Potential use of the MSG derived UV climatology

COST726 WG1-WG2 meeting
Brussels, January 29-30, 2007

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The MSG derived climatology

It consists in daily erythemal dose maps
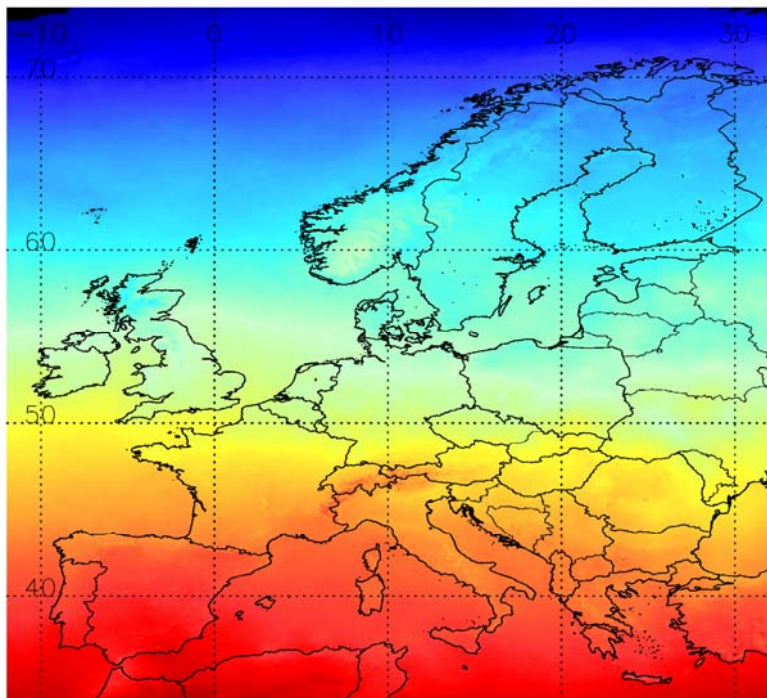
       - over Europe
       - from January 1st 1984
       - spatial resolution : 0.05 deg.
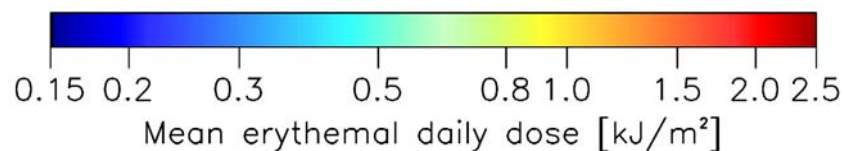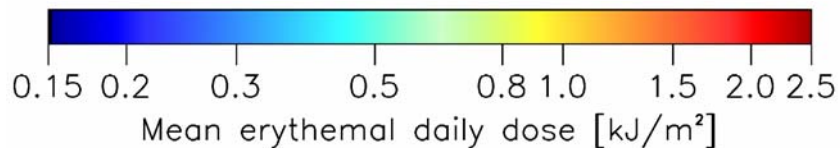
From which can be generated

       - monthly averaged daily dose maps
       **- "climatological average" daily dose maps for
         each month**

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Example : March

AVERAGE ERYTHEMAL DAILY DOSE IN MARCH

AVERAGE ERYTHEMAL DAILY DOSE IN MARCH 84

0.15 0.2   0.3   0.5   0.8 1.0   1.5 2.0 2.5
Mean erythemal daily dose [kJ/m²]

0.15 0.2   0.3   0.5   0.8 1.0   1.5 2.0 2.5
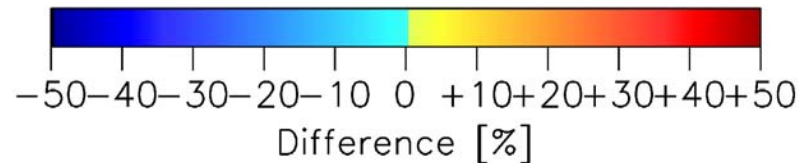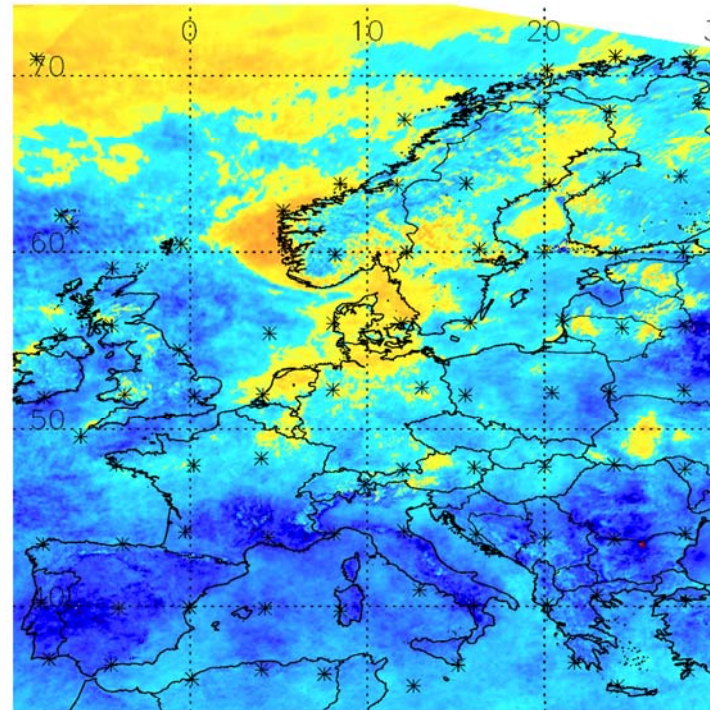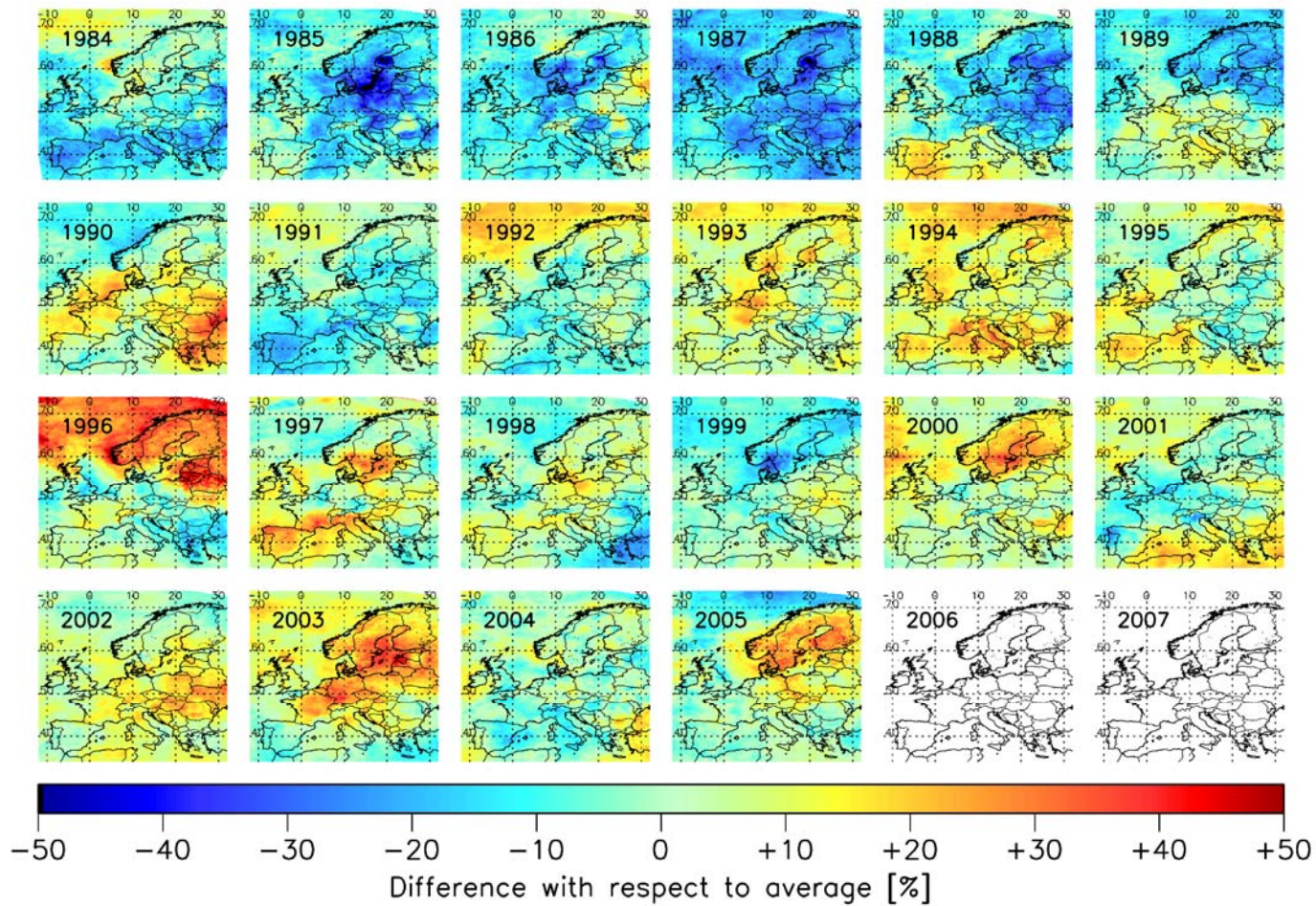Mean erythemal daily dose [kJ/m²]
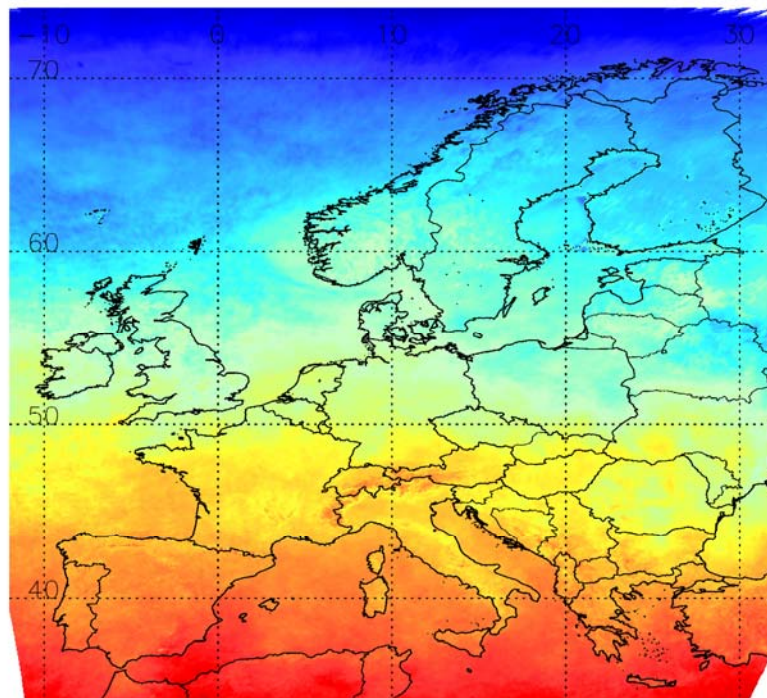
Difference (relative) between March 84 and the climatological average

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(SAT−CLIMAV)/SAT
MARCH 1984

Difference [%]

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Variability of erythemal dose over 22 years: March

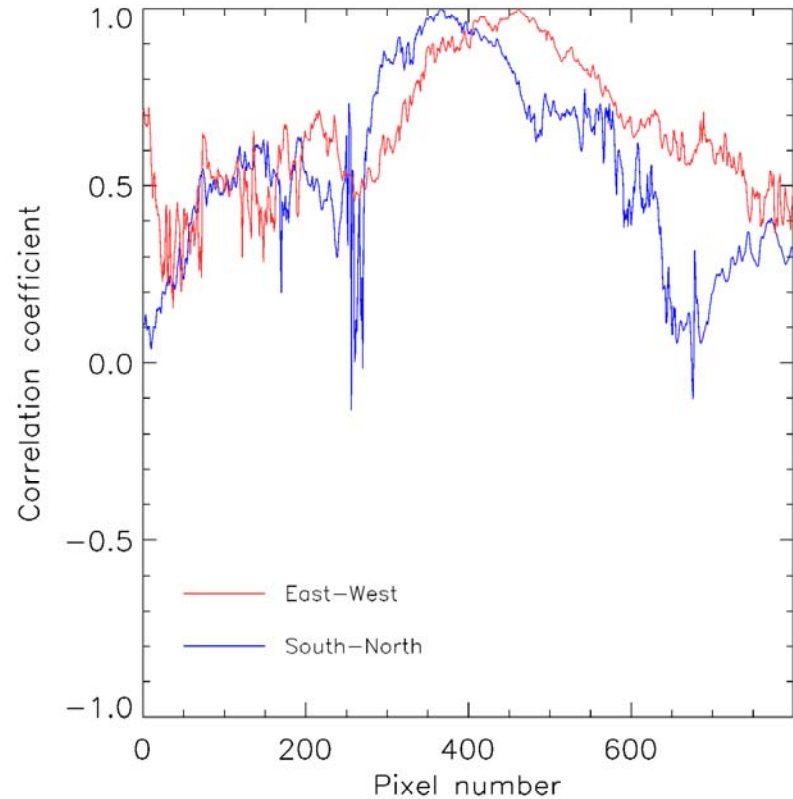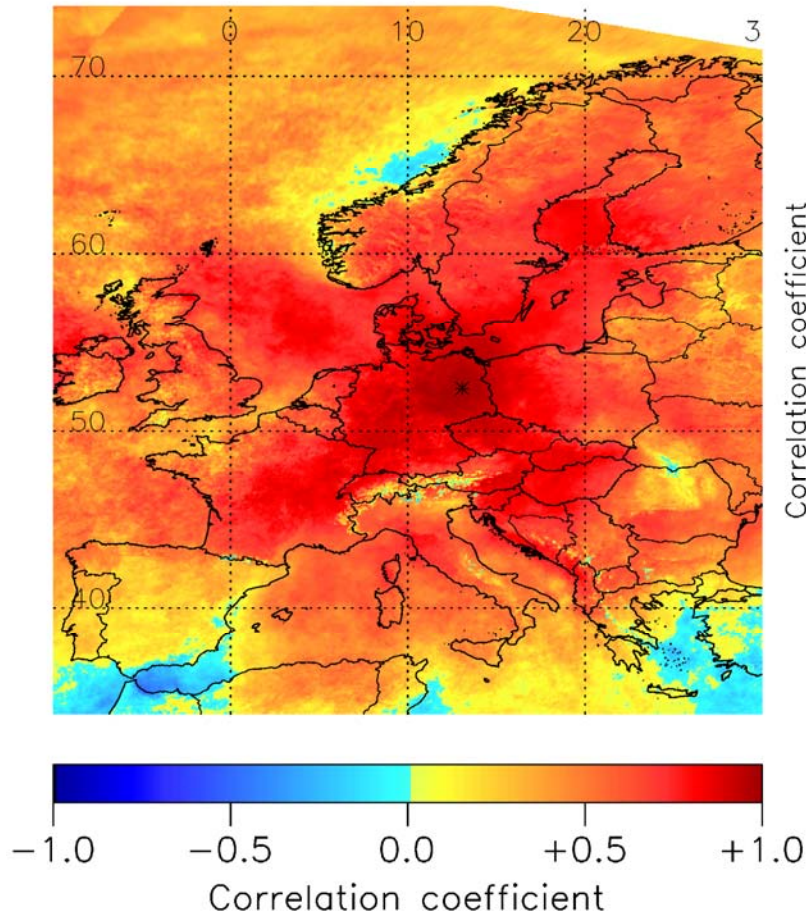DEVIATION OF THE MONTHLY AVERAGED ERYTHEMAL DAILY DOSE WITH RESPECT TO THE 1984-2005 MEAN (MARCH)

Difference with respect to average [%]

