

Delayed response of global TEC to ionization variations seen from combined SolACES-SDO/EVE solar EUV spectra

Christoph Jacobi, Claudia Unglaub

University of Leipzig, Institute for Meteorology, Leipzig, Germany

Gerhard Schmidtke, Marcel Pfeifer, Robert Schäfer, Raimund Brunner

Fraunhofer IPM, Freiburg, Germany

Thomas N. Woods

Laboratory for Atmospheric and Space Research, University of Colorado Boulder, USA

Norbert Jakowski

German Aerospace Center, Neustrelitz, Germany

Outline

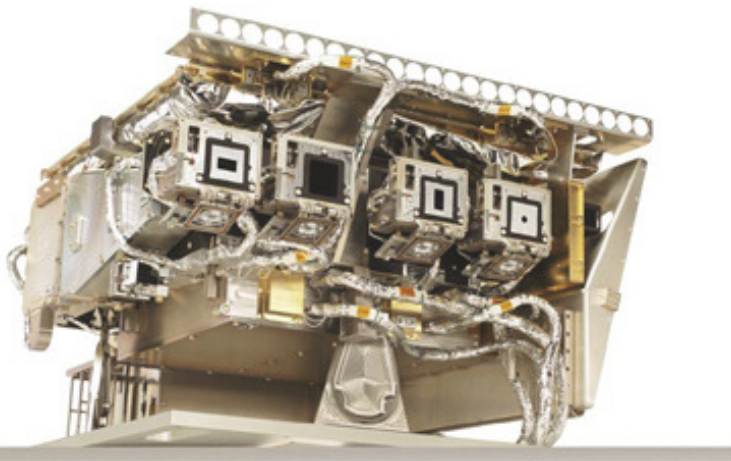
- EUV spectra from SDO/EVE and SolACES
- EUV proxy from observations and primary ionization calculations
- Analysis of ionospheric delay
- Conclusions

