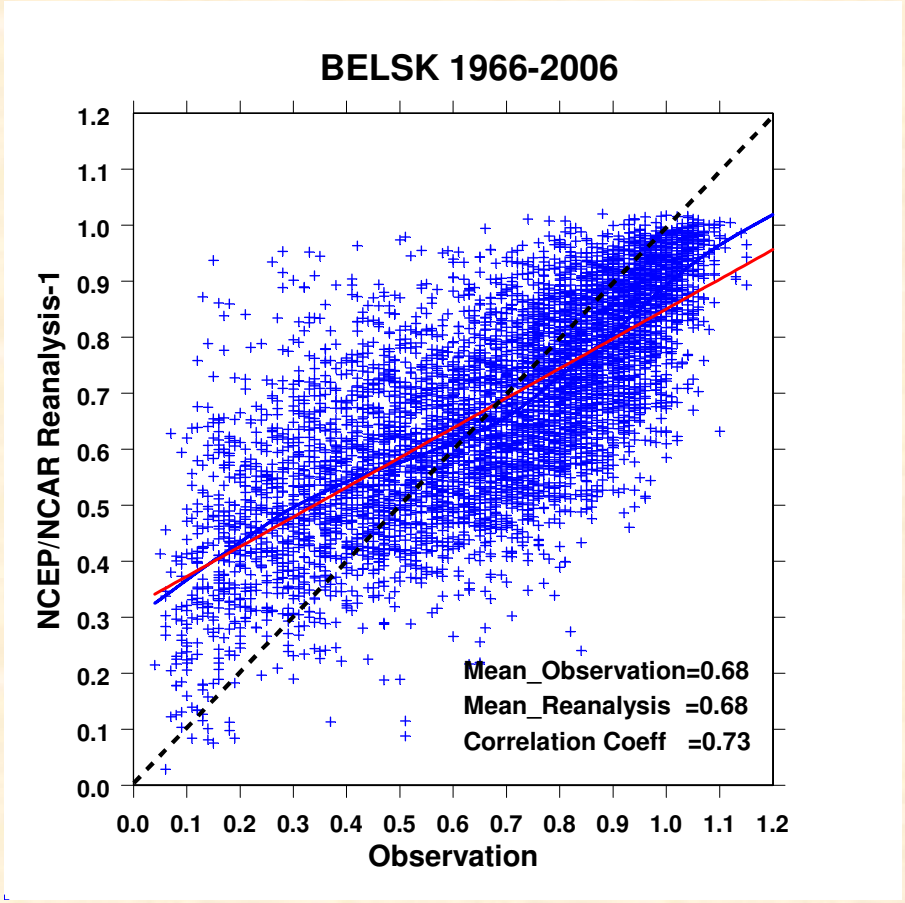
Institute of Geophysics
Polish Academy of Sciences
Warsaw, Poland