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To which extent is it possible to spatially interpolate

stations values to reconstruct a map of
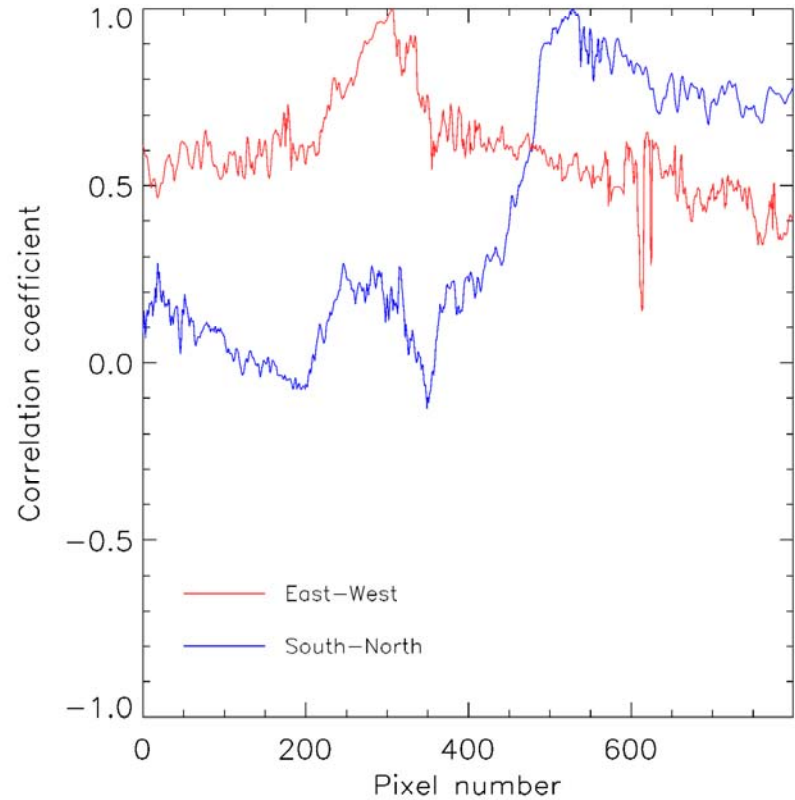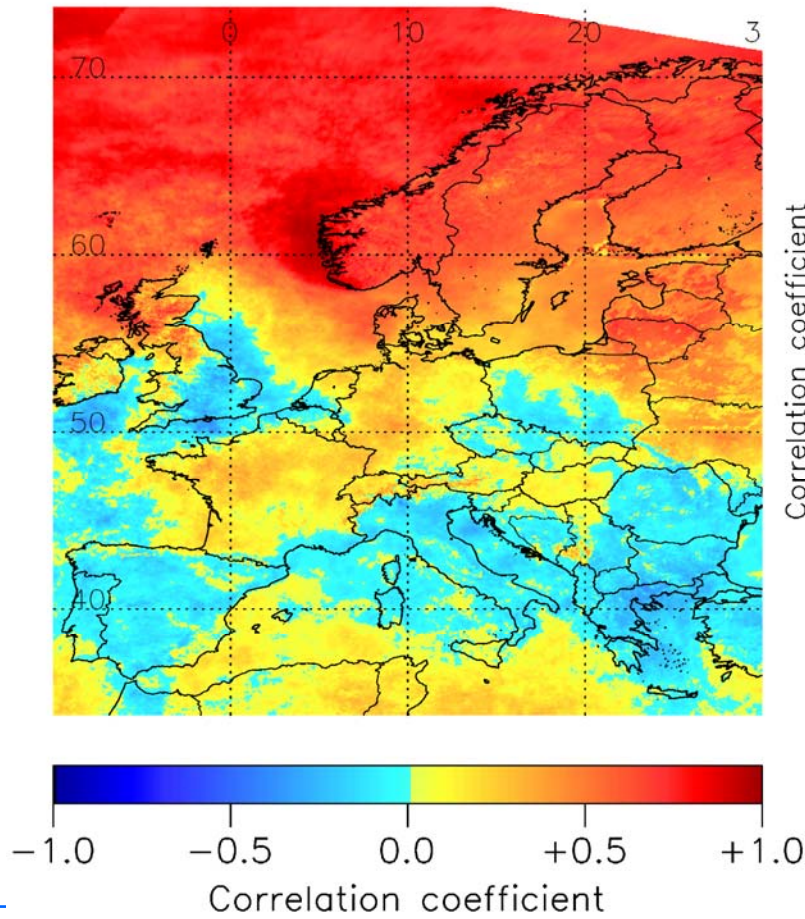
monthly averaged daily dose for a given year

?

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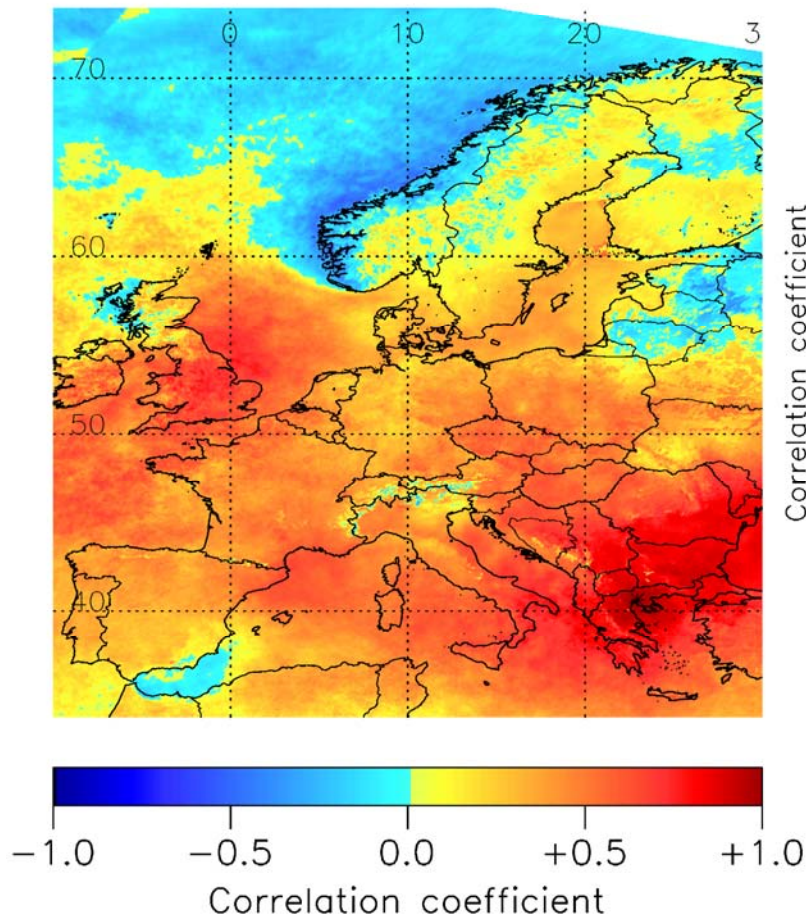RESEARCH
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Correlation pattern, Potsdam - March

SPATIAL CORRELATION COEFFICIENT, Potsdam MARCH

Correlation pattern, Bergen - March
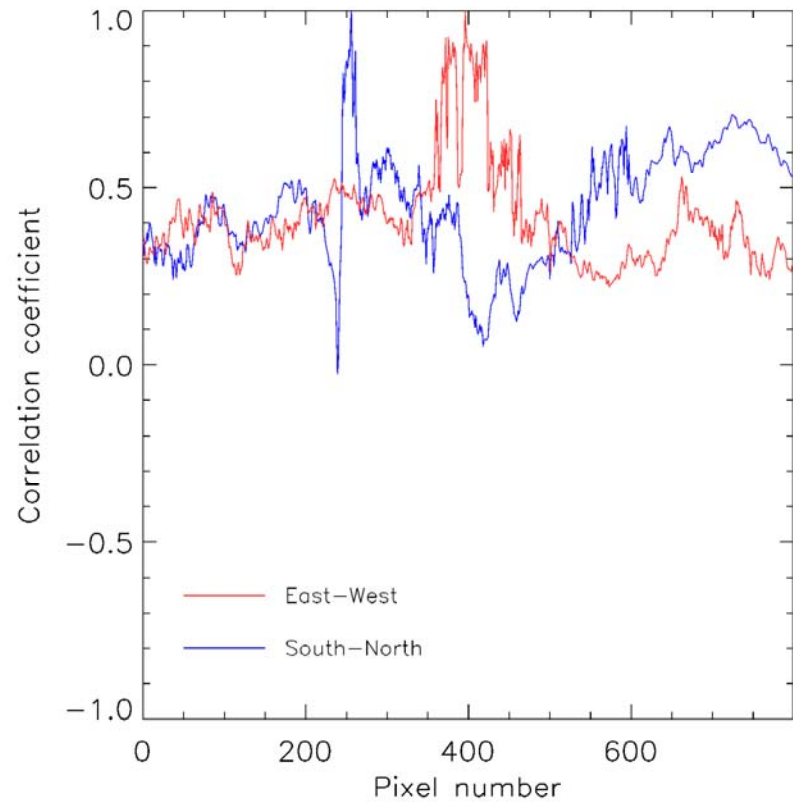

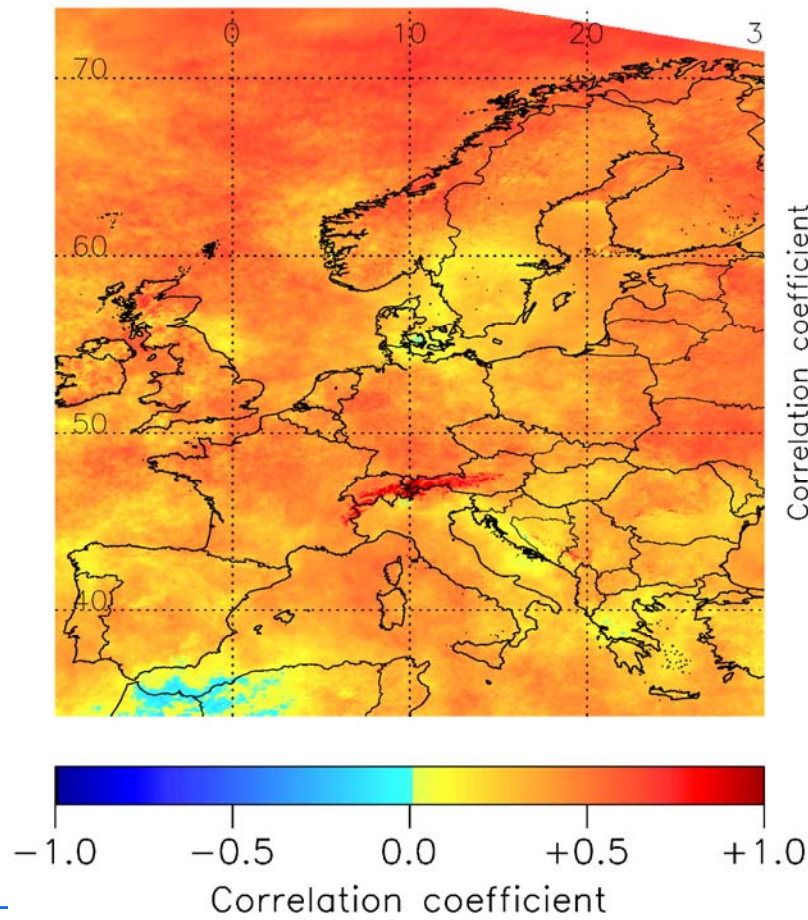SPATIAL CORRELATION COEFFICIENT, Bergen MARCH

Correlation pattern, Thessaloniki - March

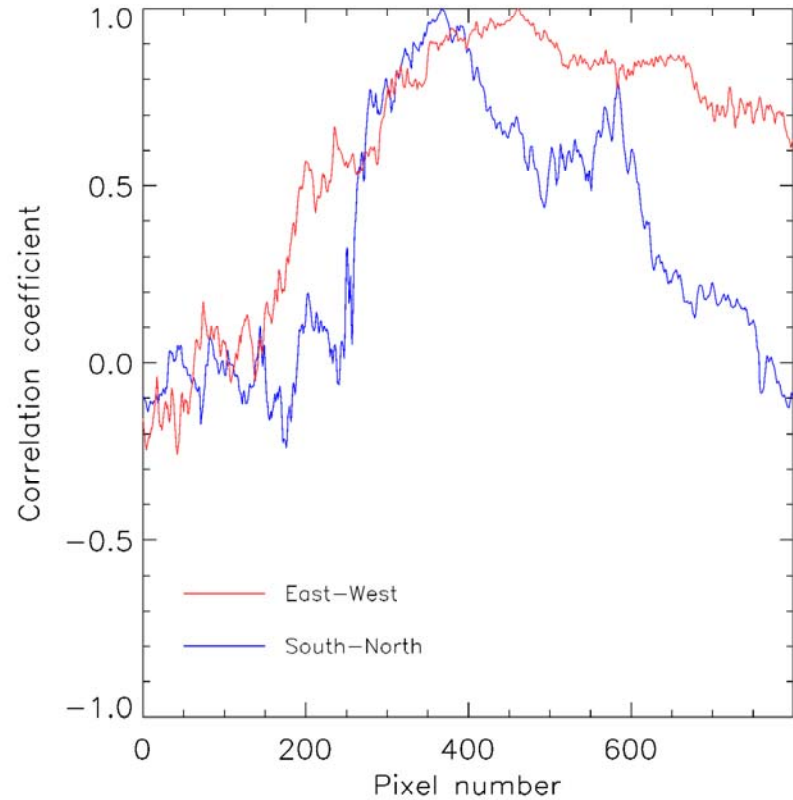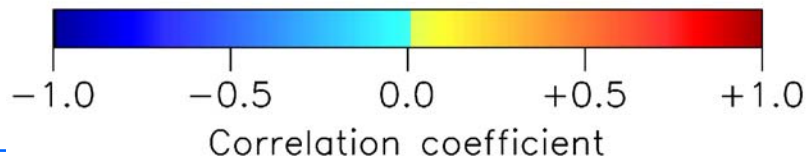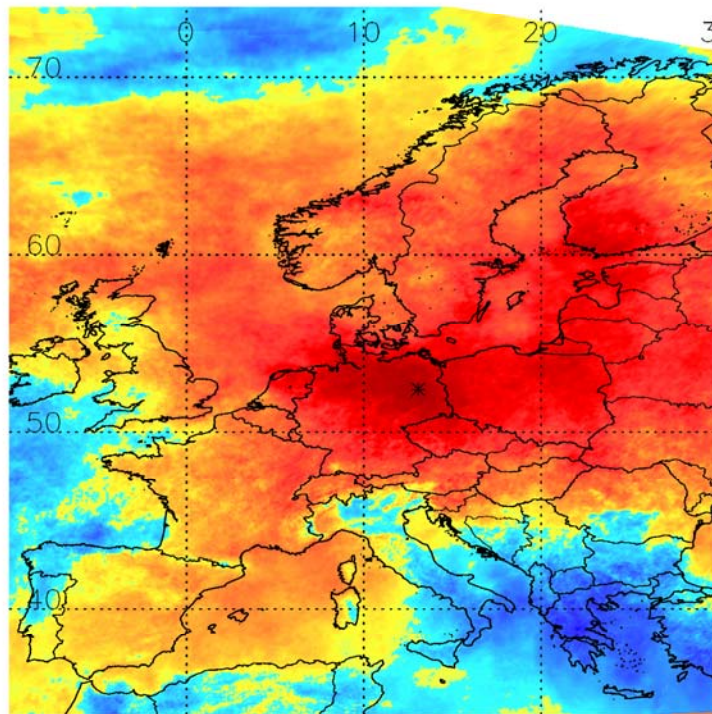SPATIAL CORRELATION COEFFICIENT, Thessaloniki MARCH
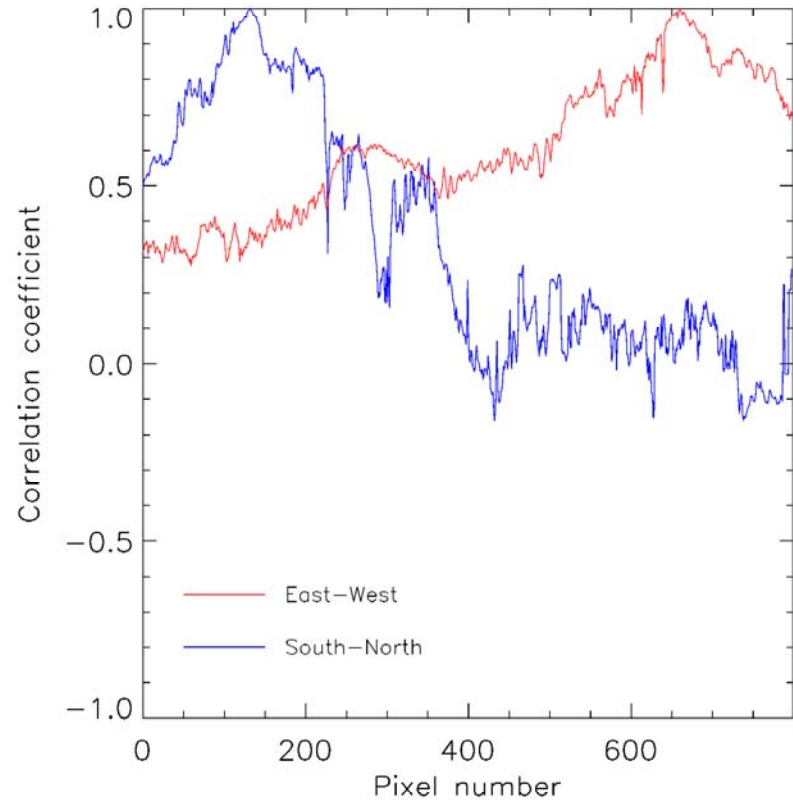
Correlation pattern, Davos - March