SDO/EVE and SoIACES

SDO/EVE

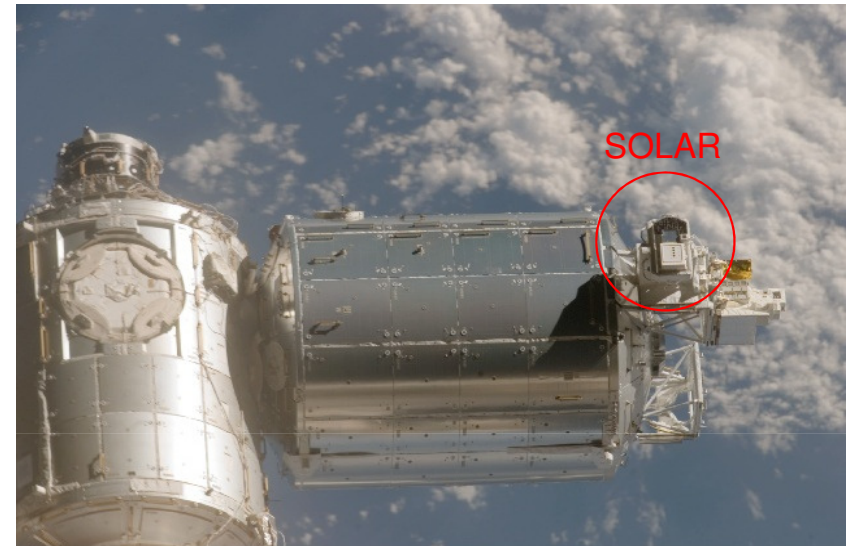


Credit: NASA

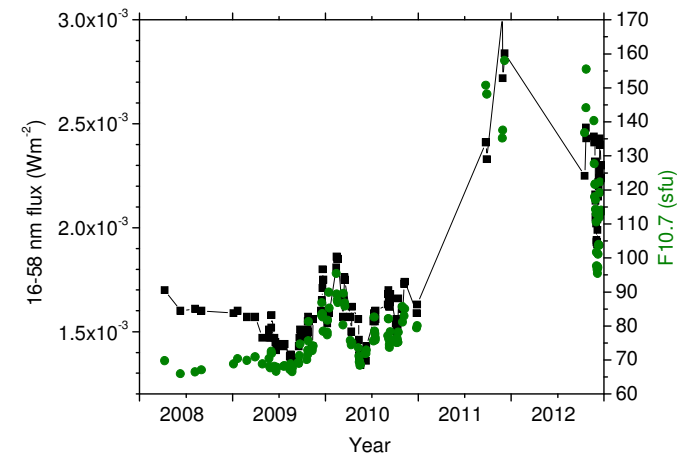


Credit: University of Colorado at Boulder

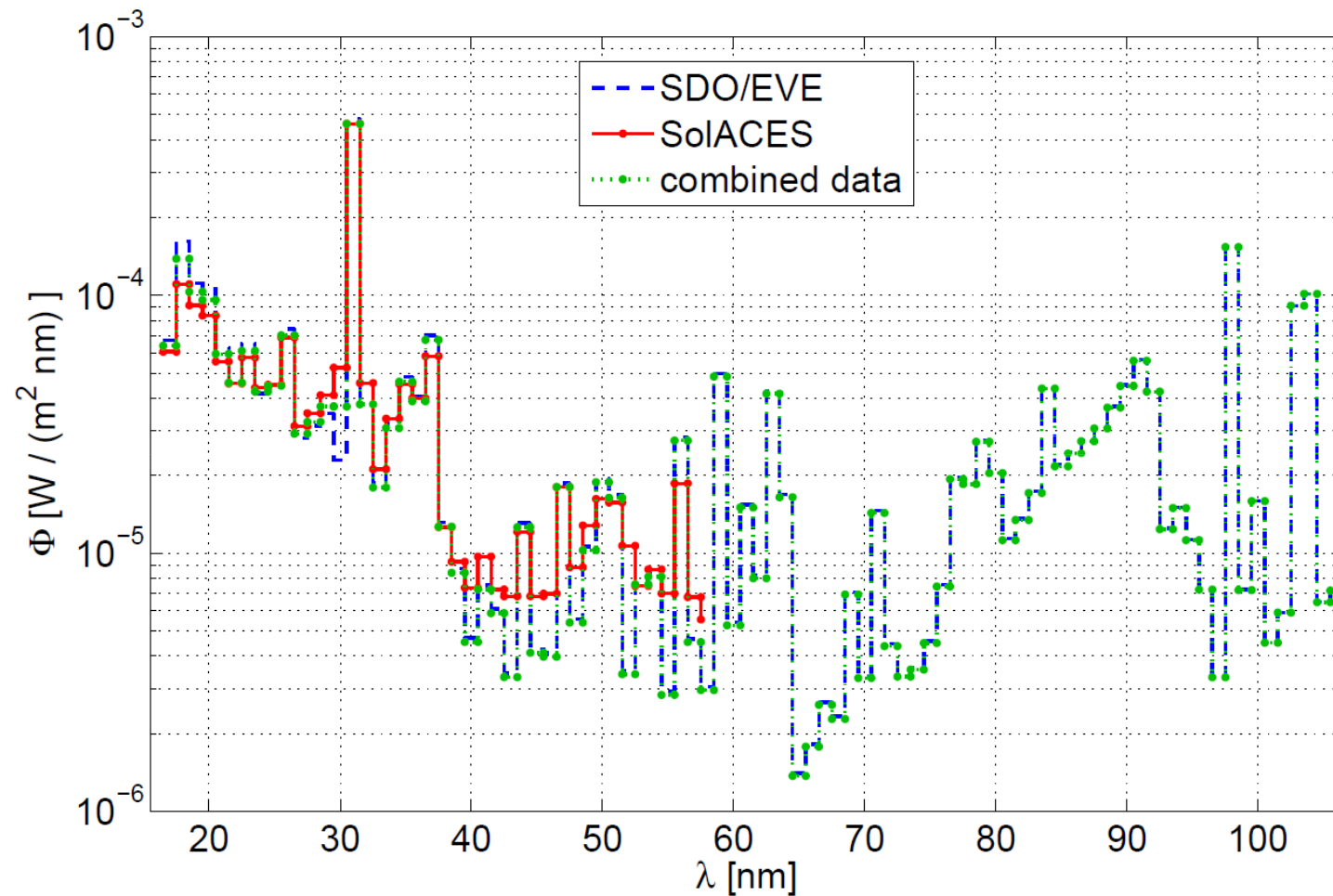
SOLAR/SoIACES