CMF$_{TOTAL}$: Daily Values: Scatter Plot – Warm Period

Global Irradiance from data base

Recalculated Global Irradiance from the cloud cover data base



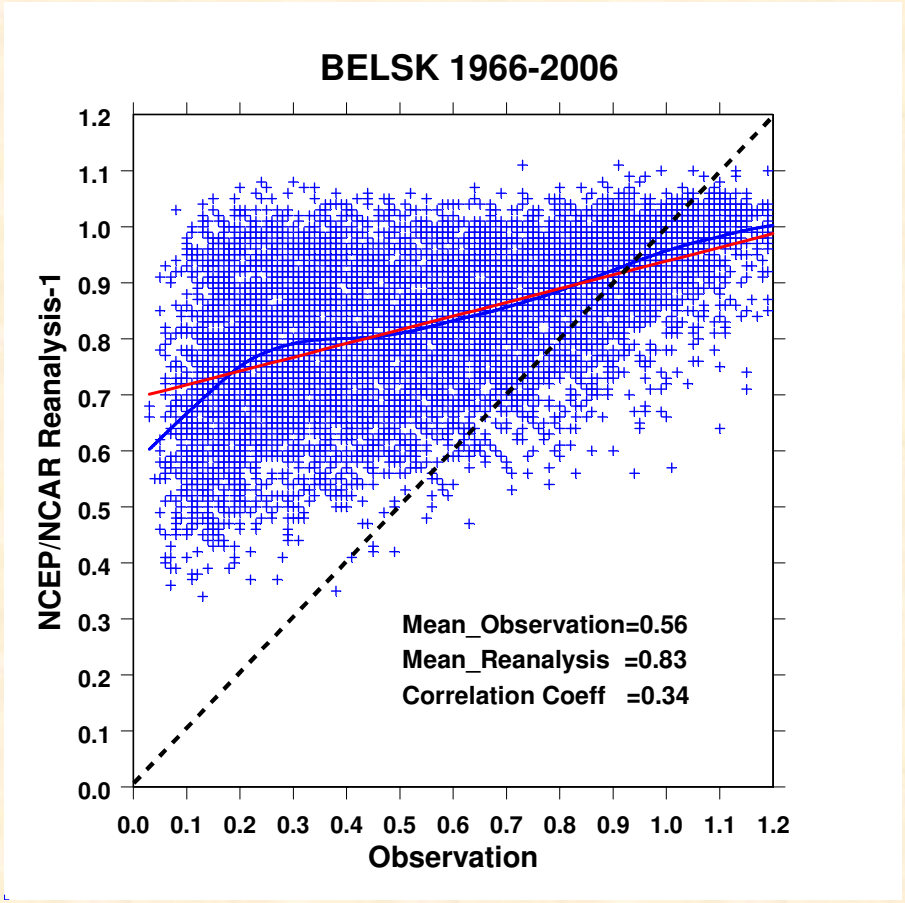


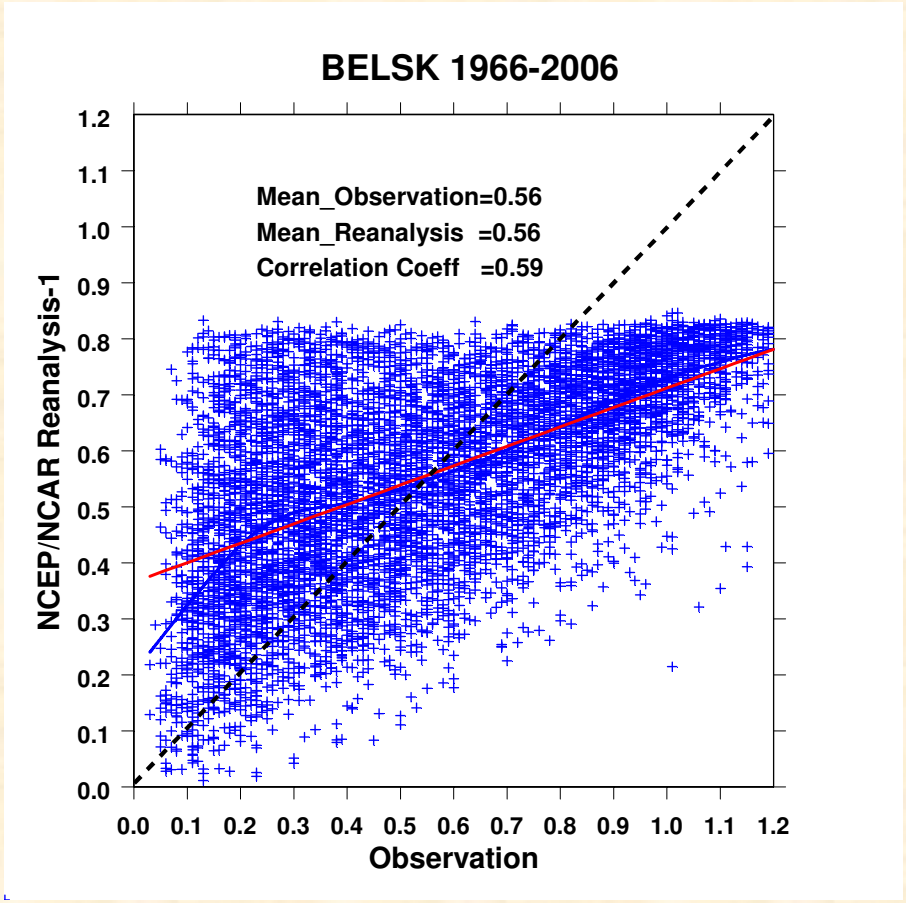
Institute of Geophysics
Polish Academy of Sciences
Warsaw, Poland