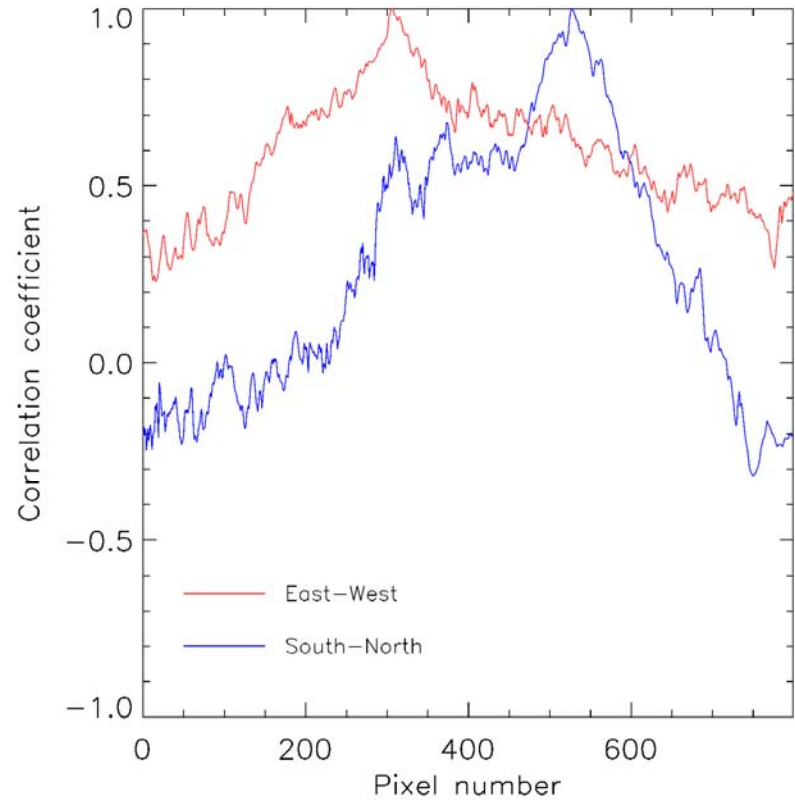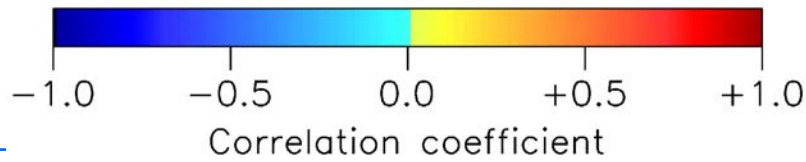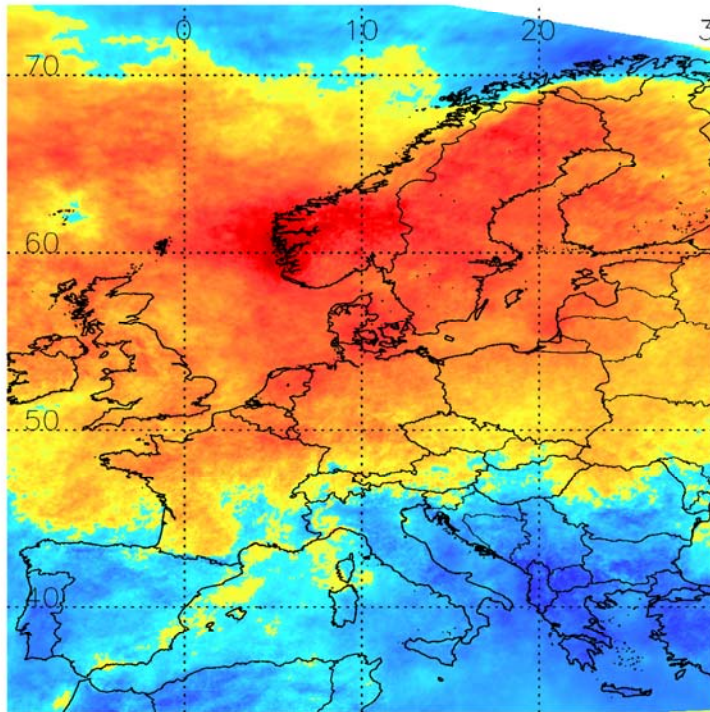SPATIAL CORRELATION COEFFICIENT, Davos MARCH

Correlation pattern, Potsdam - July
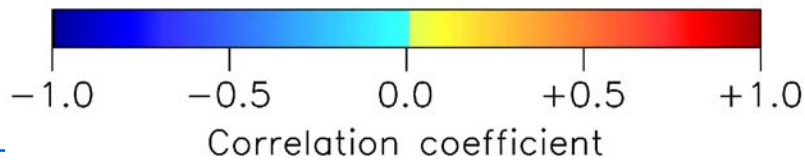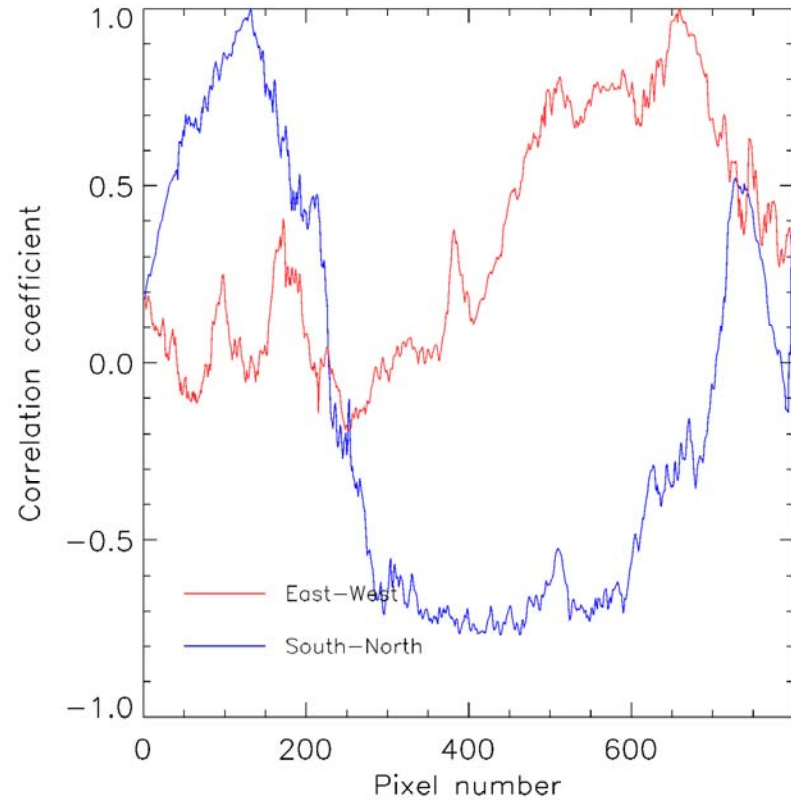

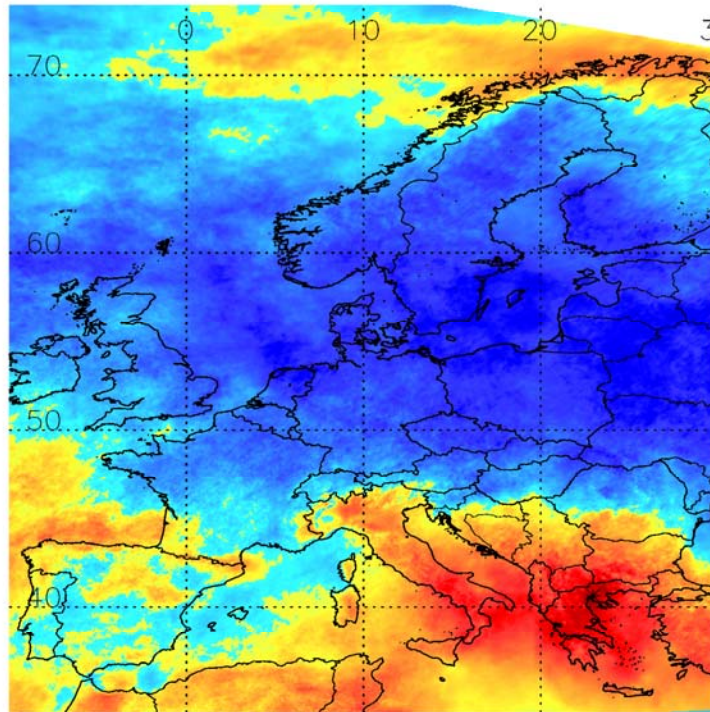SPATIAL CORRELATION COEFFICIENT, Potsdam JULY

Correlation pattern, Bergen - July
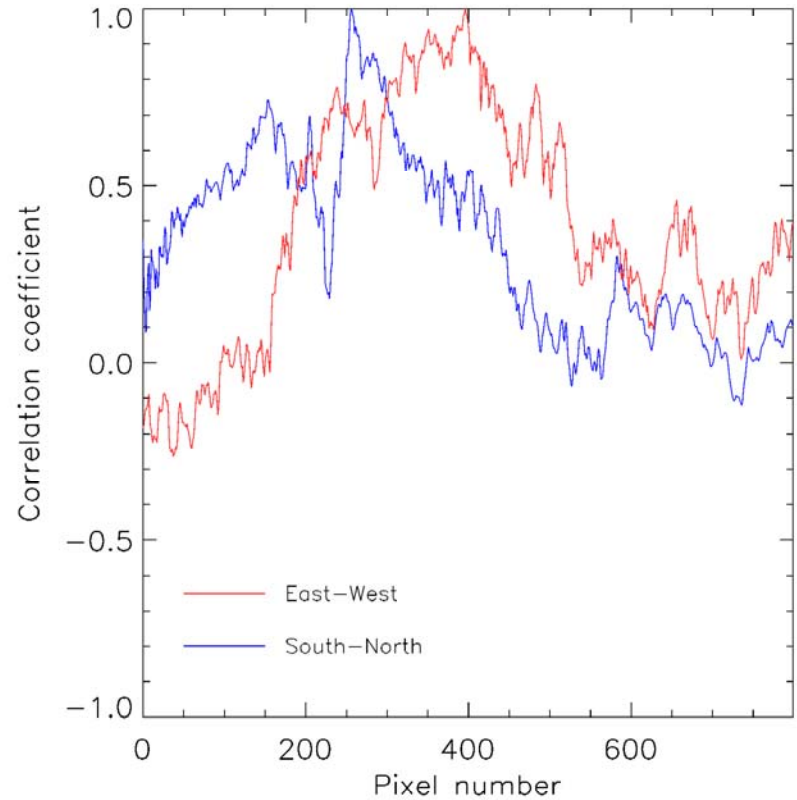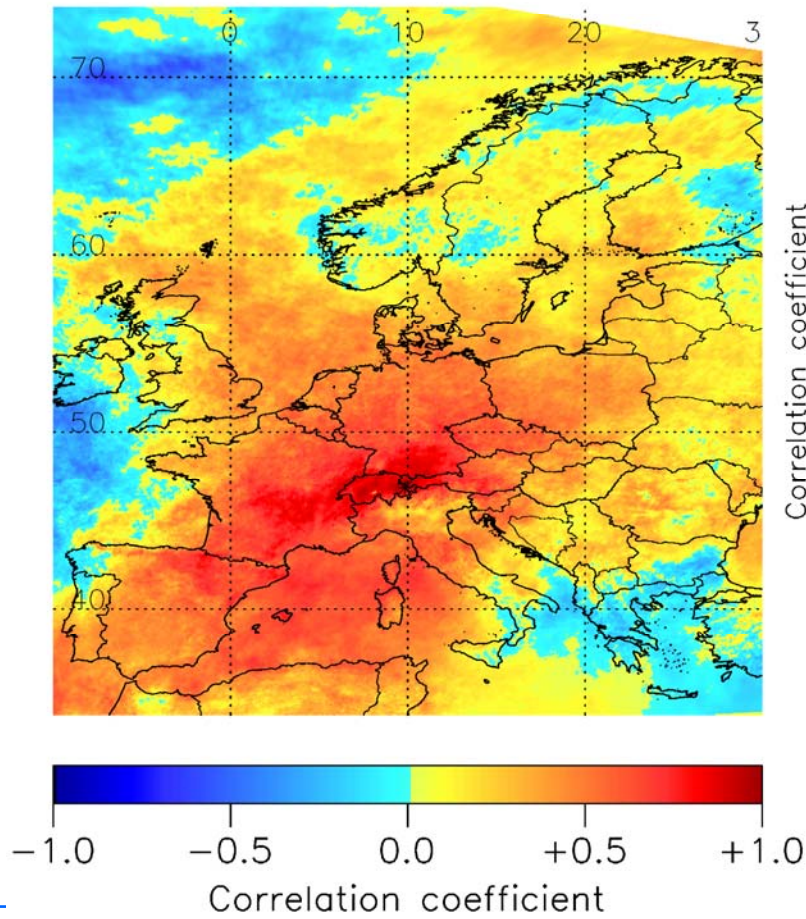

SPATIAL CORRELATION COEFFICIENT, Bergen JULY

Correlation pattern, Thessaloniki - July

SPATIAL CORRELATION COEFFICIENT, Thessaloniki JULY

Correlation pattern, Davos - July

SPATIAL CORRELATION COEFFICIENT, Davos JULY

Station interpolation: choice of stations

Selected area: 10W-30E   34N-74N

Divided in 4x4 deg. boxes

Select one station per box

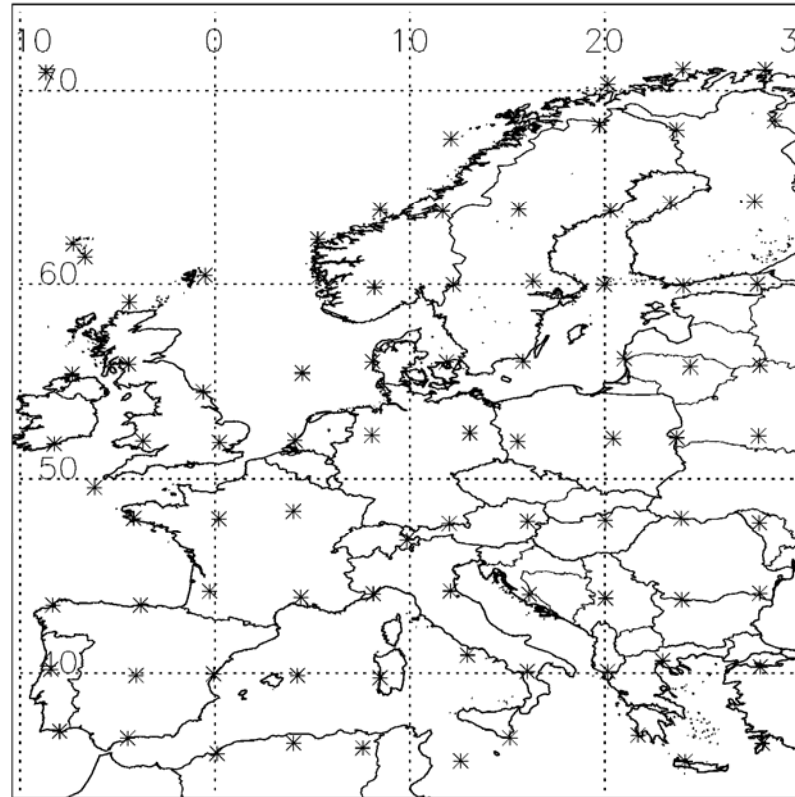   as close as possible from the box center

      using a database of real meteorological stations

   including Potsdam, Bergen, Thessaloniki and Davos

Result: 87 stations

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Station interpolation: choice of stations