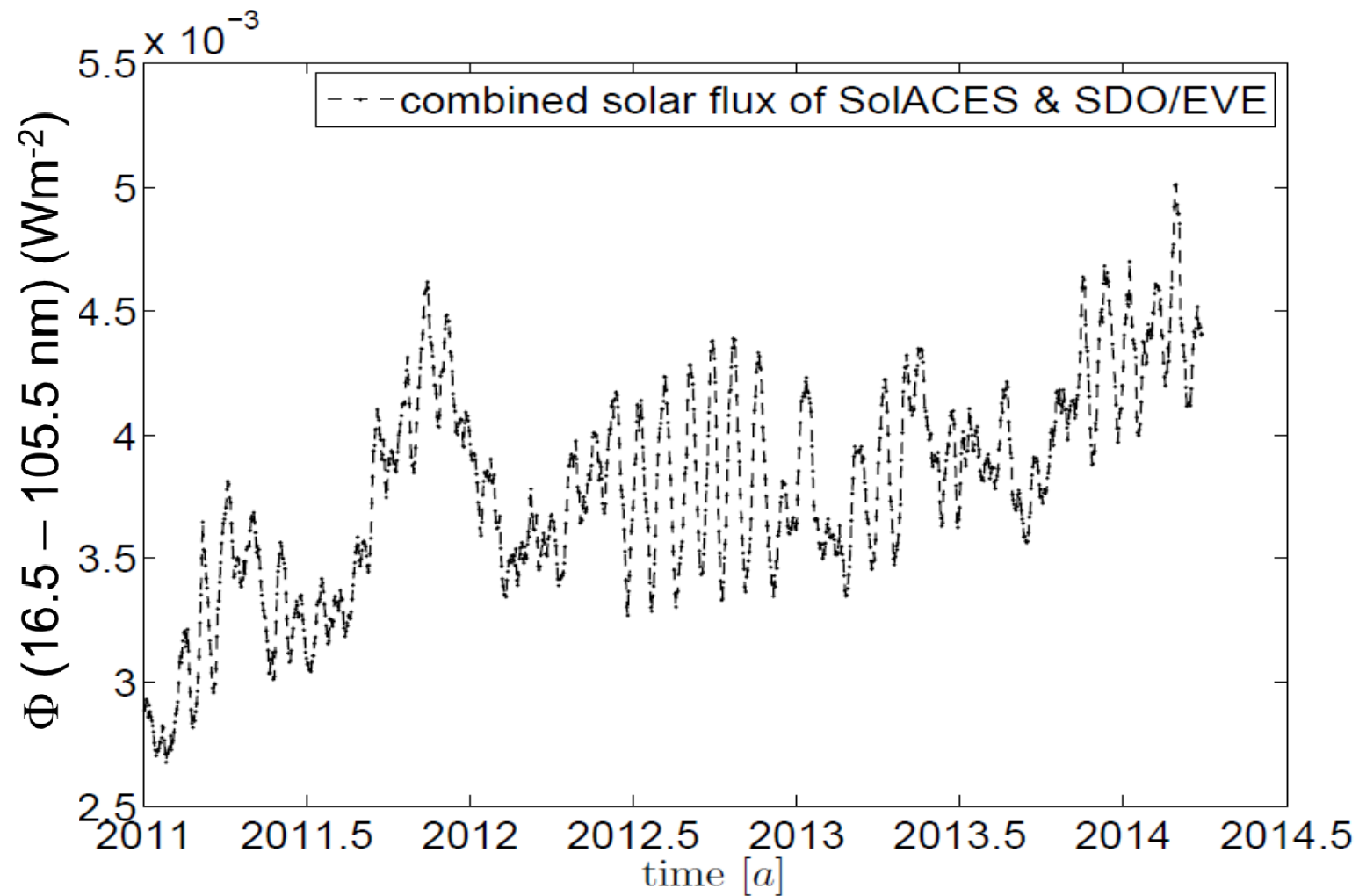
S122E009992



Combination of SDO-EVE and SoIACES spectra



Combined SDO/EVE and SoIACES Dataset

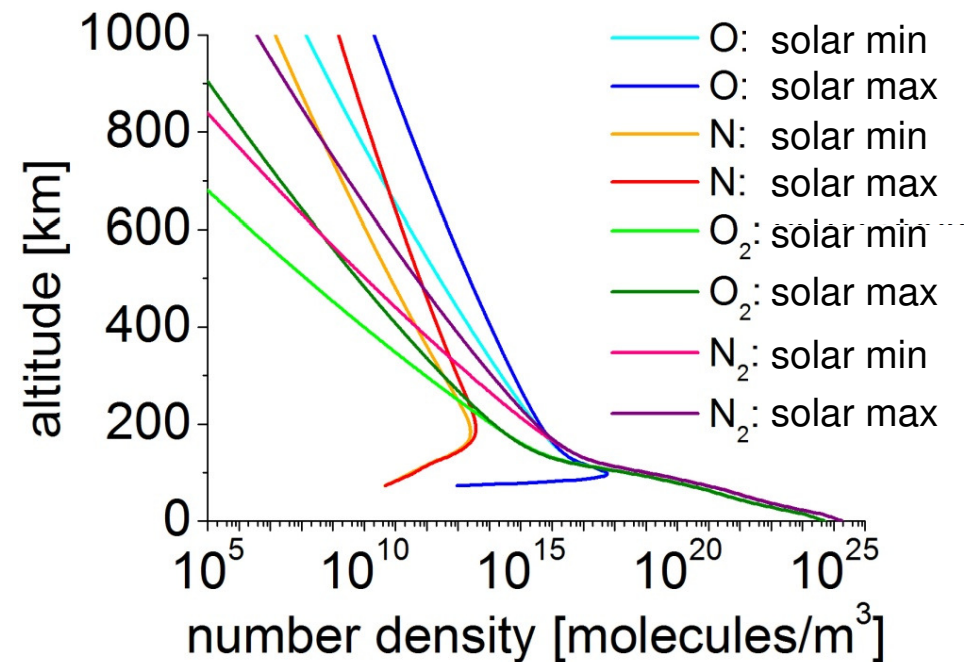
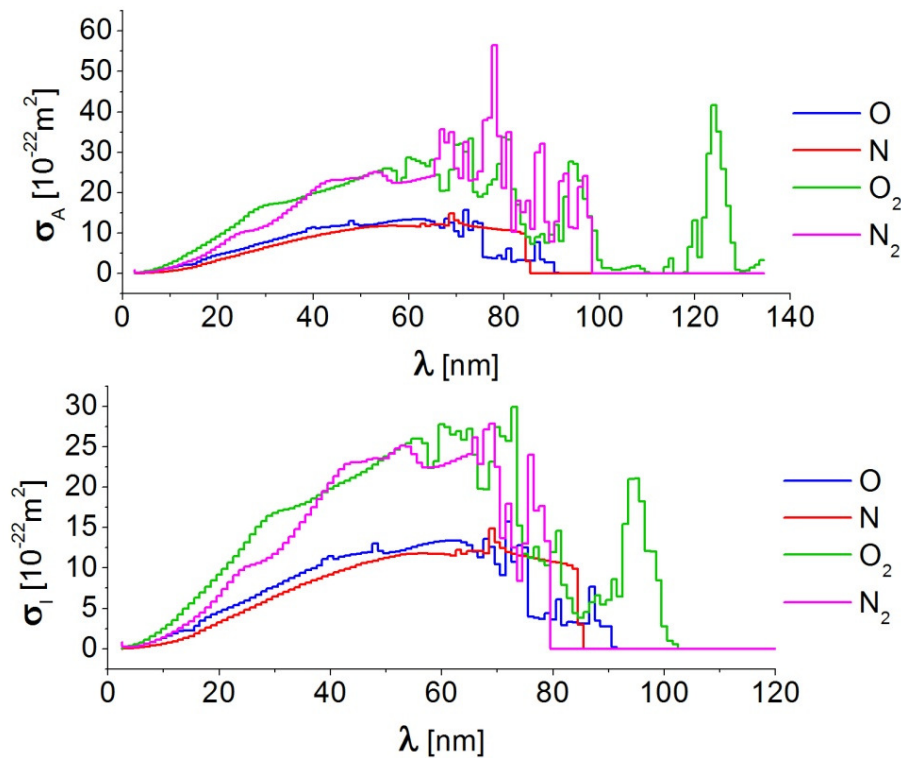