CMF$_{TOTAL}$: Daily Values: Scatter Plot – Cold Period

Global Irradiance from data base

Recalculated Global Irradiance from the cloud cover data base

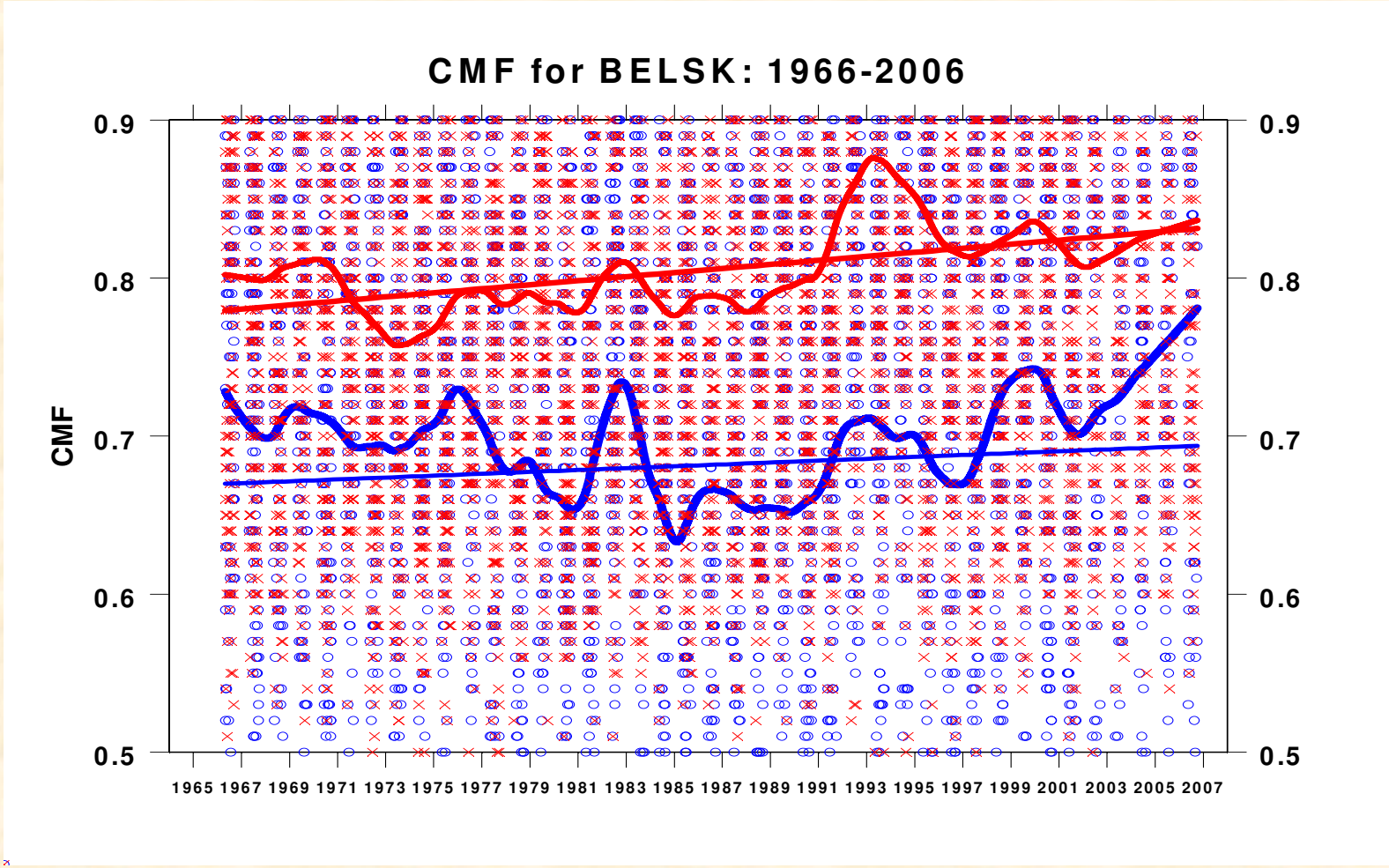