STATIONS SELECTED FOR INTERPOLATION

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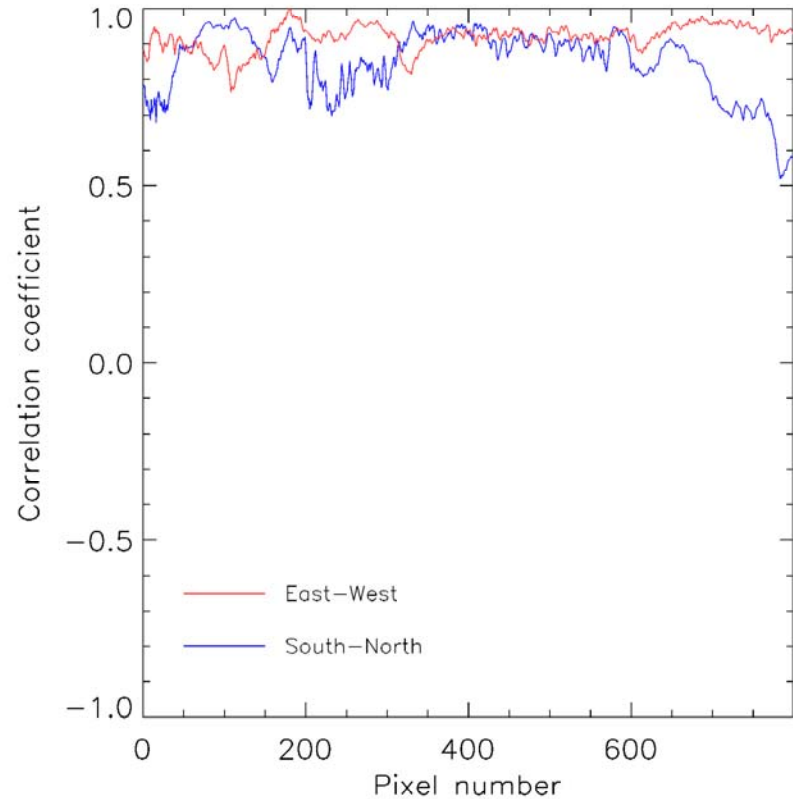
JOINT
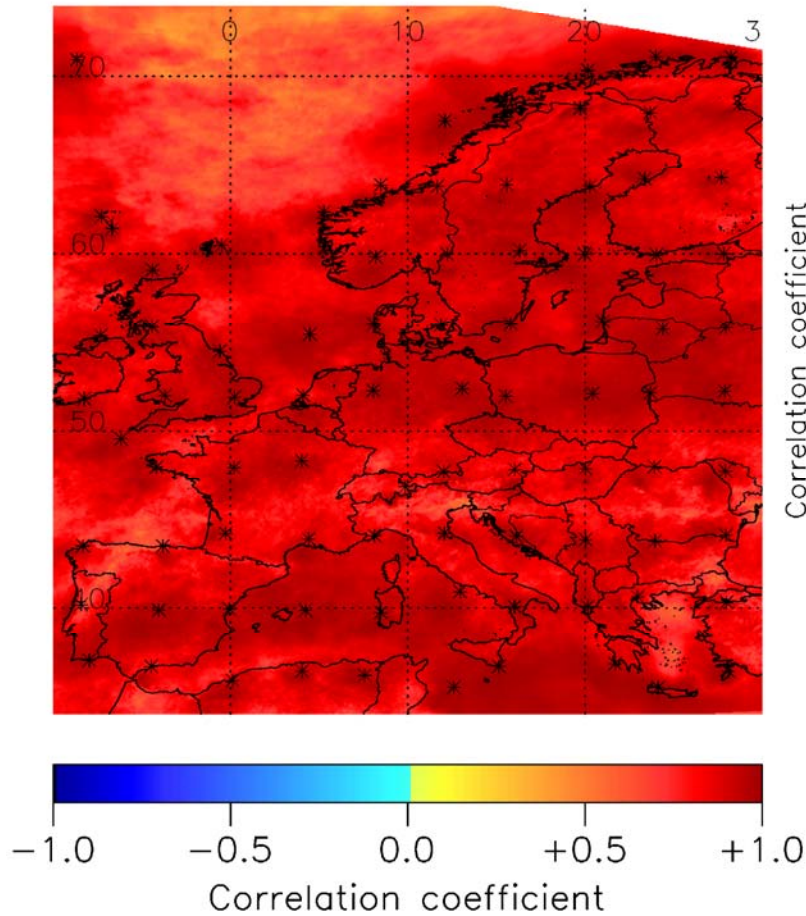RESEARCH
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Best correlation coefficient, 87 stations, March

MAXIMAL SPATIAL CORRELATION COEFFICIENT, 87 stations, MARCH
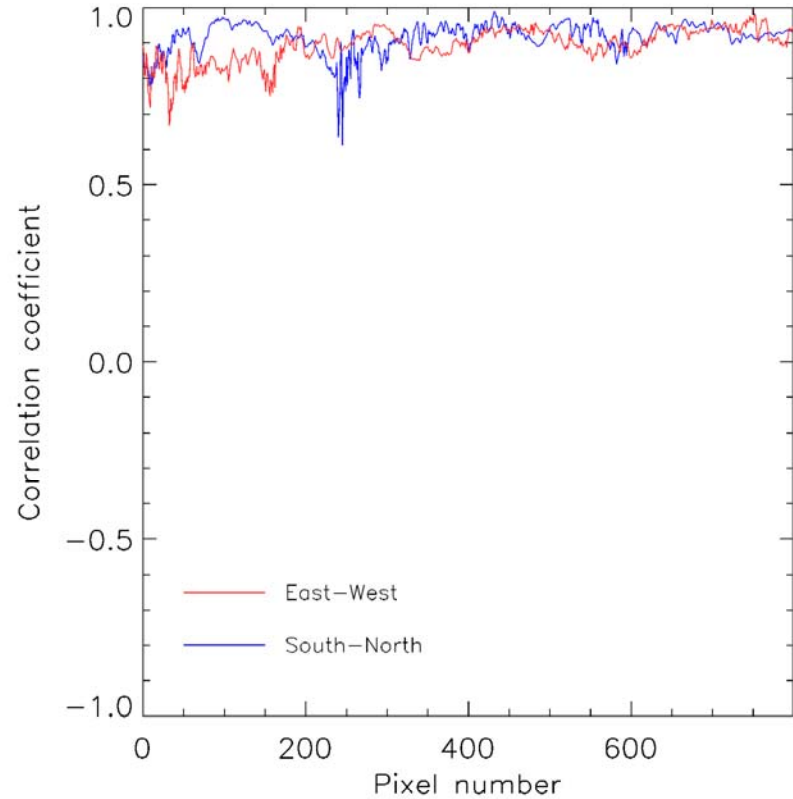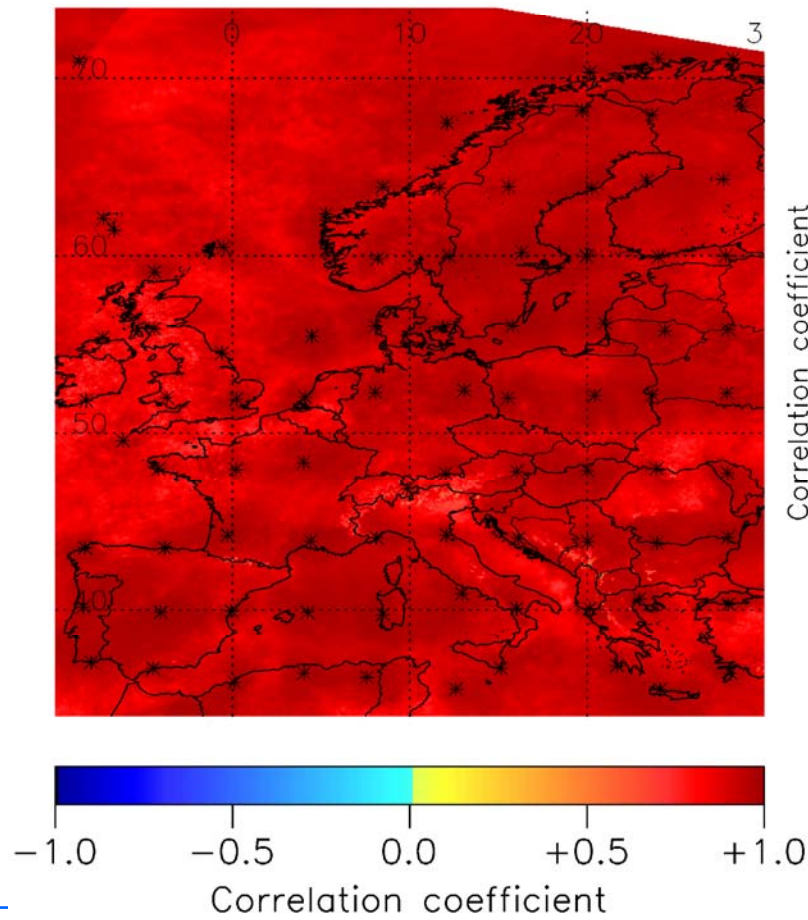
Best correlation coefficient, 87 stations, July

MAXIMAL SPATIAL CORRELATION COEFFICIENT, 87 stations, JULY

Interpolation formula (for each map pixel)

select the 9 best correlated stations
discard those for which the correlation coefficient r_i is less than 80% of the best correlation coefficient

hence N selected stations with 1<N<9
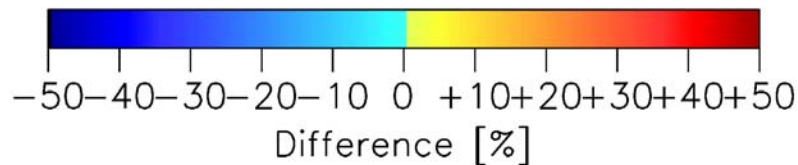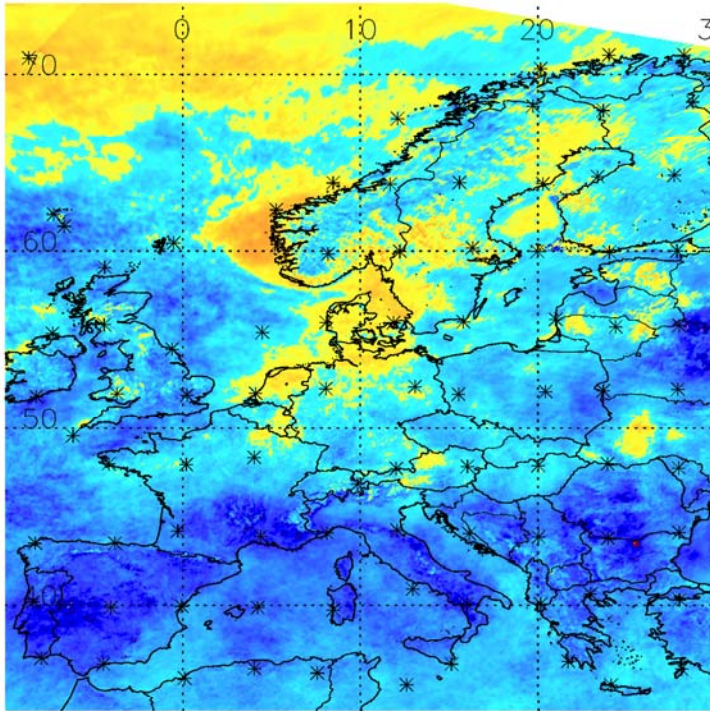
Set the pixel value (V_{pix}) to:

$$V_{pix} = C_{pix} \times \left(\sum_{0}^{N} w(r_i) \times \frac{V_i}{C_i} \right) \Big/ \left(\sum_{0}^{N} w(r_i) \right)$$

with $\quad w(r) = tg\left(\frac{\pi}{2} \times r\right)$
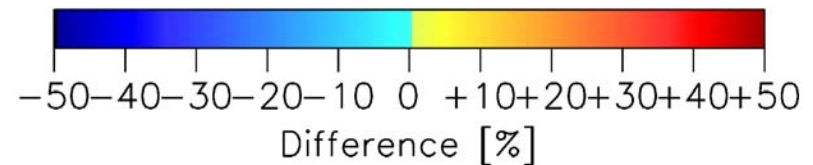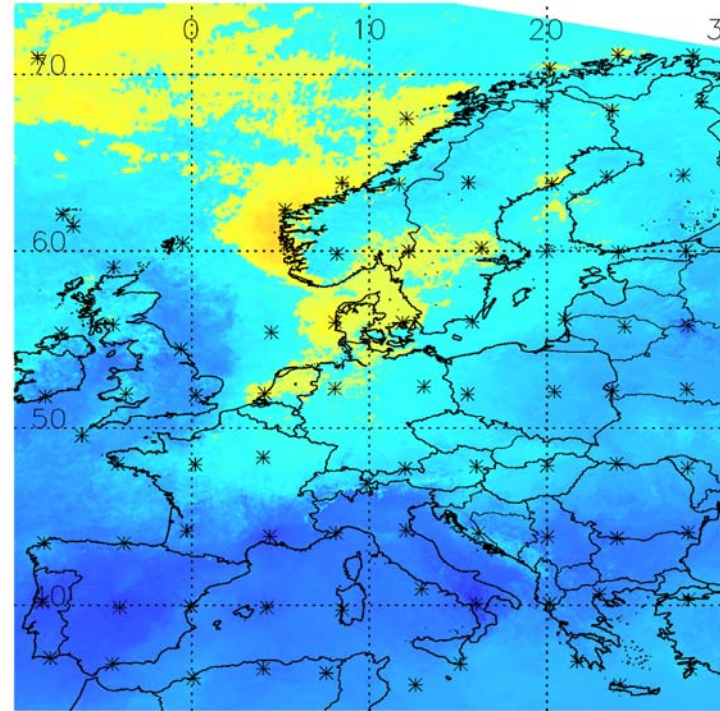
C being the climatological average for the month