Schmidtke et al., ASR,
submitted

Extension including TIMED/SEE data in progress

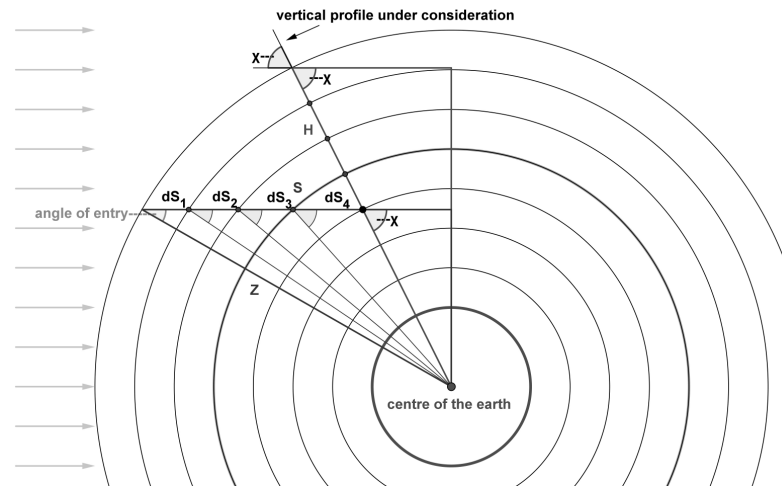
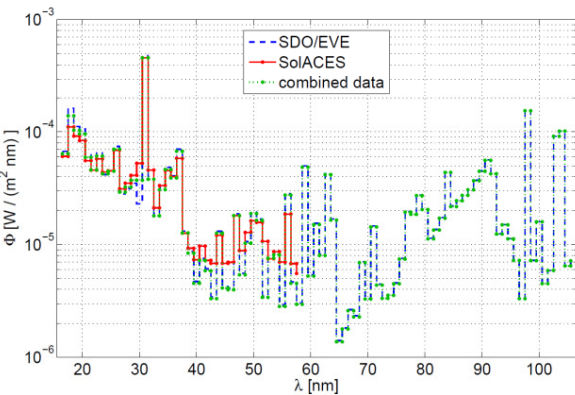
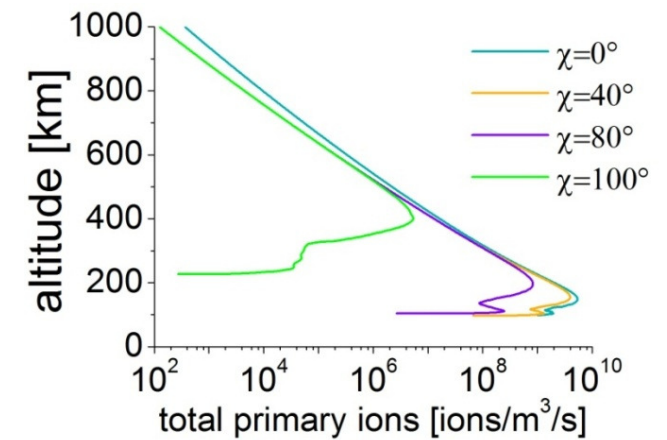
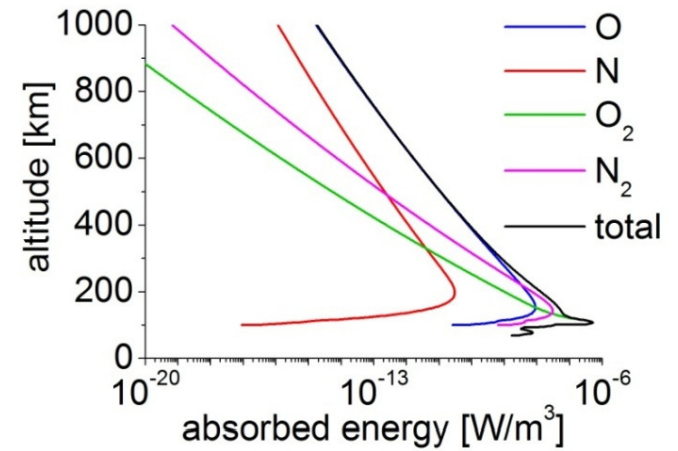
EUV-TEC Index calculation (Unглаub et al., 2011)

Absorption and primary ionization calculated for 4 major components
NRLMSISE-00 global mean background atmosphere
Based on combined SDO-EVE and SolACES spectra

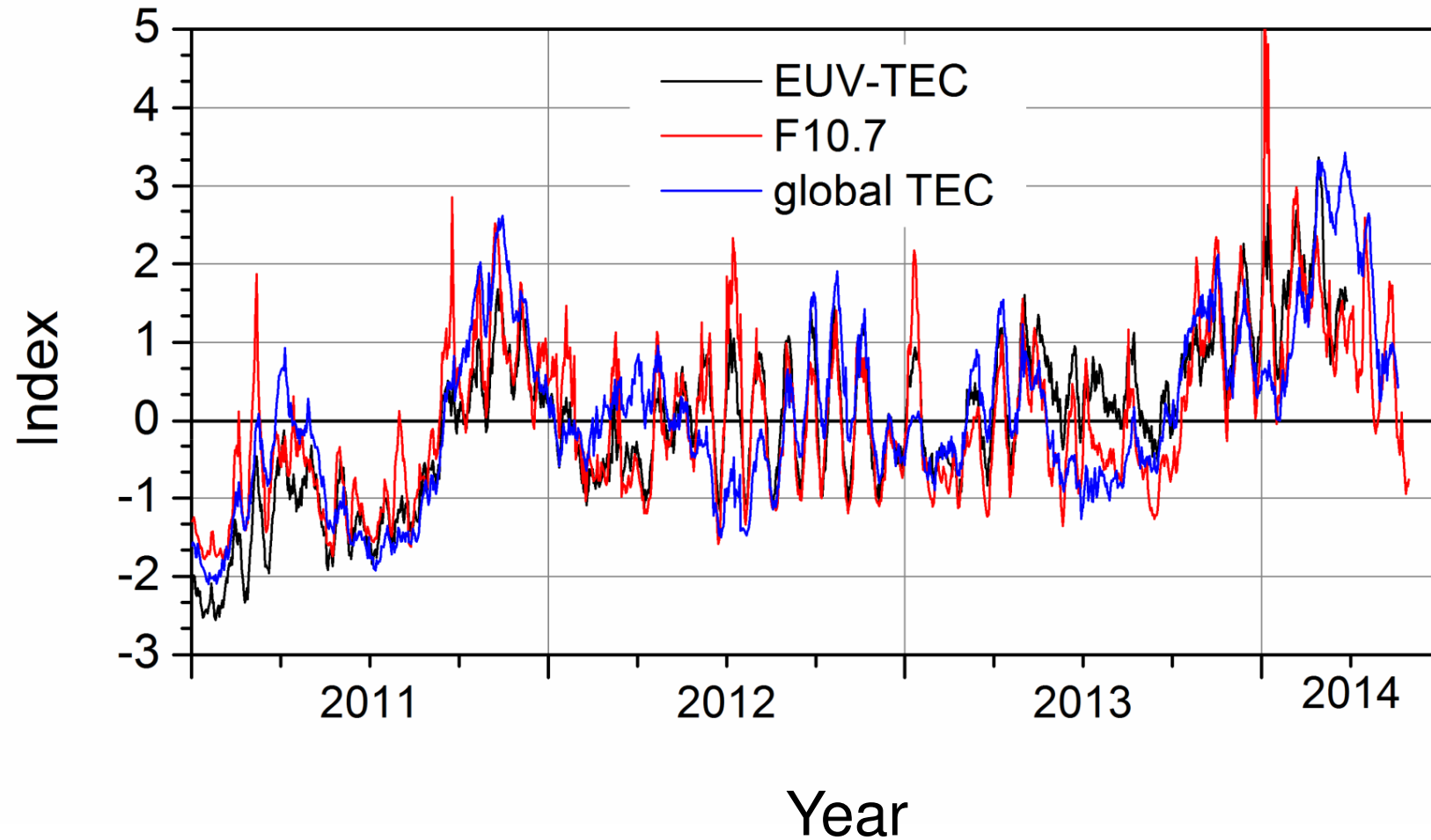


EUV-TEC index calculation (Unглаub et al., 2011)