Institute of Geophysics
Polish Academy of Sciences
Warsaw, Poland

CMF$_{TOTAL}$: Daily Values: Time Series – Warm Period

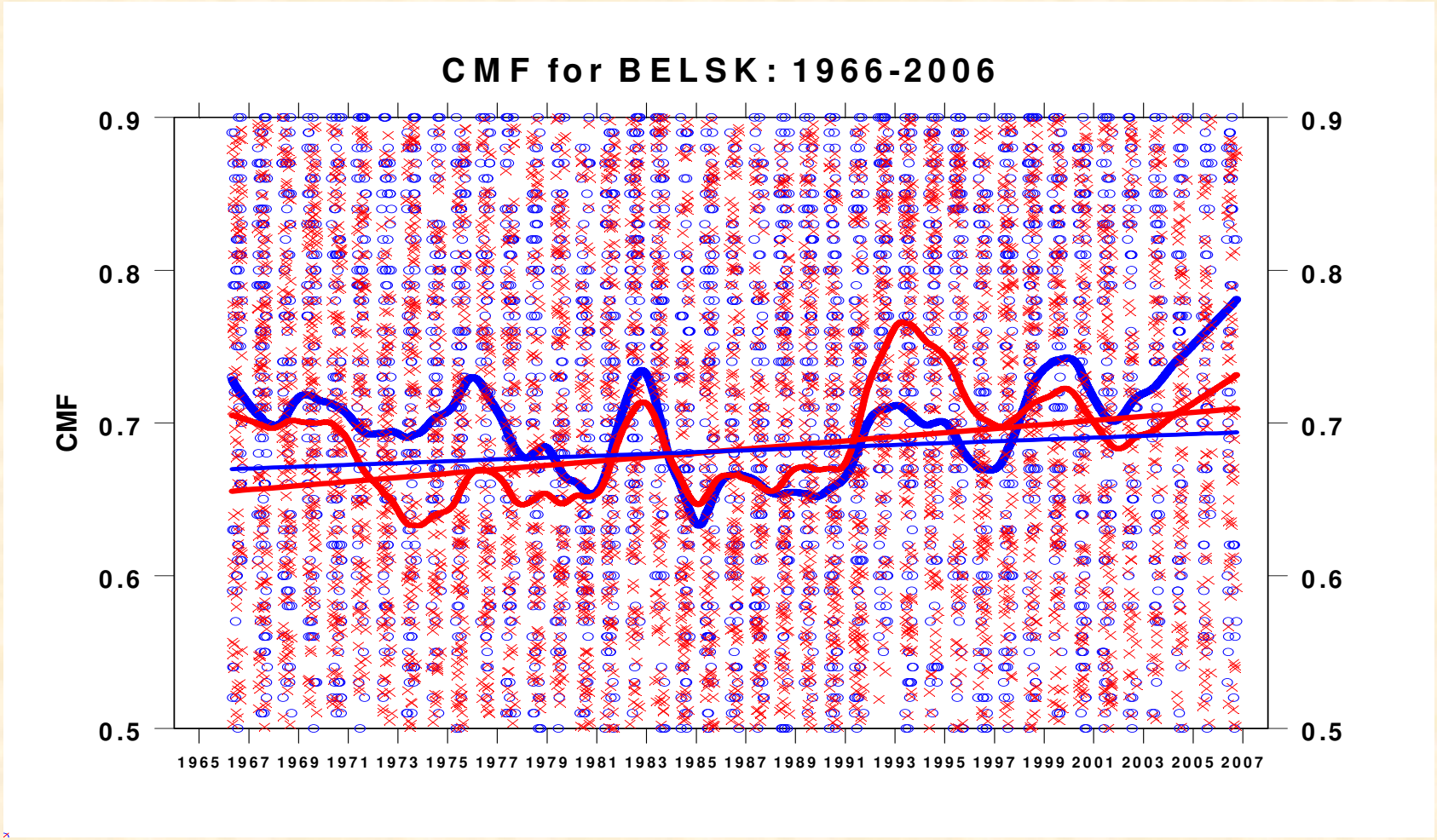
Global Irradiance from data base



Institute of Geophysics