Satellite derived and station interpolated, March 84

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
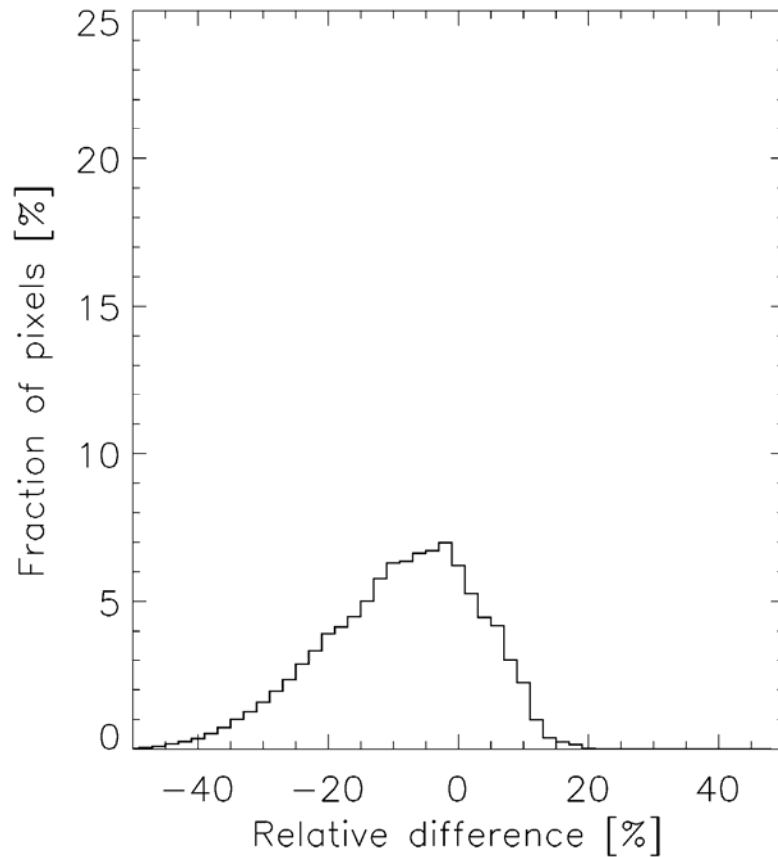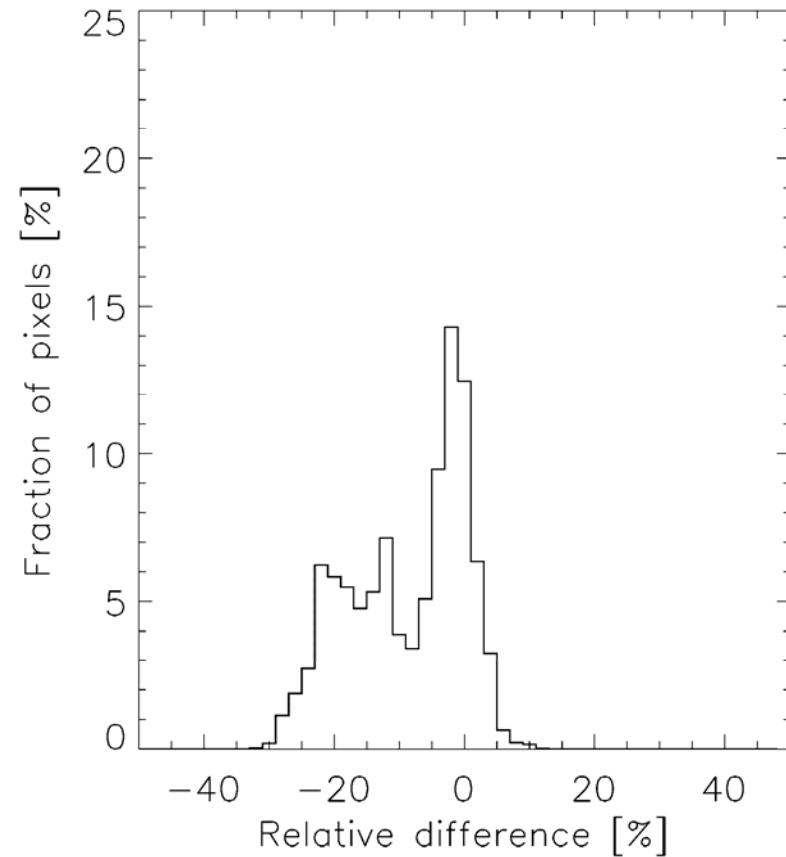(SAT–CLIMAV)/SAT
MARCH 1984
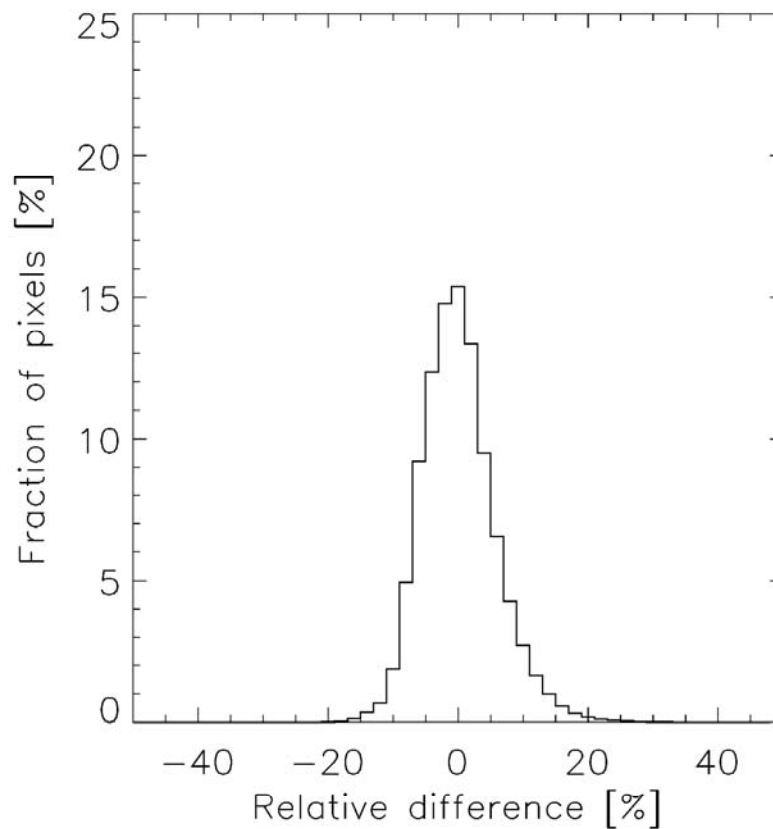
DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(RECONS.–CLIMAV)/RECONS.
MARCH 1984

−50 −40 −30 −20 −10   0 +10 +20 +30 +40 +50
Difference [%]

Satellite derived and station interpolated, March 84

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Difference between satellite derived and station interpolated, March 84

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE (RECONSTRUCTED−SAT)/SAT, MARCH 1984

Satellite derived and station interpolated, March 96

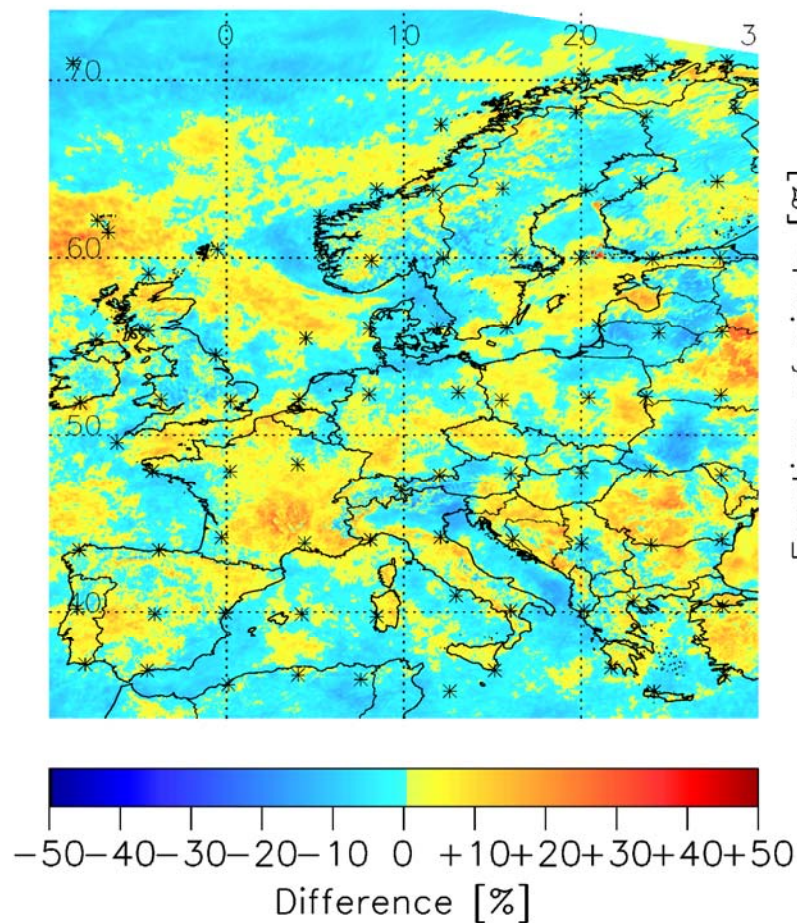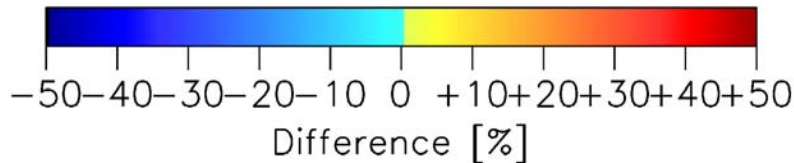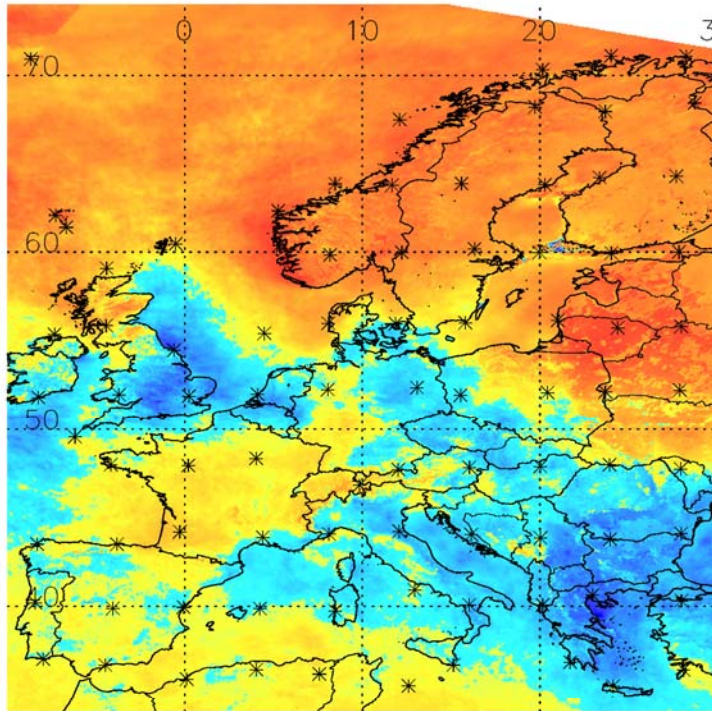DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(SAT−CLIMAV)/SAT
MARCH 1996

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(RECONS.−CLIMAV)/RECONS.
MARCH 1996

−50 −40 −30 −20 −10 0 +10 +20 +30 +40 +50
Difference [%]

−50 −40 −30 −20 −10 0 +10 +20 +30 +40 +50
Difference [%]

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JOINT
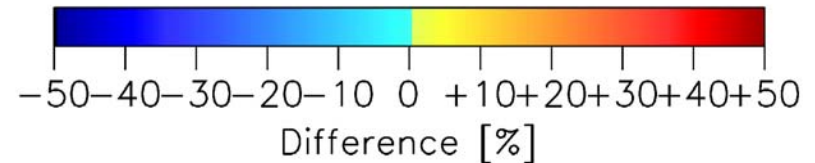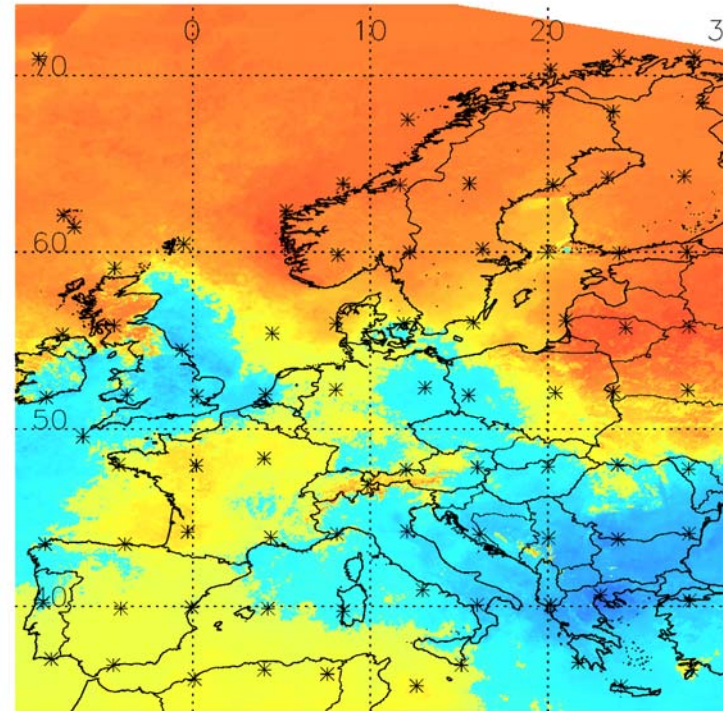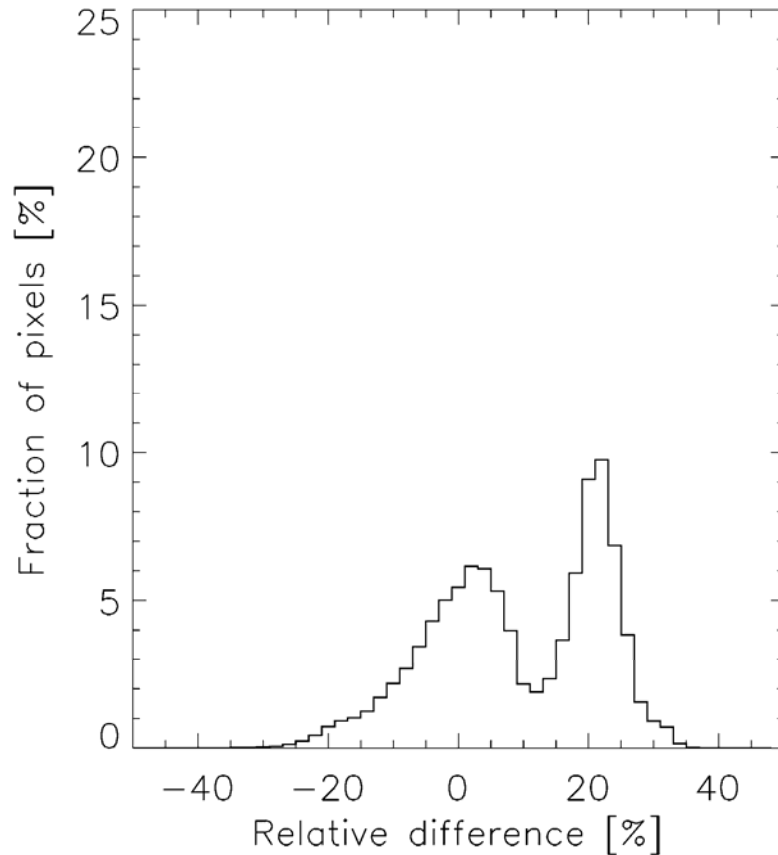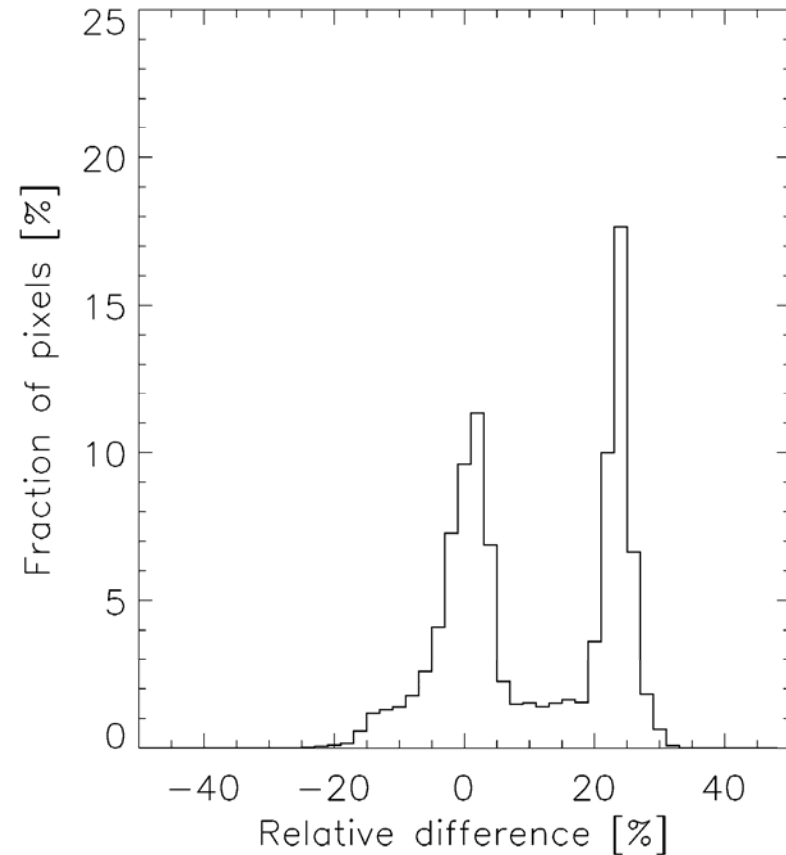RESEARCH
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Satellite derived and station interpolated, March 96