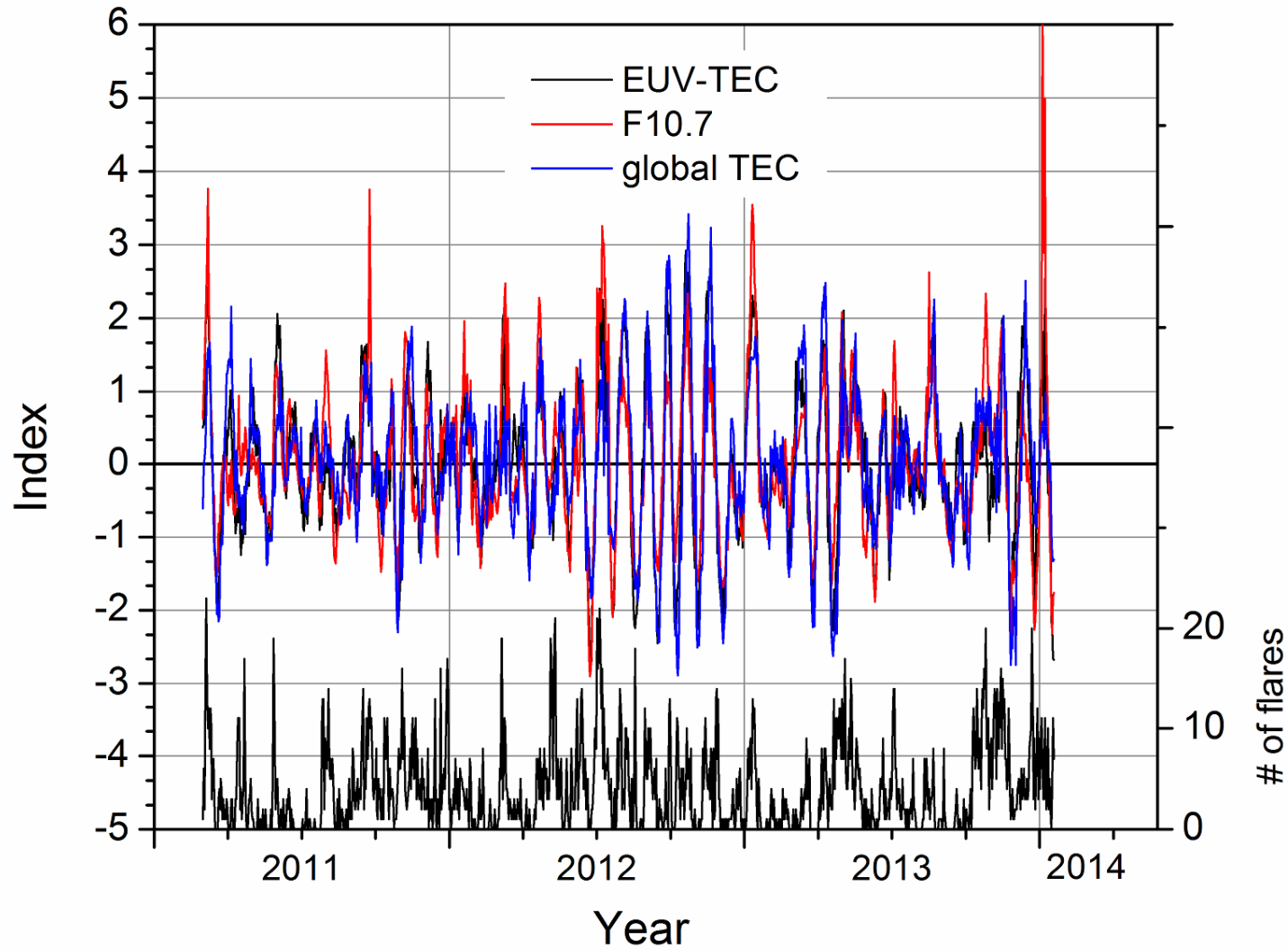
Absorption and primary ionization calculated for 4 major components
 NRLMSISE-00 global mean background atmosphere
 Based on combined SDO-EVE and SolACES spectra



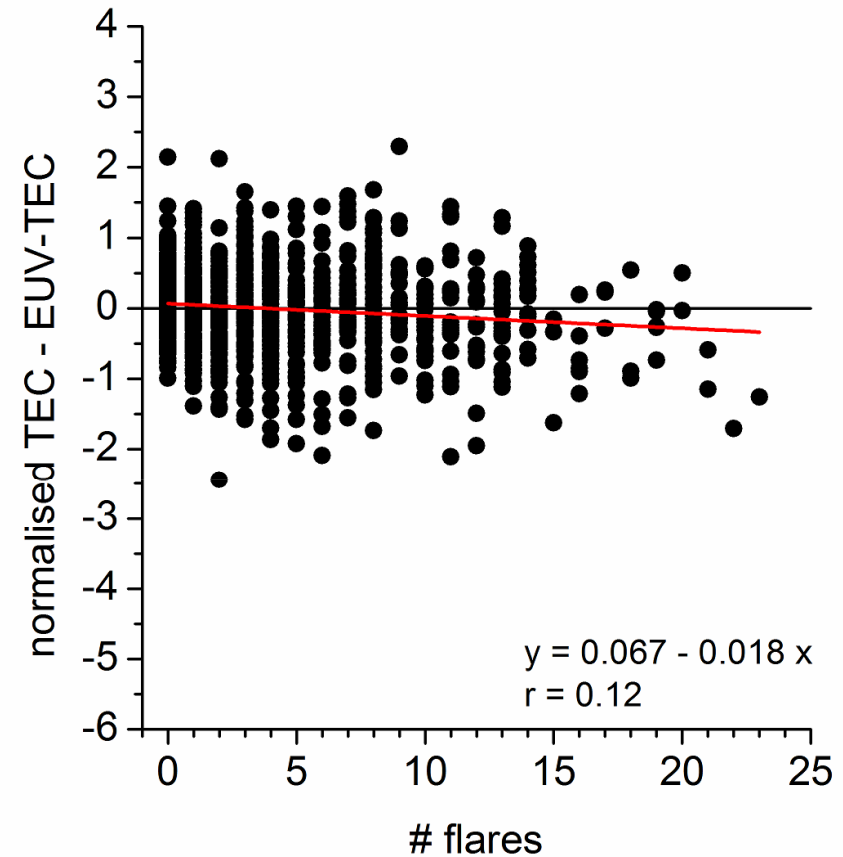
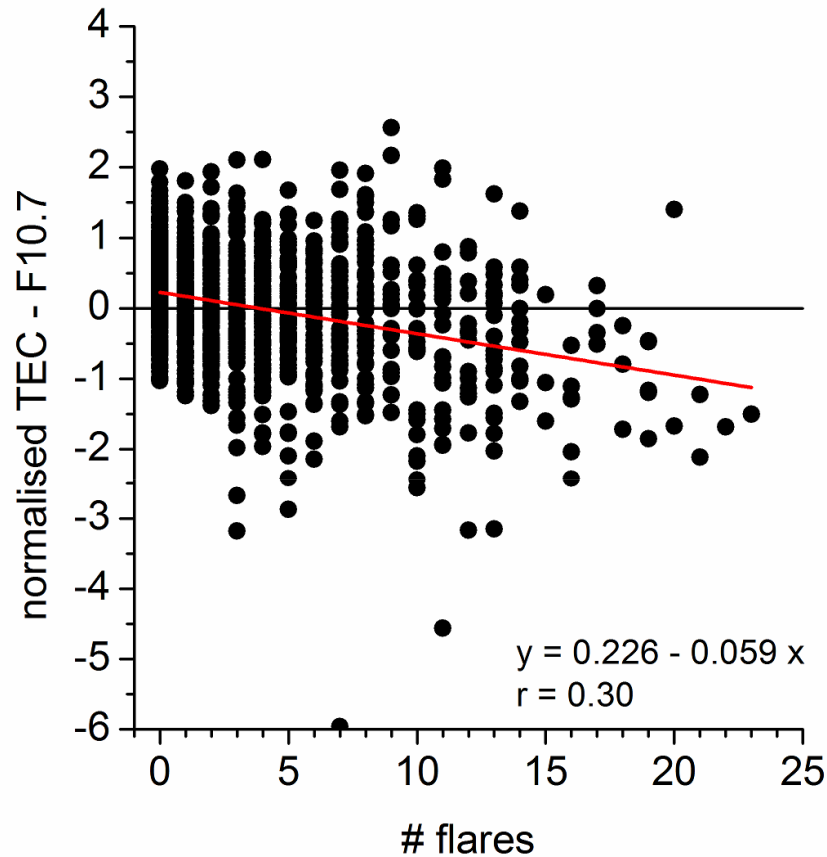
Time series of normalised indices