Polish Academy of Sciences
Warsaw, Poland

CMF$_{TOTAL}$: Daily Values : Time Series – Warm Period

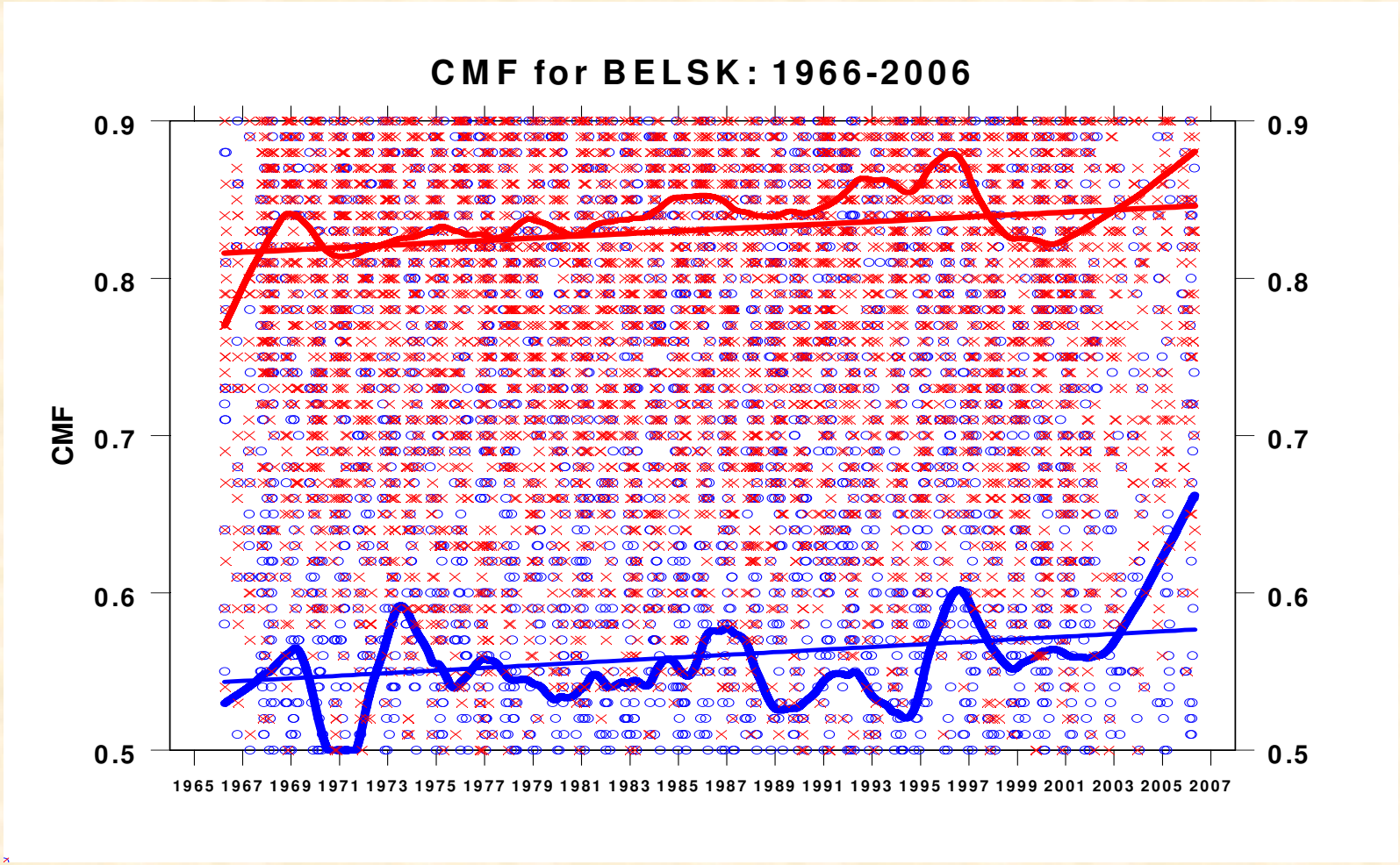
Recalculated Global Irradiance from the cloud cover data base