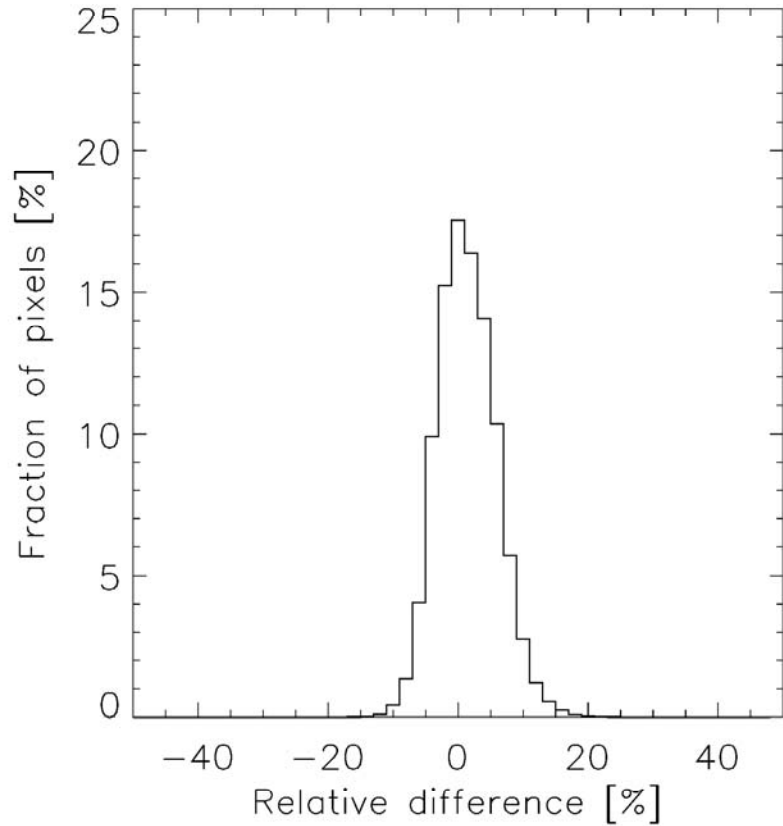DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(SAT−CLIMAV)/SAT
MARCH 1996

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(RECONS.−CLIMAV)/RECONS.
MARCH 1996

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Difference between satellite derived and station interpolated, March 96

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE (RECONSTRUCTED−SAT)/SAT, MARCH 1996

Satellite derived and station interpolated. March 97

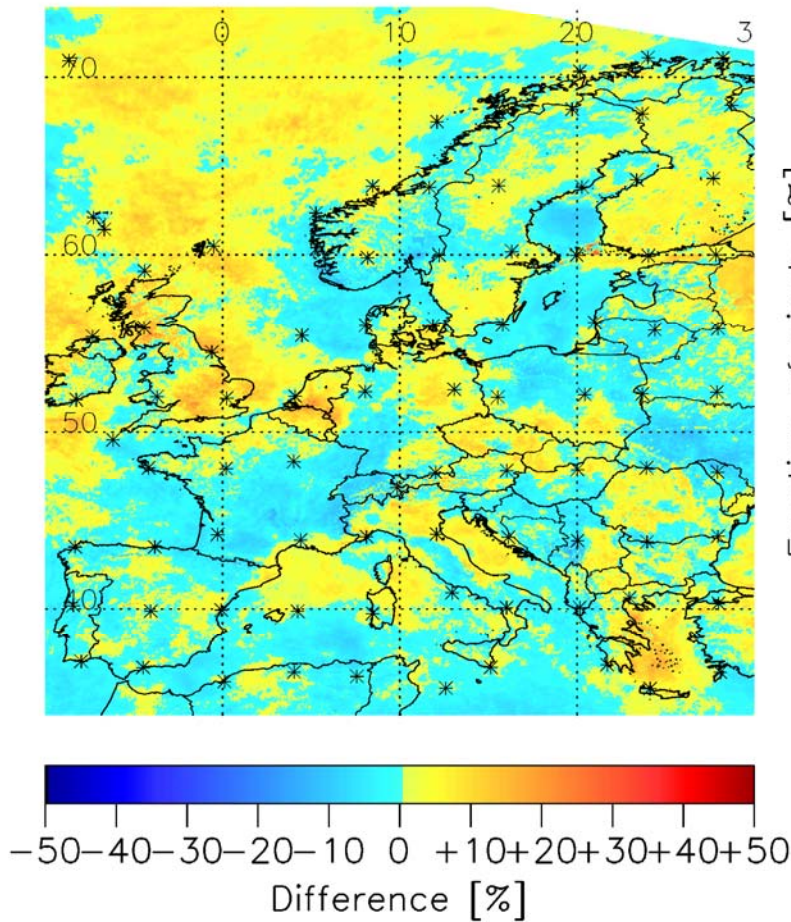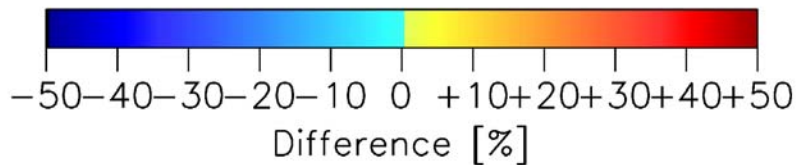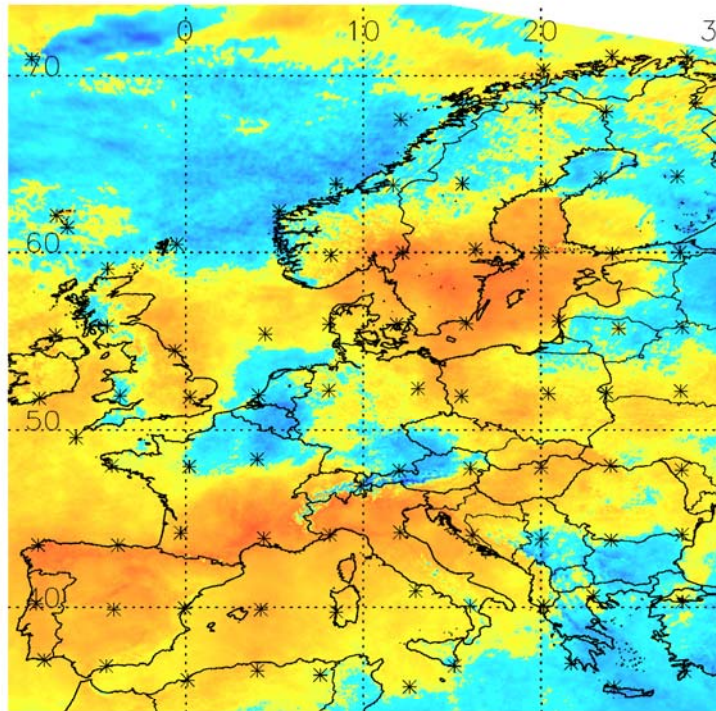DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(SAT—CLIMAV)/SAT
MARCH 1997

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(RECONS.—CLIMAV)/RECONS.
MARCH 1997

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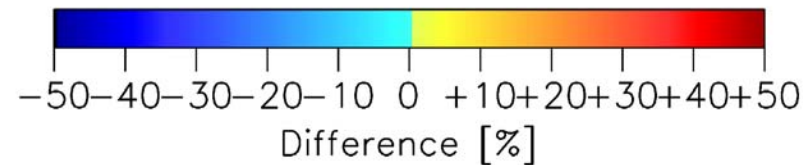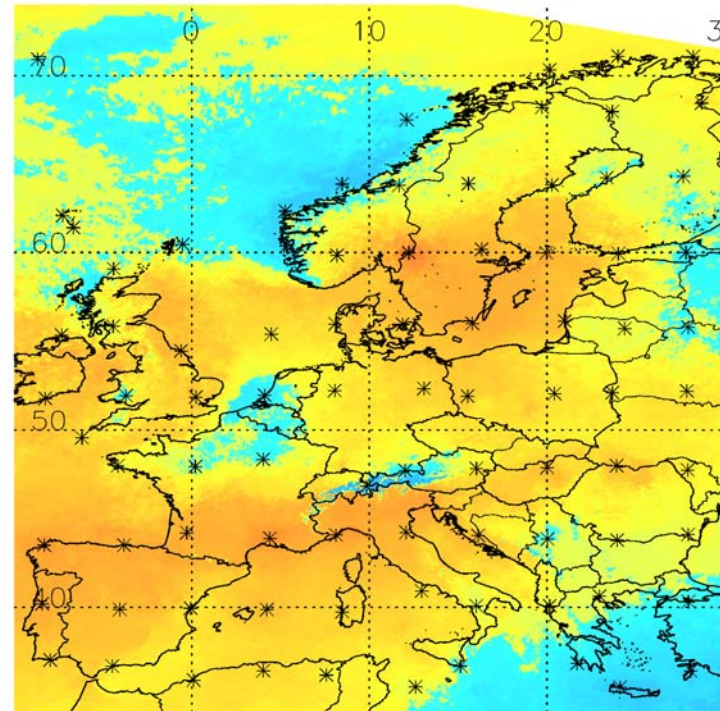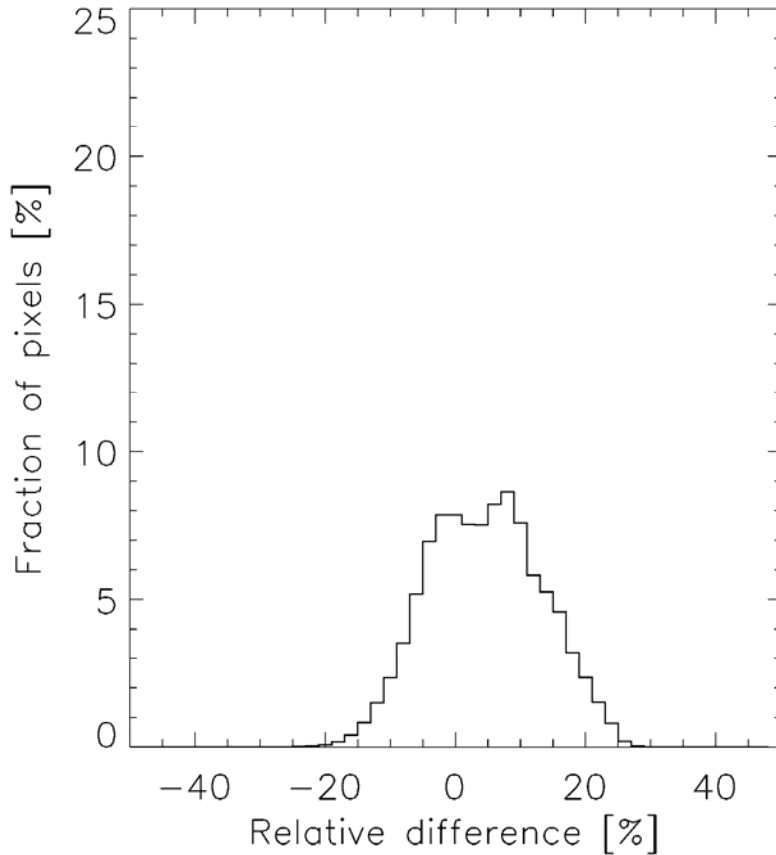RESEARCH
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Satellite derived and station interpolated, March 97

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(SAT−CLIMAV)/SAT
MARCH 1997

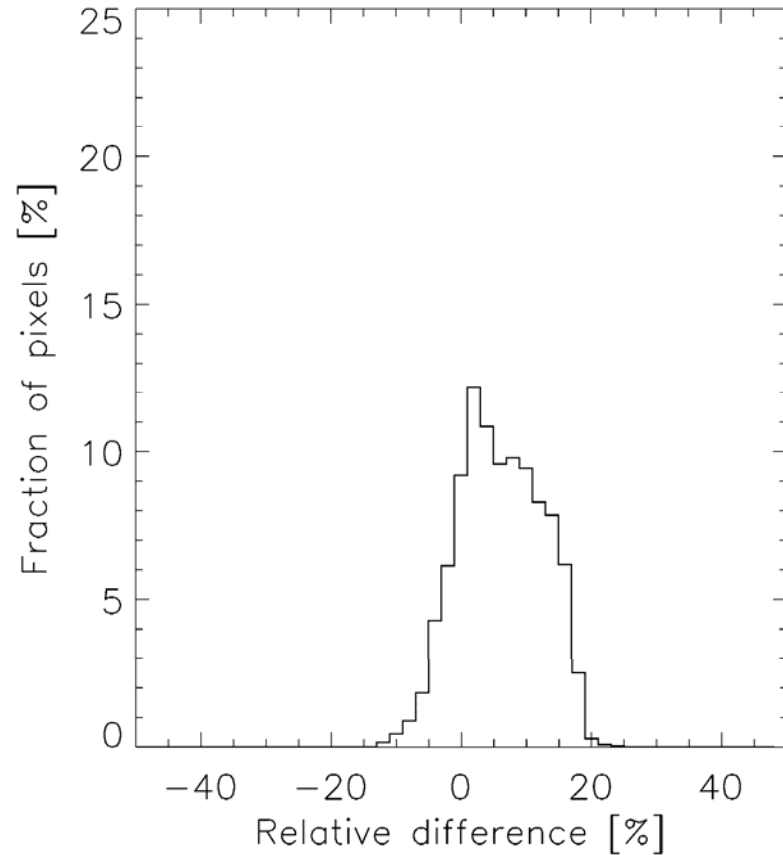DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(RECONS.−CLIMAV)/RECONS.
MARCH 1997

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Difference between satellite derived and station interpolated, March 97

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE (RECONSTRUCTED—SAT)/SAT, MARCH 1997

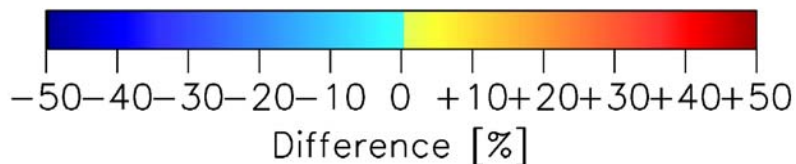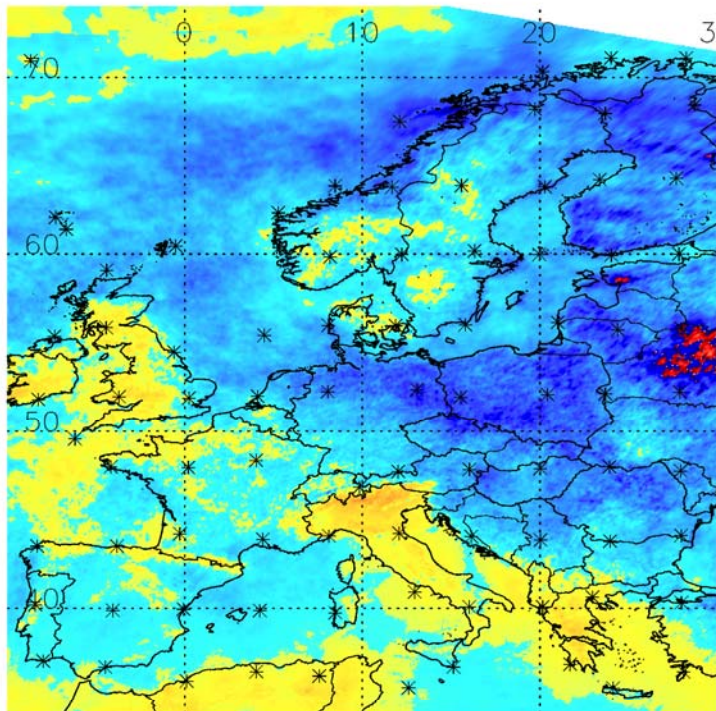# Satellite derived and station interpolated, July 84

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(SAT−CLIMAV)/SAT
JULY 1984

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(RECONS.−CLIMAV)/RECONS.
JULY 1984

−50 −40 −30 −20 −10 0 +10 +20 +30 +40 +50
Difference [%]

−50 −40 −30 −20 −10 0 +10 +20 +30 +40 +50
Difference [%]