Time scale 90 days

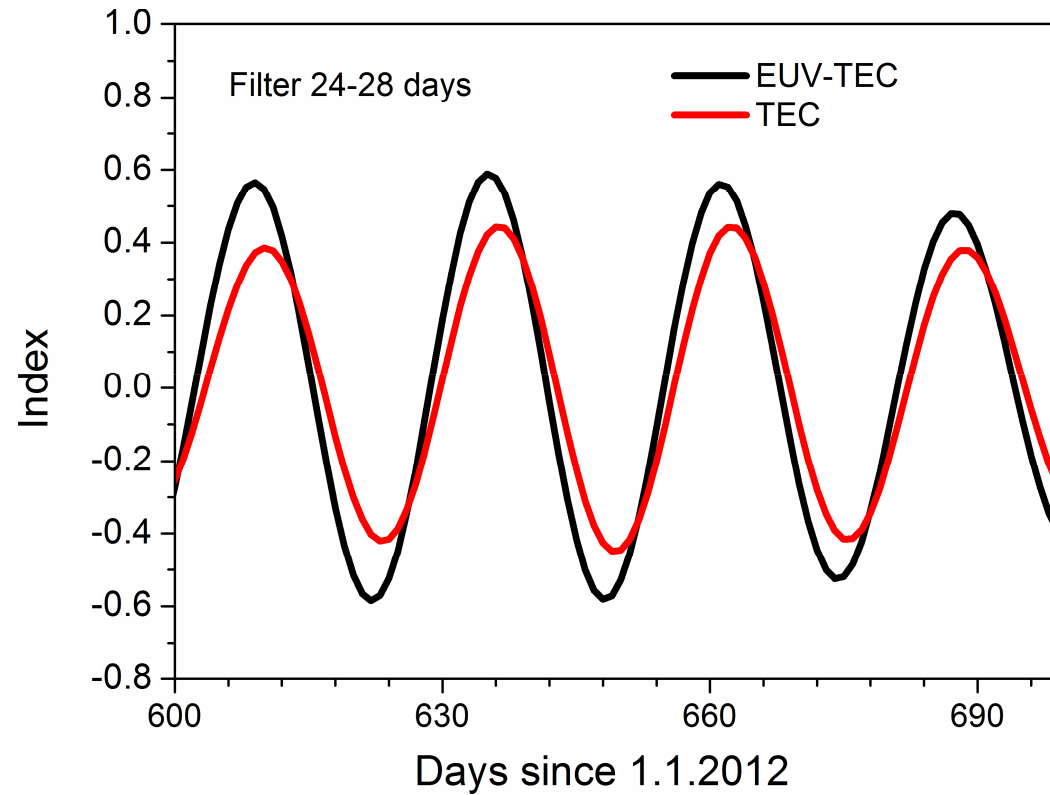


EUV indices and solar flares

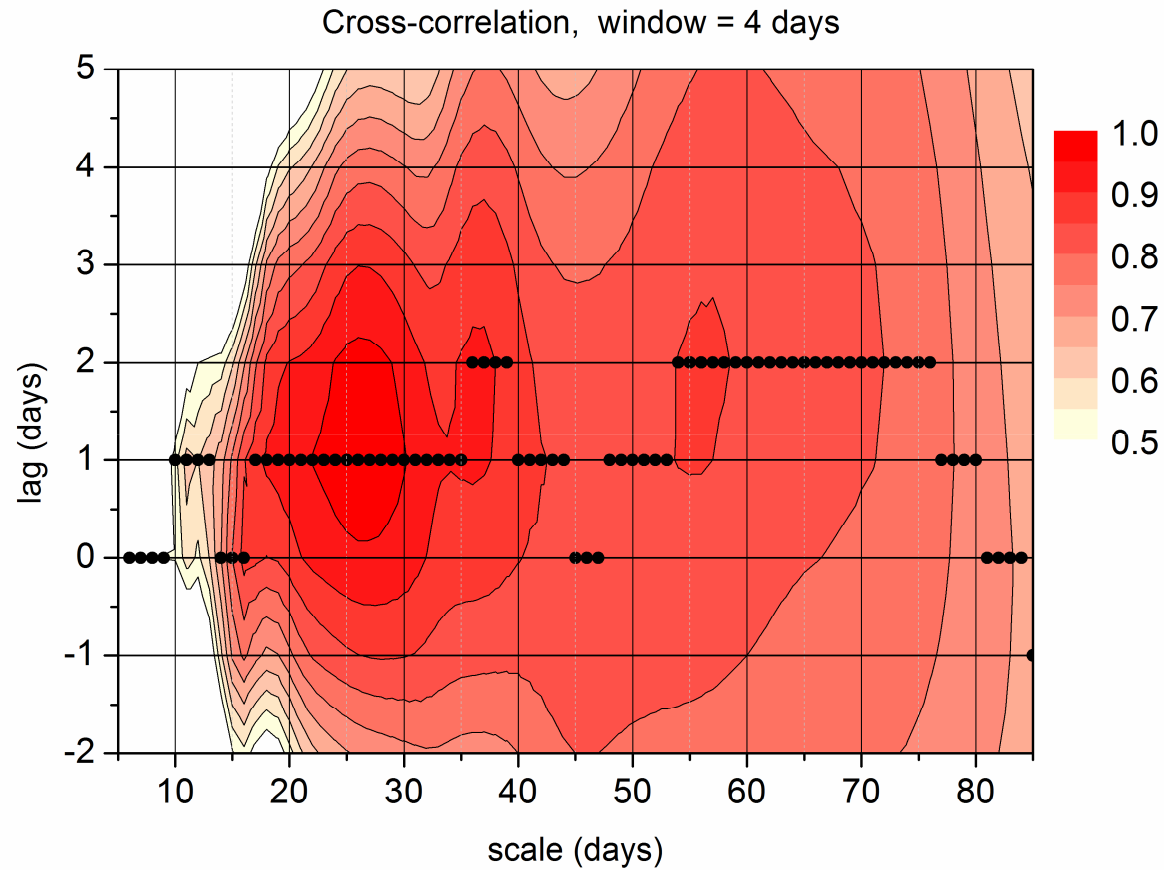


EUV-TEC describes short-term TEC variability well

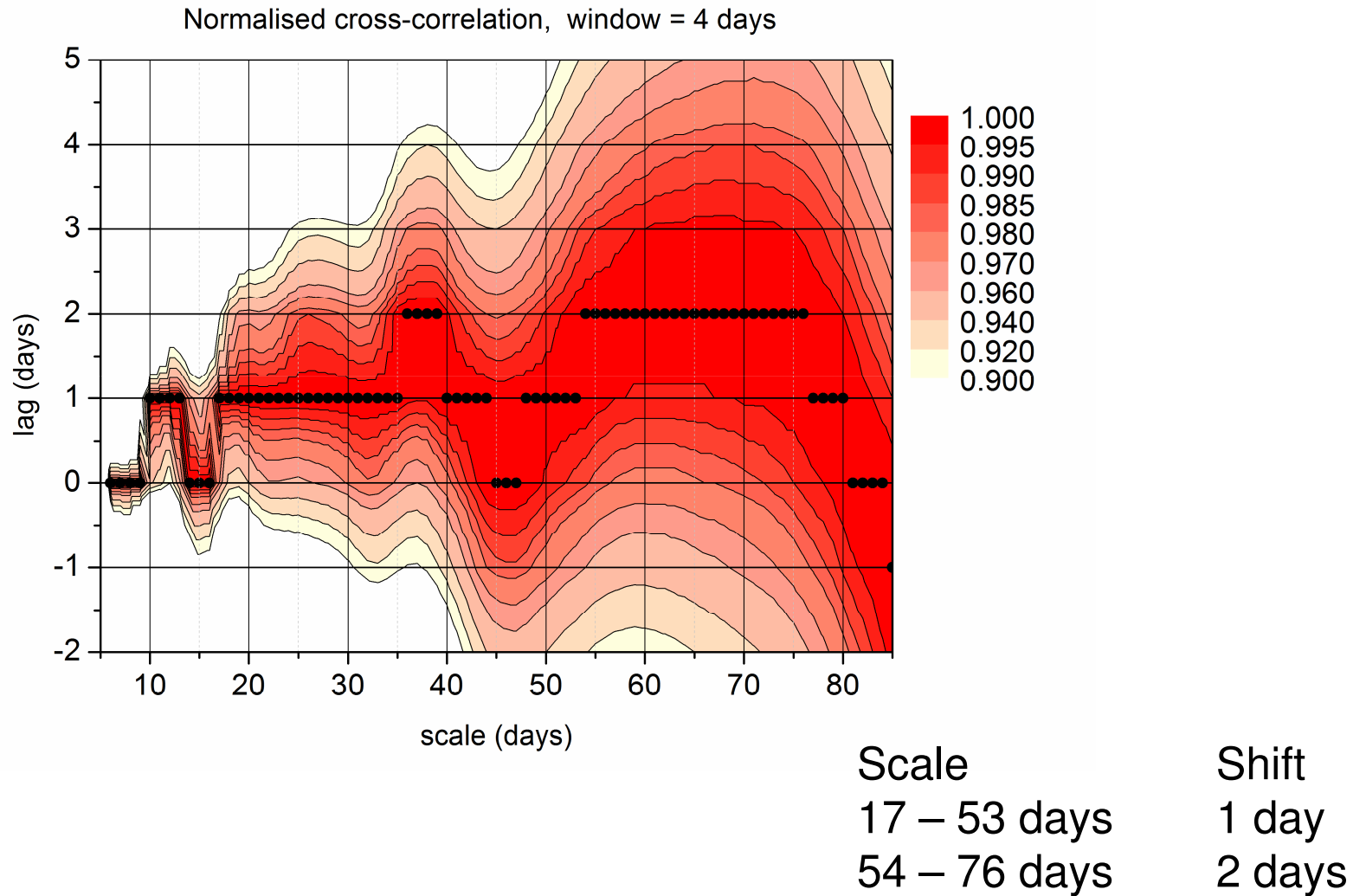
Filtered time series



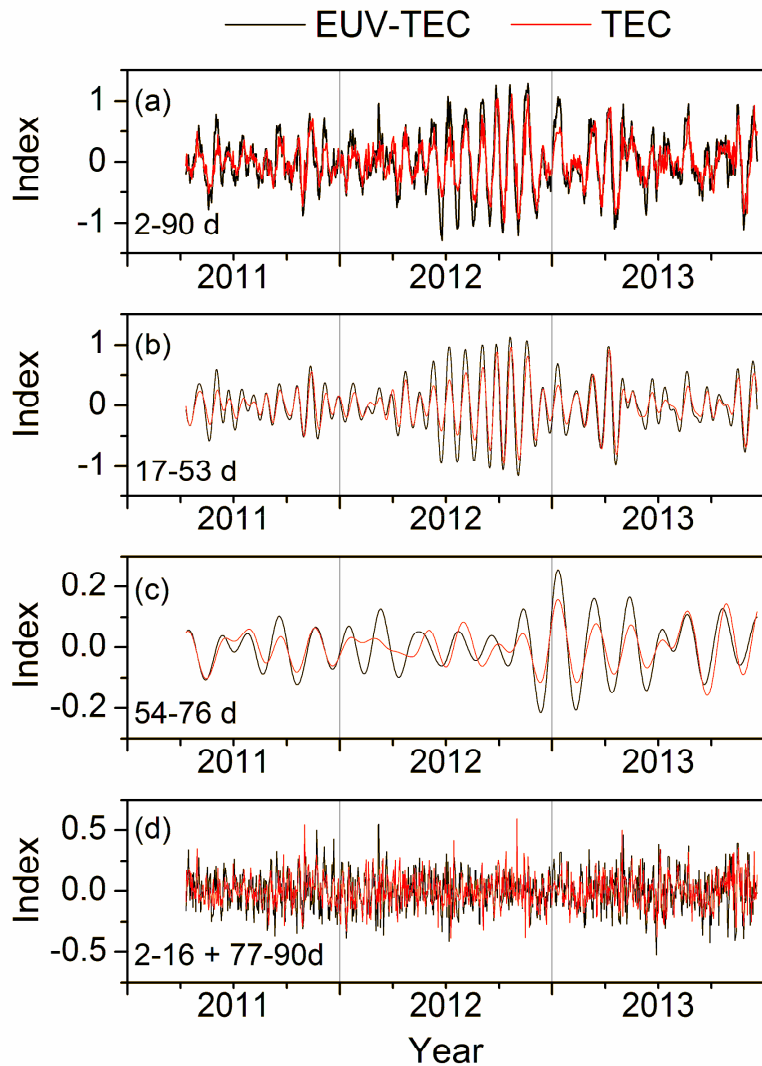
TEC delay at different time scales



TEC delay at different time scales