Institute of Geophysics
Polish Academy of Sciences
Warsaw, Poland

CMF$_{TOTAL}$: Time Series – Cold Period

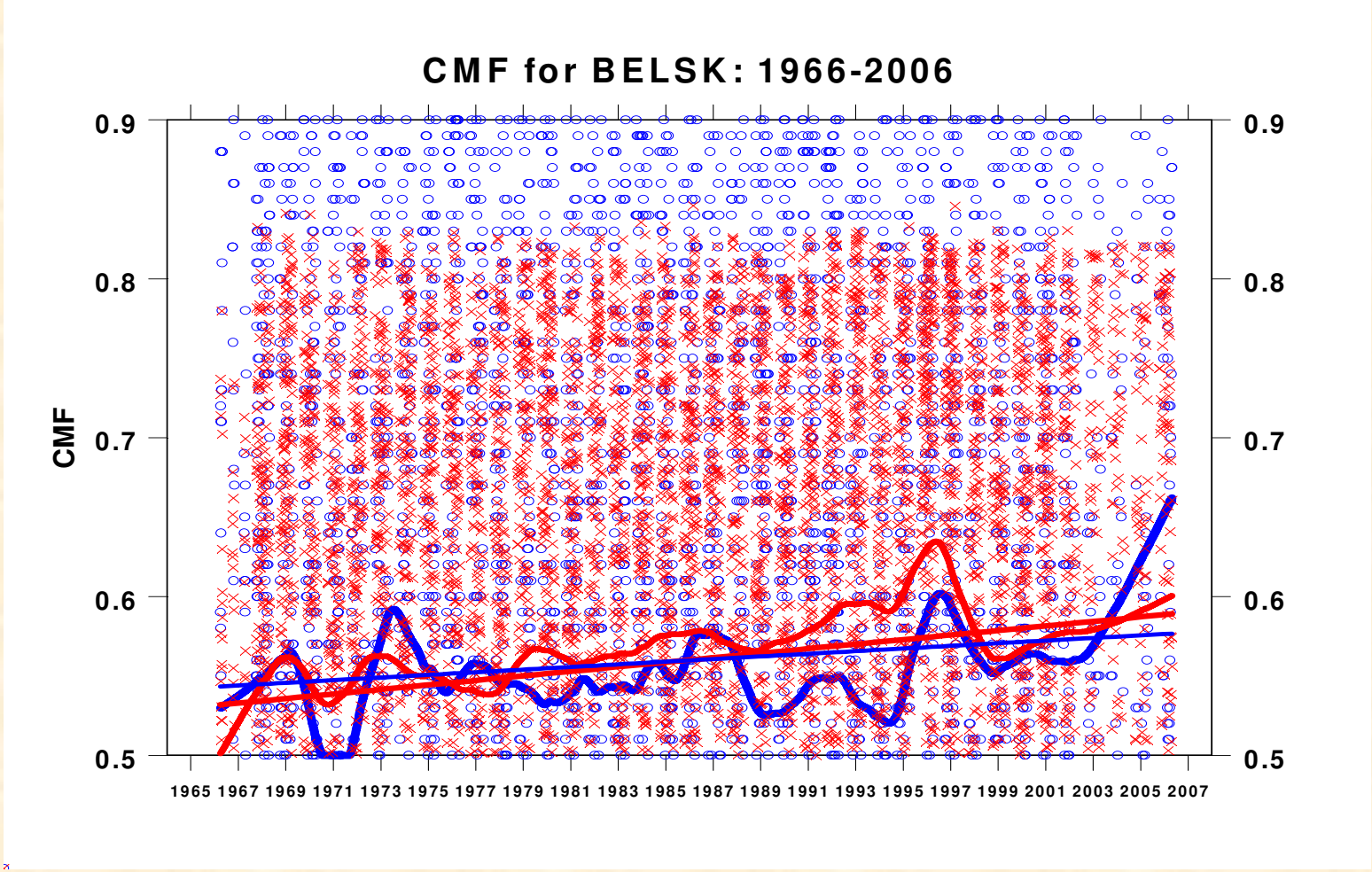
Global Irradiance from data base



Institute of Geophysics
Polish Academy of Sciences
Warsaw, Poland

CMF$_{TOTAL}$: Daily Values :Time Series – Cold Period

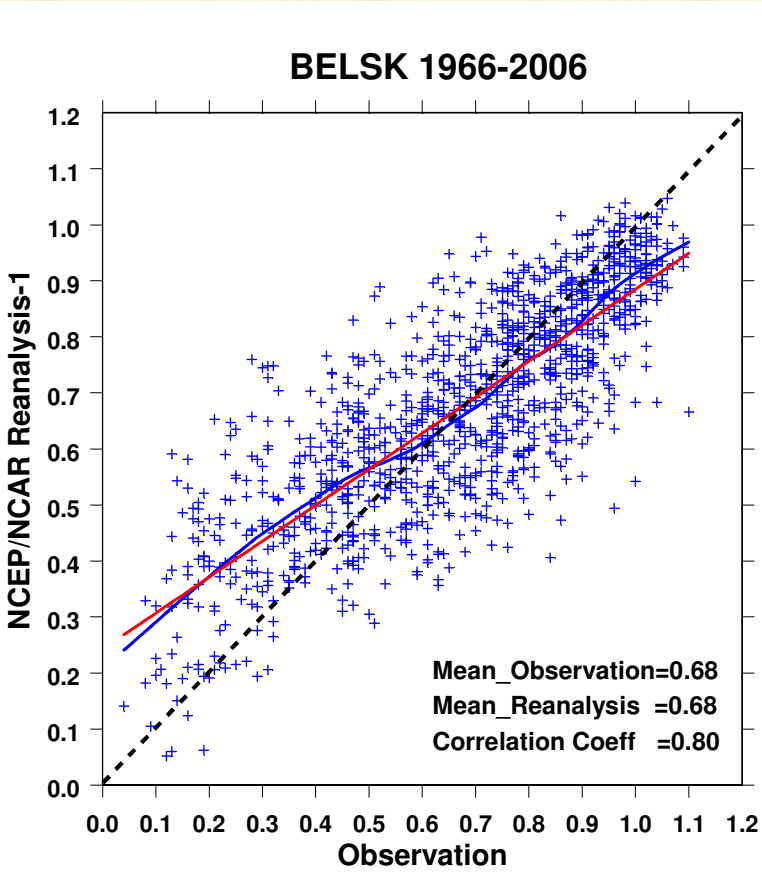
Recalculated Global Irradiance from the cloud cover data base



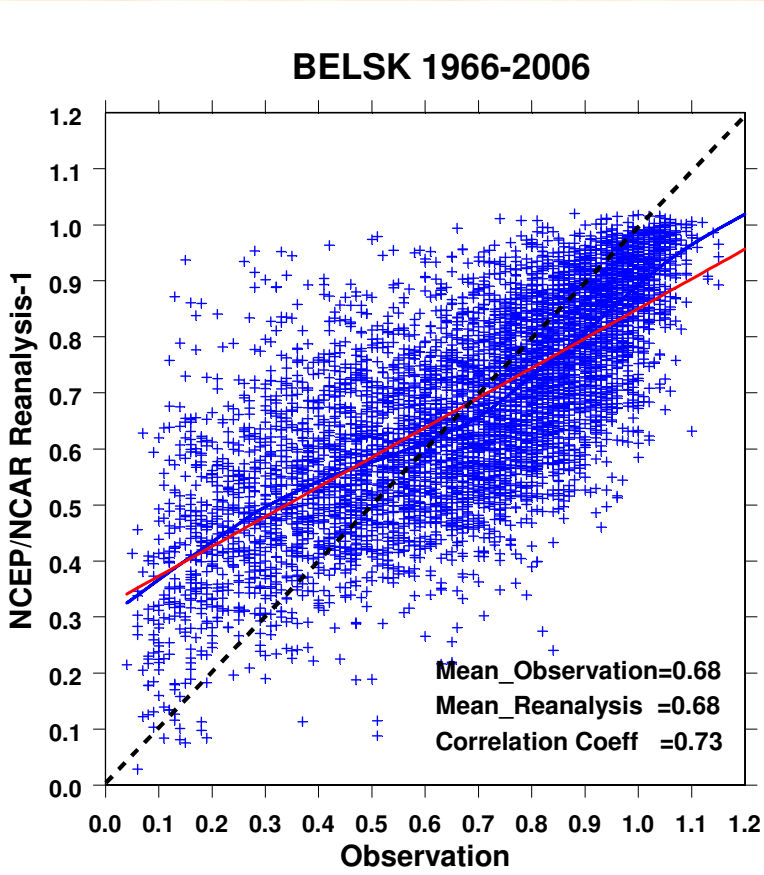
Institute of Geophysics
Polish Academy of Sciences
Warsaw, Poland

CMF$_{TOTAL}$: Daily Values: Scatter Plot – Warm Period

Recalculated (Nonlinear Regression)
Global Irradiance for June
from the cloud cover data base



Recalculated (Ordinary Regression)
Global Irradiance for MAY-SEP.
from the cloud cover data base



Institute of Geophysics
Polish Academy of Sciences
Warsaw, Poland

Correlation Coefficients between measured and model CMF_{TOTAL}

Daily Data

Station	CMF **directly**	CMF **recalculated**
Belsk	0.65	0.73
Bergen	-0.07	0.15
Potsdam	0.32	0.44