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JOINT
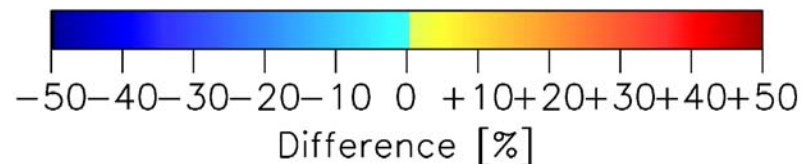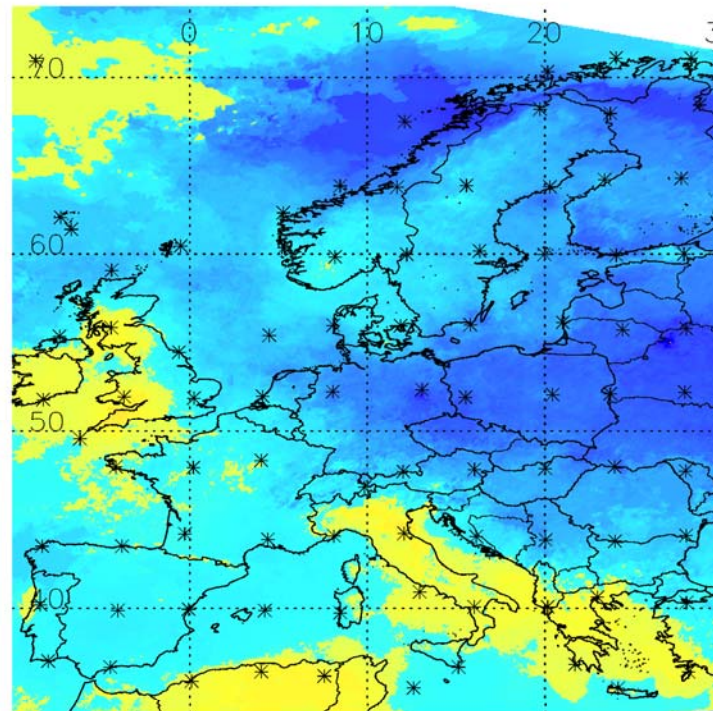RESEARCH
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Satellite derived and station interpolated, July 84

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(SAT−CLIMAV)/SAT
JULY 1984

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(RECONS.−CLIMAV)/RECONS.
JULY 1984

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Difference between satellite derived and station interpolated, July 84

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE (RECONSTRUCTED−SAT)/SAT, JULY 1984

Satellite derived and station interpolated, July 94

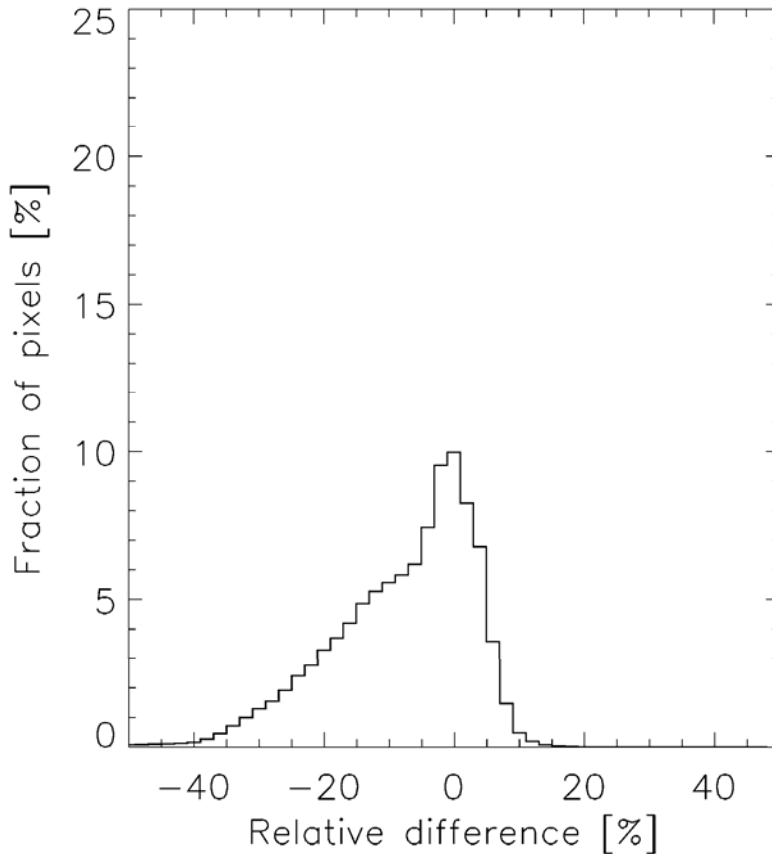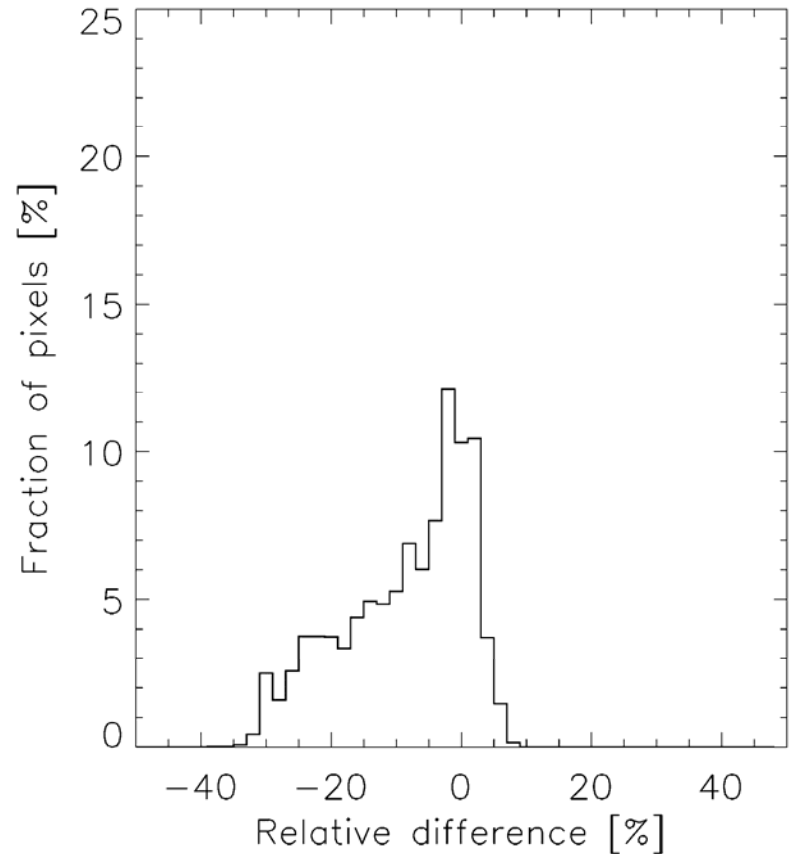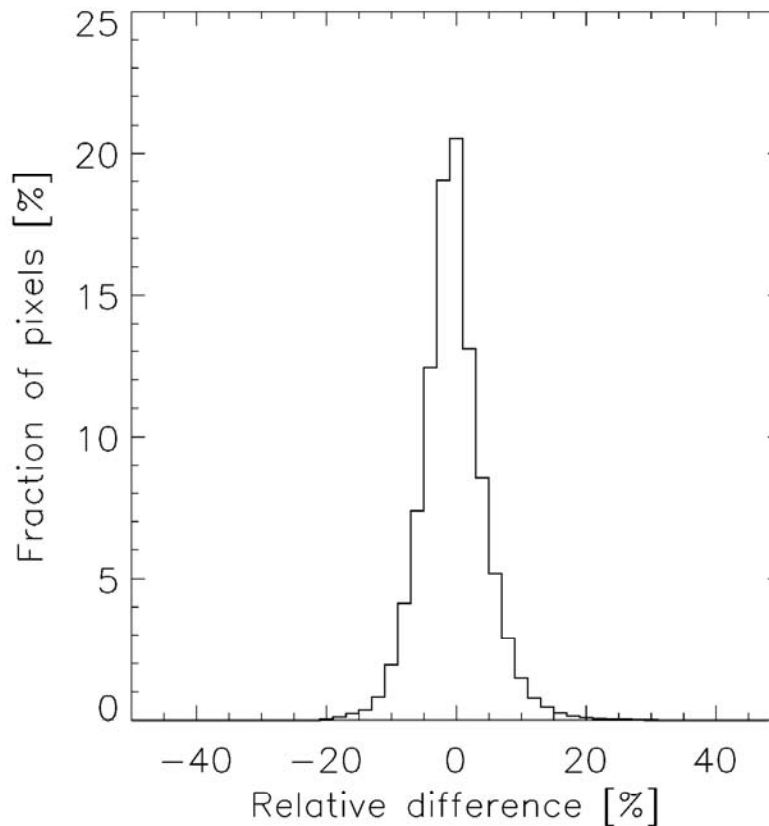DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
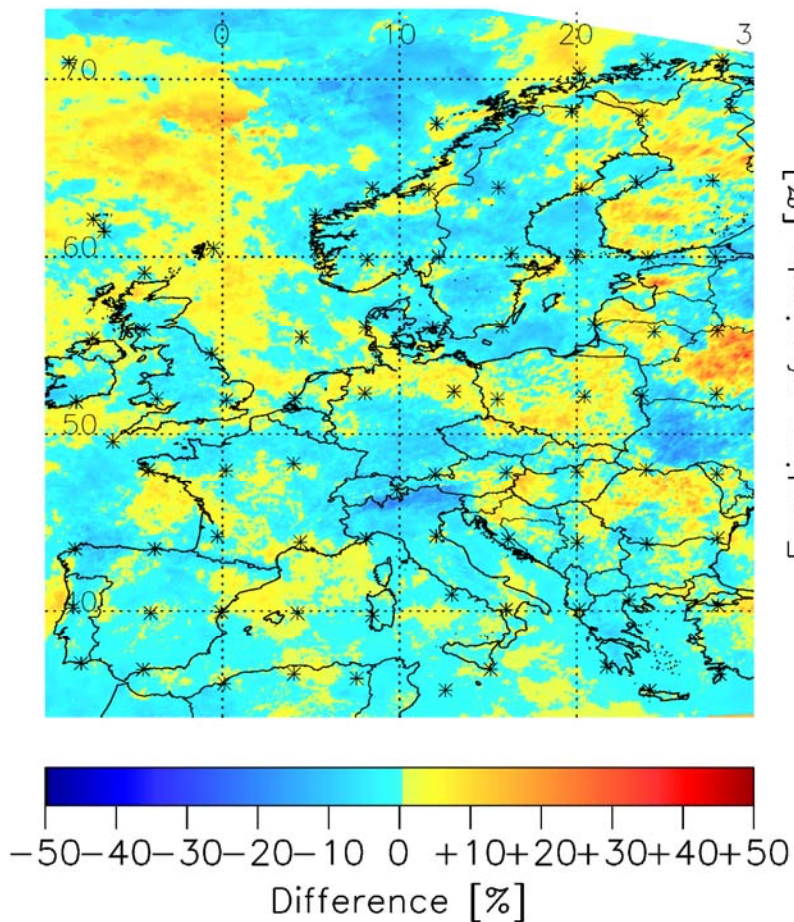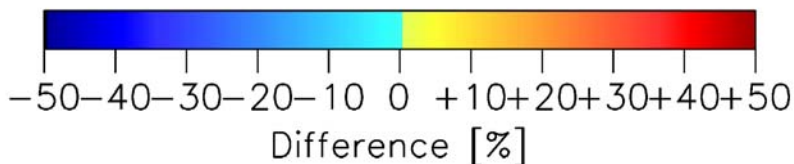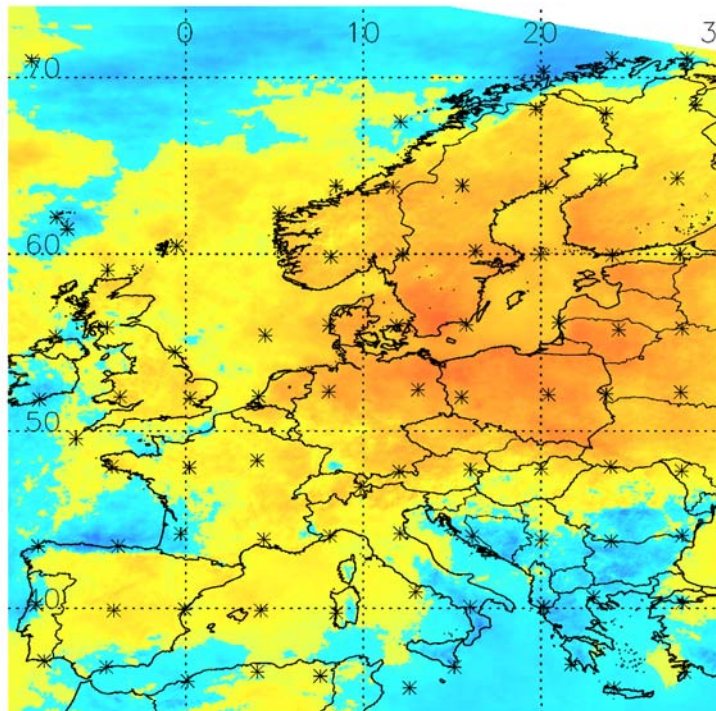(SAT−CLIMAV)/SAT
JULY 1994

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(RECONS.−CLIMAV)/RECONS.
JULY 1994

−50 −40 −30 −20 −10 0 +10 +20 +30 +40 +50
Difference [%]

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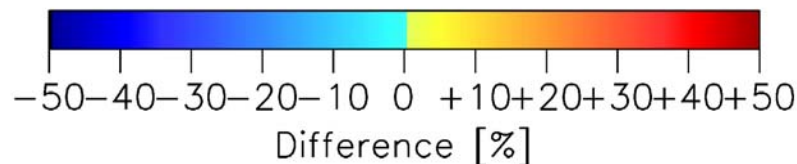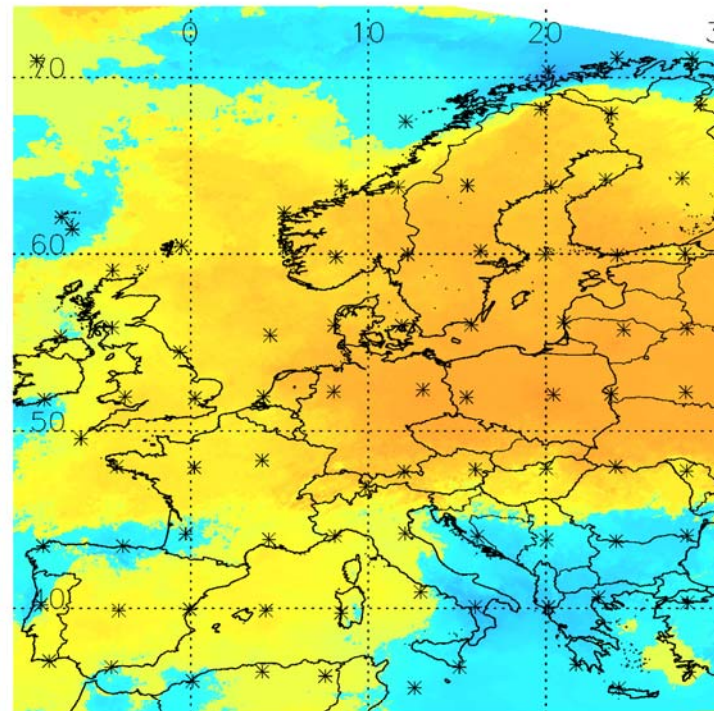RESEARCH
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Satellite derived and station interpolated, July 94

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(SAT−CLIMAV)/SAT
JULY 1994

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(RECONS.−CLIMAV)/RECONS.
JULY 1994

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Difference between satellite derived and station interpolated, July 94

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE (RECONSTRUCTED−SAT)/SAT, JULY 1994