Construction of new EUV-TEC index



shift by 1 day



shift by 2 days

Scale

17 – 53 days

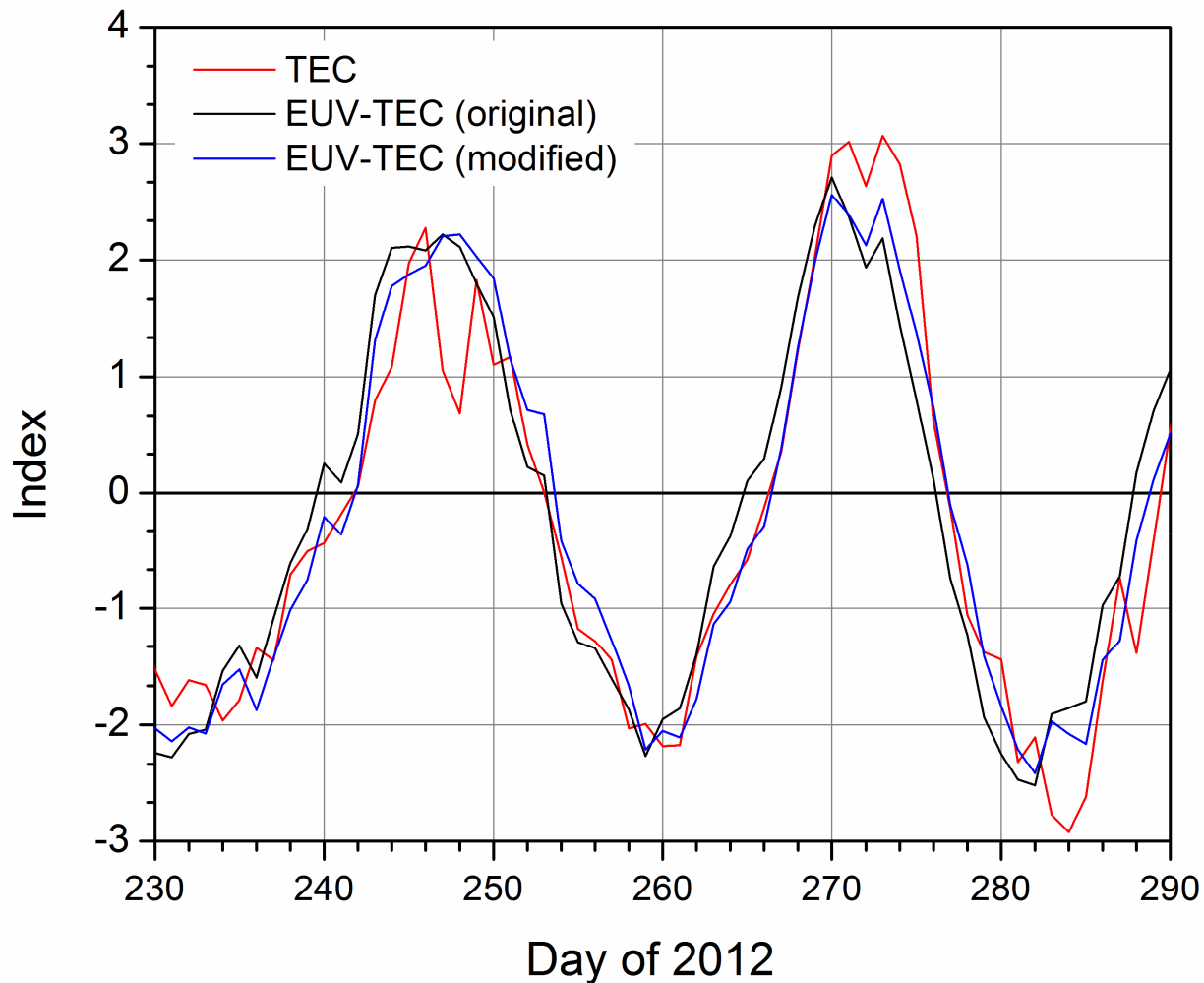
54 – 76 days

Shift

1 day

2 days

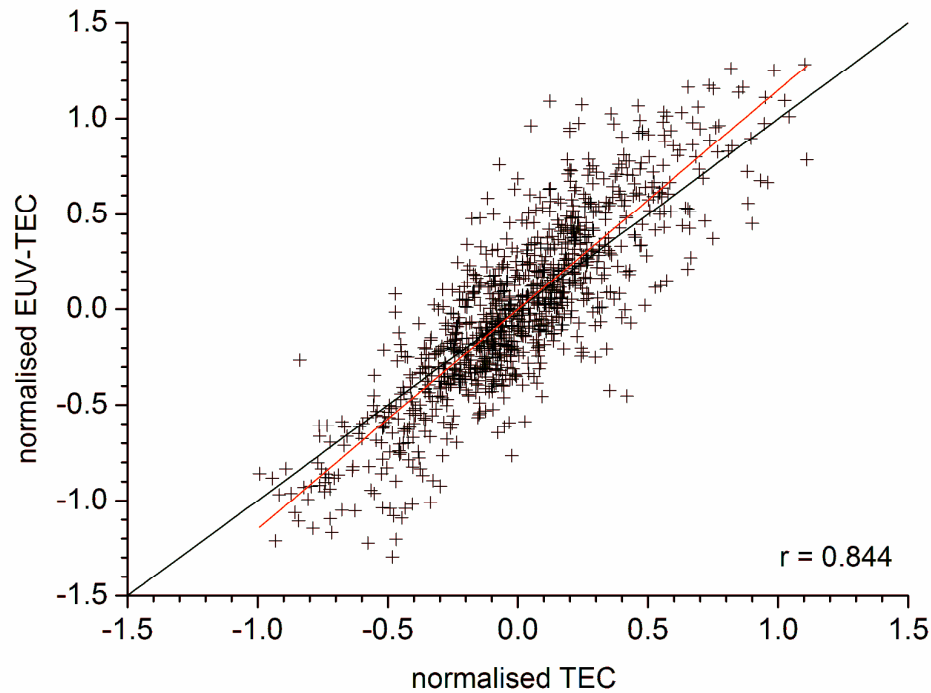
Construction of new EUV-TEC index



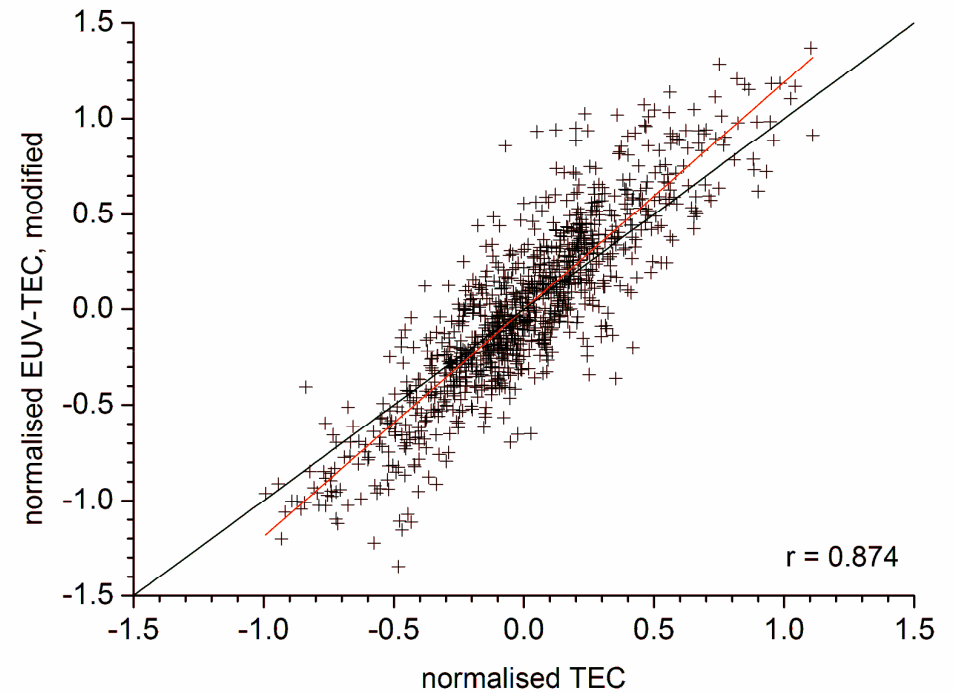
Shift
17 – 53 days 1 day
54 – 76 days 2 days