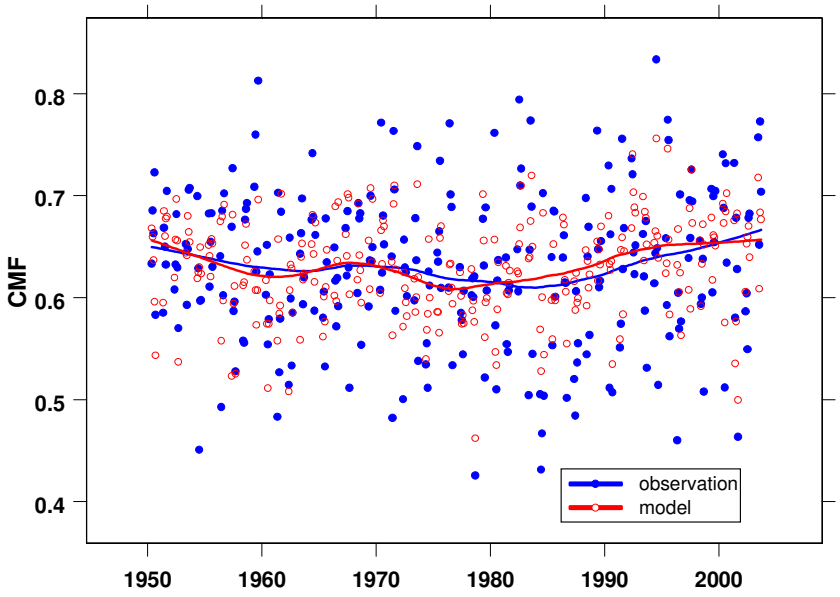
Monthly mean data

Station	CMF **directly**	CMF **recalculated**
Belsk	0.67	0.78
Bergen	-0.17	0.46
Potsdam	0.53	0.65

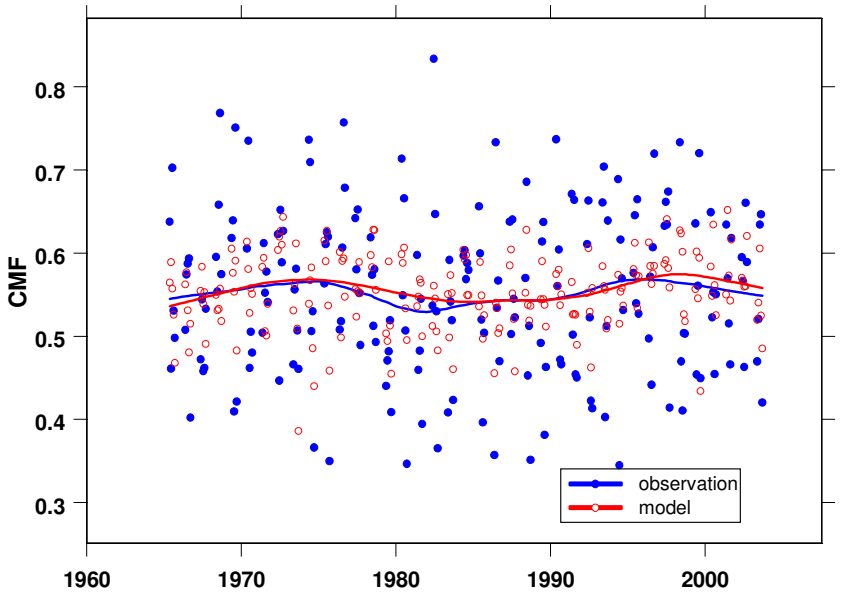
Institute of Geophysics
Polish Academy of Sciences
Warsaw, Poland

Measured and Modeled Monthly CMF_{Total} – WARM PERIOD

Potsdam



Bergen



Institute of Geophysics
Polish Academy of Sciences
Warsaw, Poland

Conclusions

- Bias (overestimation) in CMF_{TOTAL} taken straightforwardly from the data base but long-term pattern is reproduced – need of recalculation of CMF_{TOTAL}
- Alternatively CMF_{TOTAL} values could be calculated from an ordinary regression of measured CMF_{TOTAL} on the cloud cover taken from the NCAR/NOAA data base

Suggestions for future COST-726 activity

Use the cloud cover data base and a statistical model to construct gridged CMF values over Europe (problem – selection of regression constants valid for all locations)

Repeat the calculation for stations providing long-term global radiation records and extend the CMF record back to January 1950