Satellite derived and station interpolated, July 2000

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
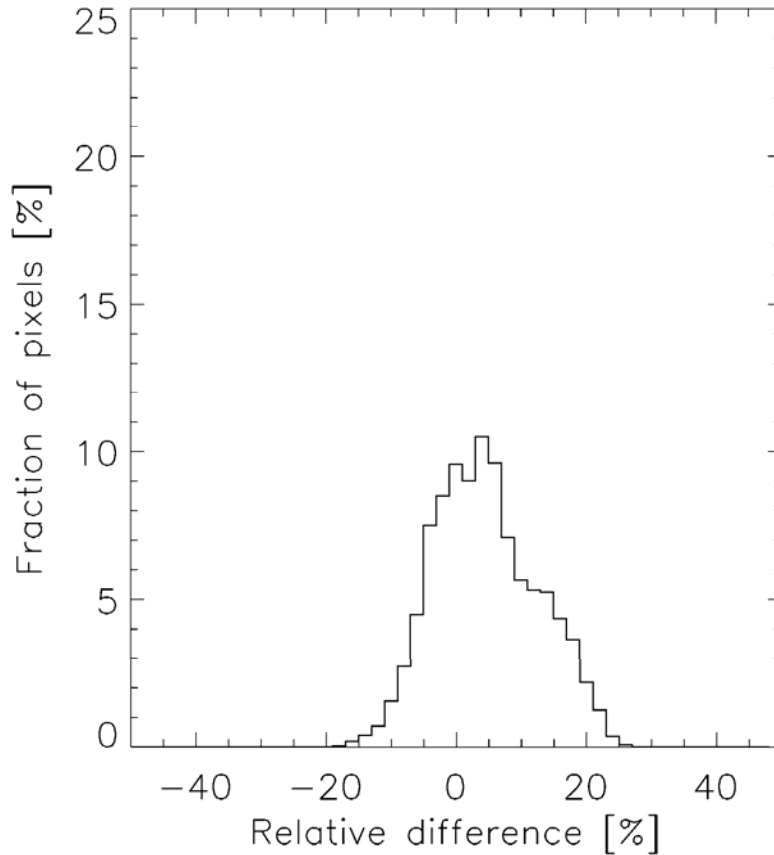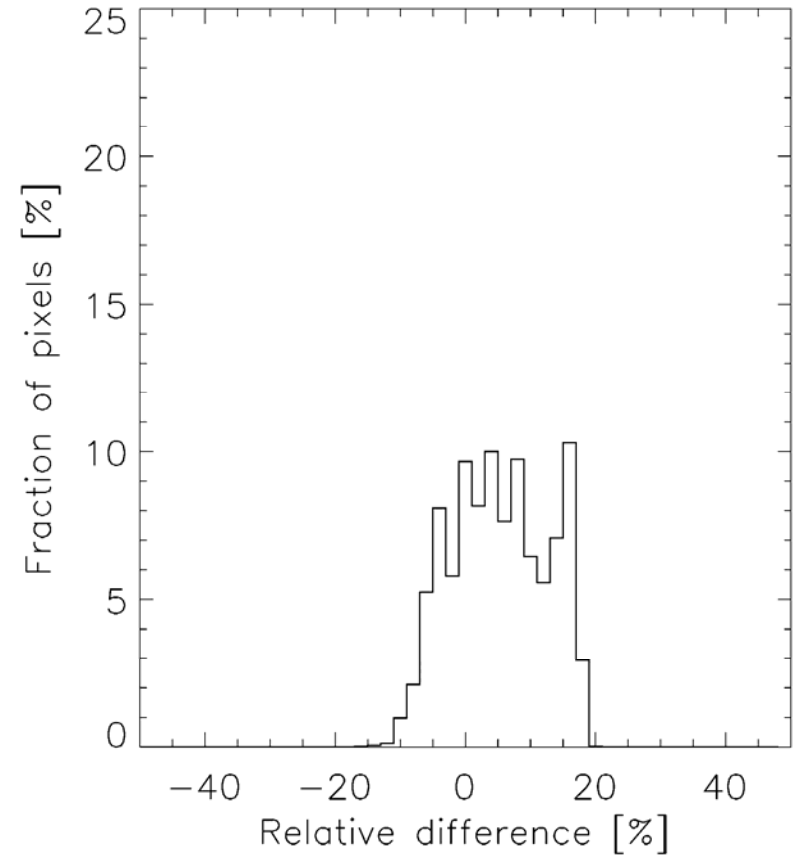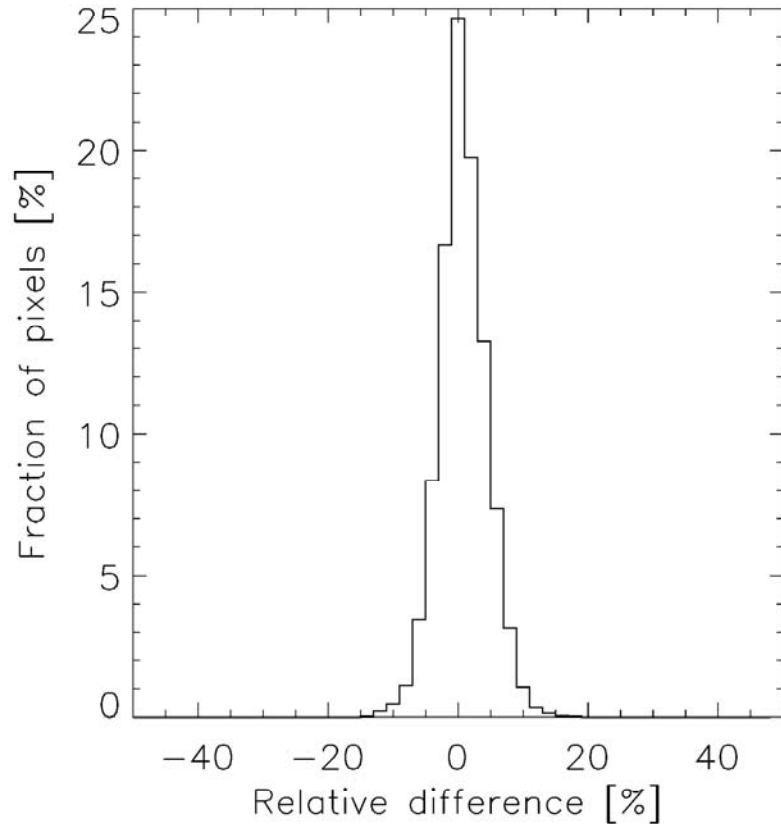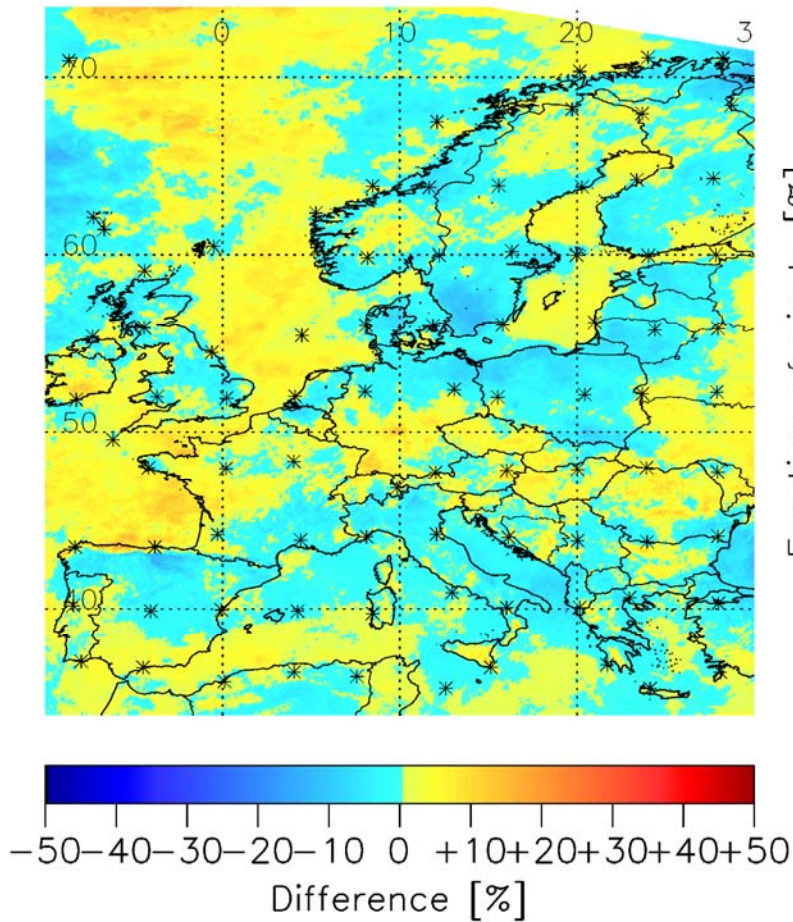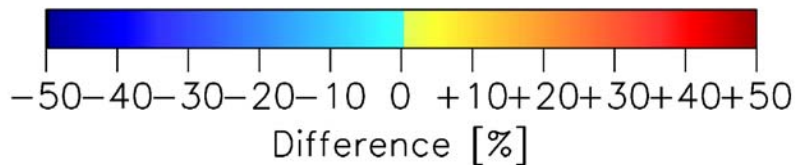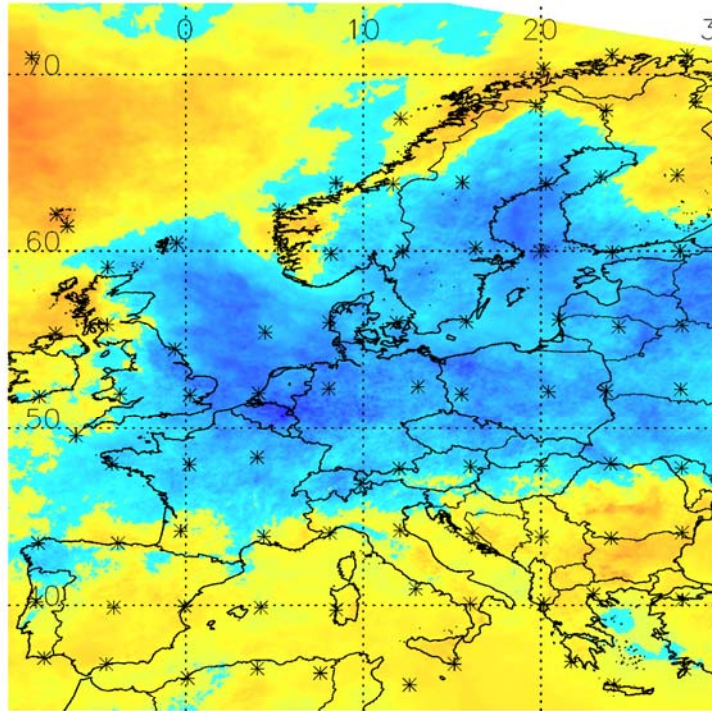(SAT−CLIMAV)/SAT
JULY 2000

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(RECONS.−CLIMAV)/RECONS.
JULY 2000

−50 −40 −30 −20 −10 0 +10 +20 +30 +40 +50
Difference [%]

−50 −40 −30 −20 −10 0 +10 +20 +30 +40 +50
Difference [%]

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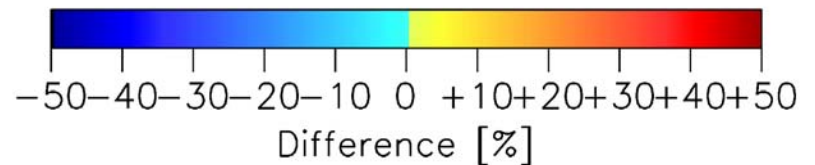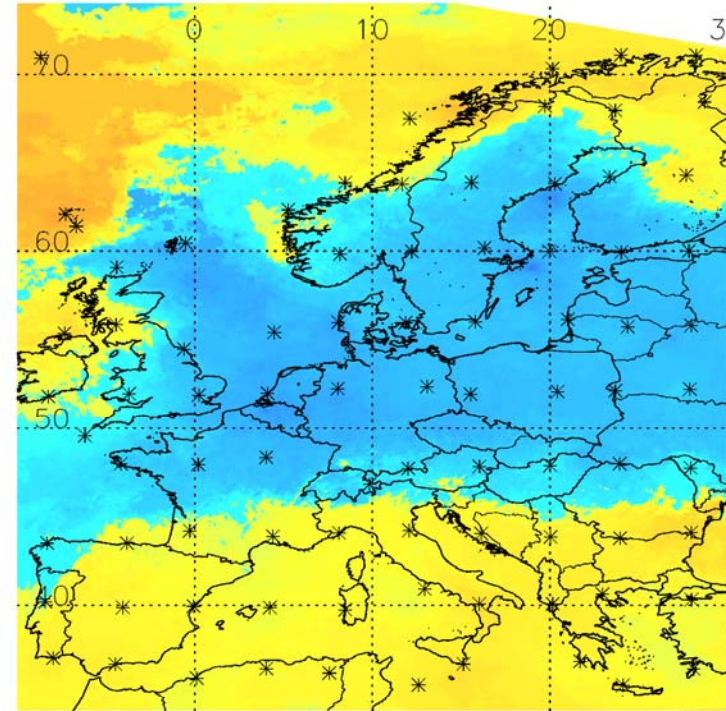JOINT RESEARCH CENTRE
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Satellite derived and station interpolated, July 2000

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
(SAT–CLIMAV)/SAT
JULY 2000

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE
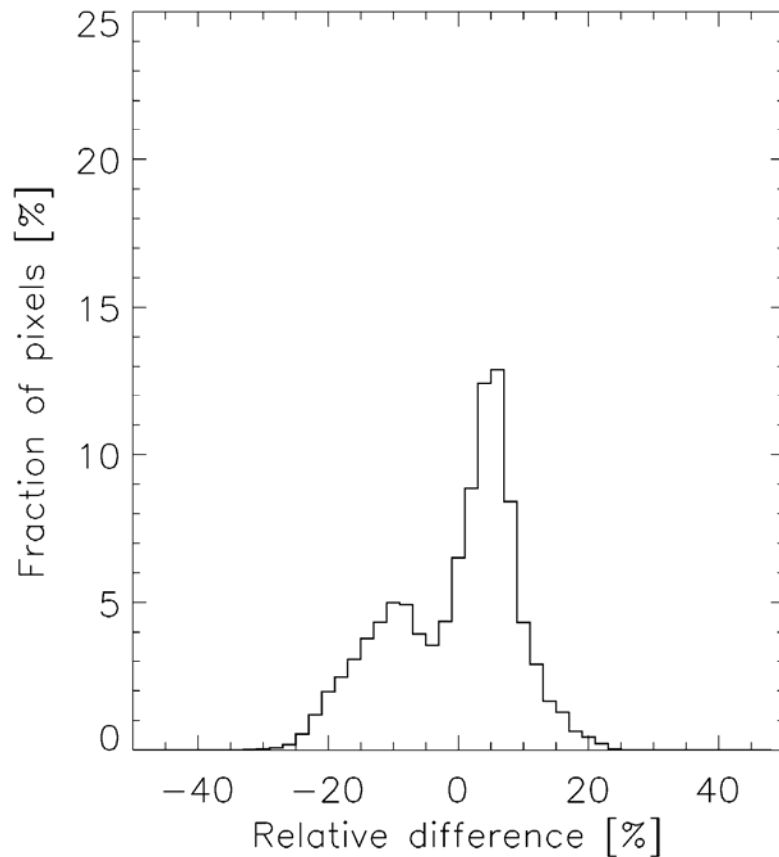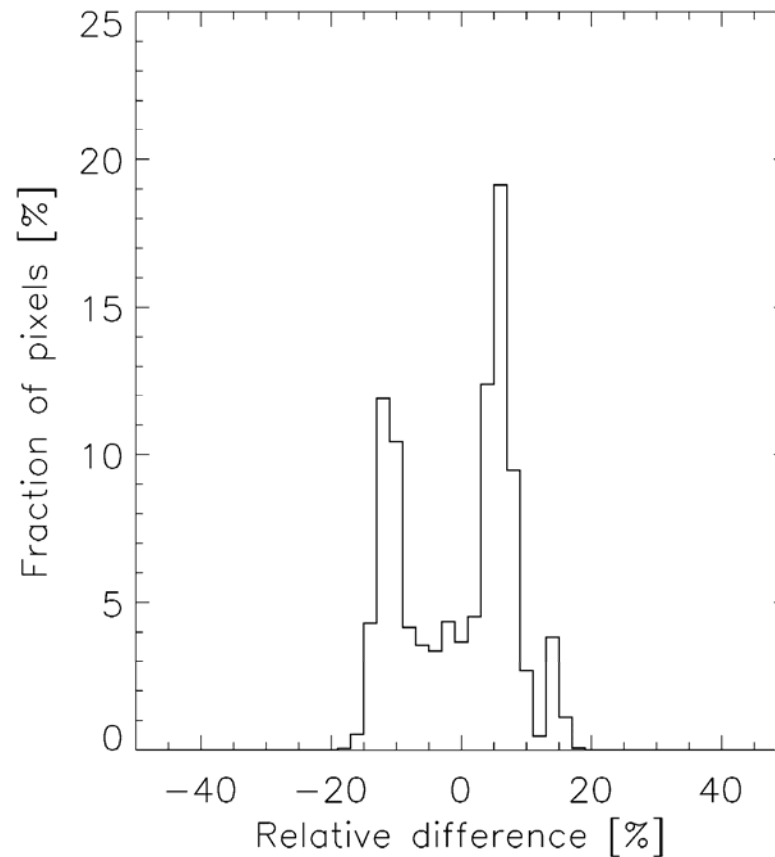(RECONS.–CLIMAV)/RECONS.
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Difference between satellite derived and station interpolated, July 2000

DIFFERENCE IN AVERAGE ERYTHEMAL DOSE (RECONSTRUCTED−SAT)/SAT, JULY 2000