Correlation of EUV-TEC and TEC

Original



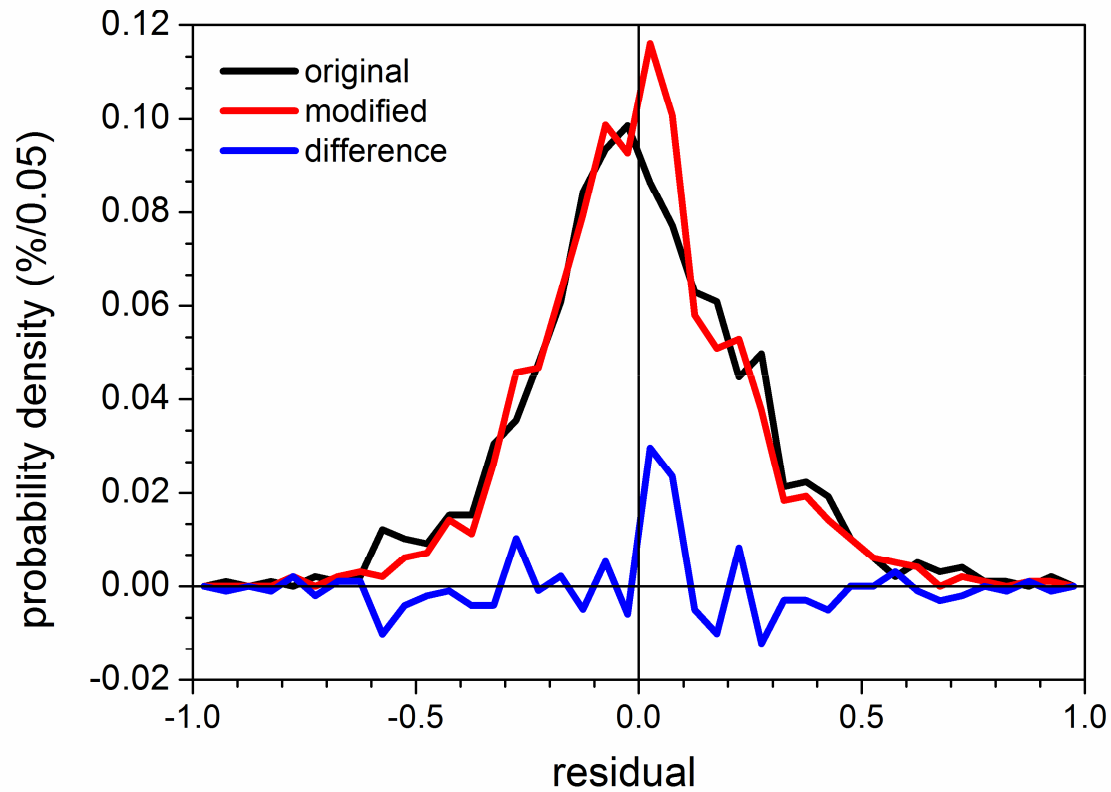
Modified



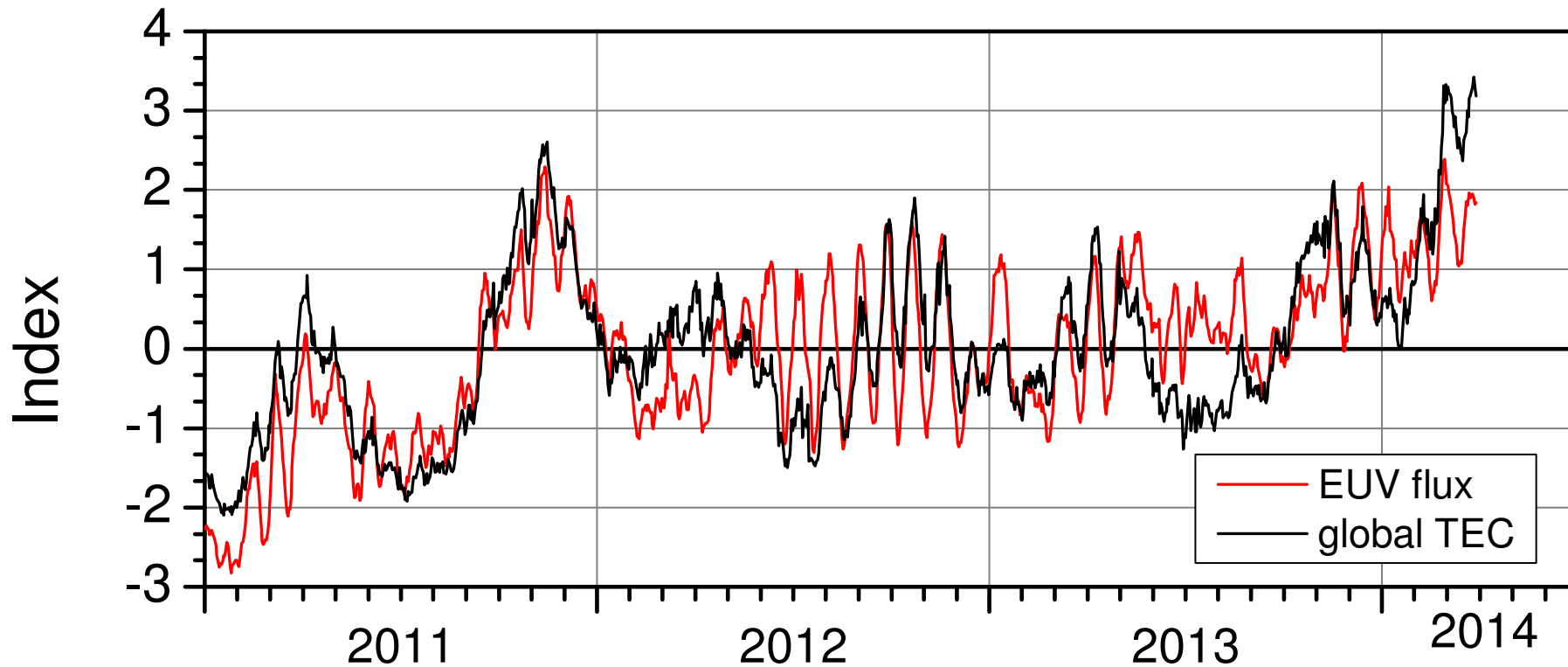
Taking into account the delay
increases $r^2 = 0.71 \rightarrow r^2 = 0.76$

Scale	Shift
17 – 53 days	1 day
54 – 76 days	2 days

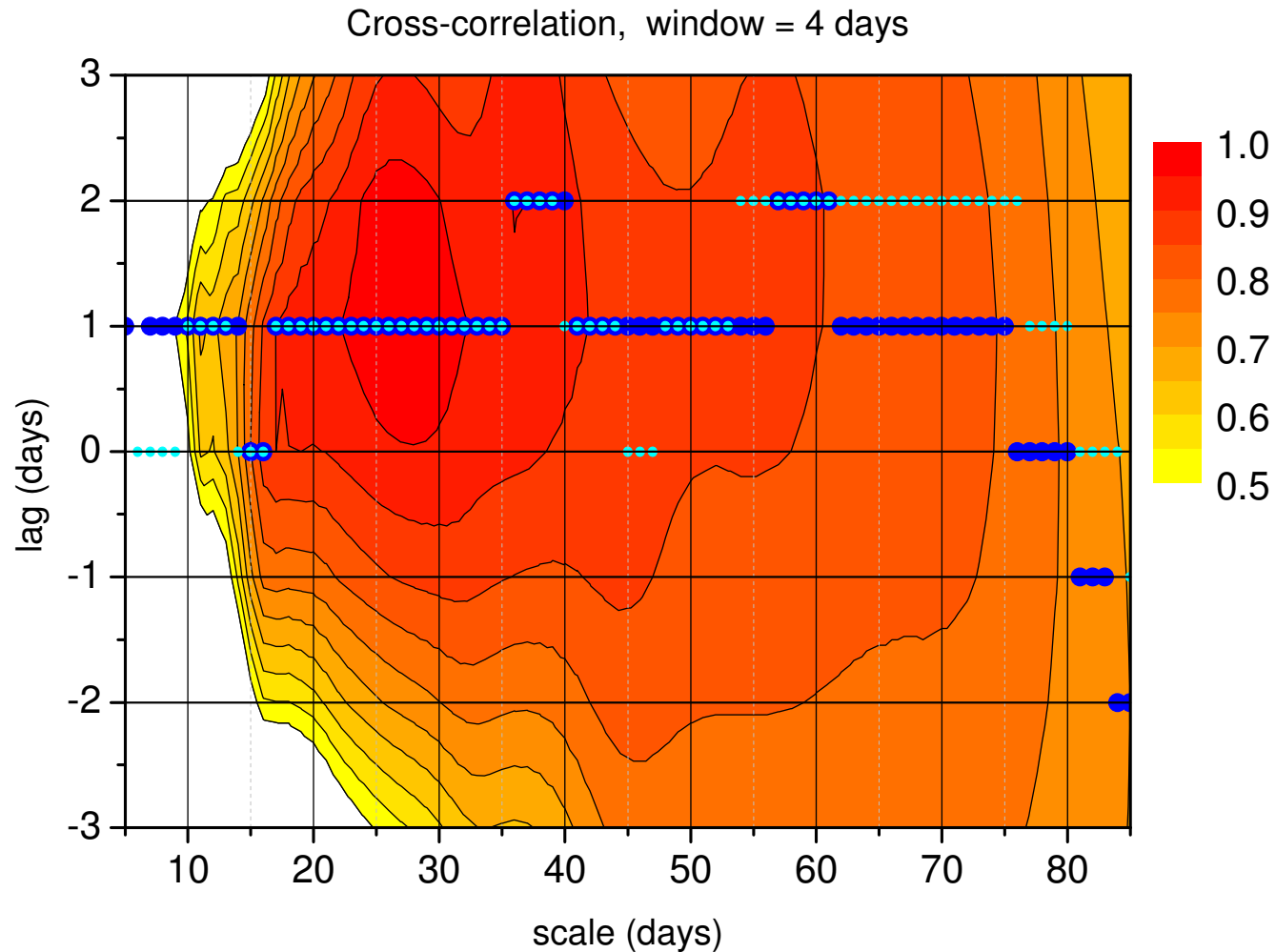
Residuals: differences TEC – EUV-TEC



SDO/EVE Version 5 integrated fluxes



TEC delay at different time scales from SDO/EVE Version 5 fluxes



Taking into account the delay increases $r^2 = 0.75 \rightarrow r^2 = 0.81$

Conclusions

- EUV fluxes and primary ionization explains about 70-75% of TEC variability on a global and seasonal scale
- SDO/EVE Version 5 spectra perform even better
- Ionospheric delay of 1 – 2 days for the solar rotation and longer time scale
- Taking this into account gives better representation of TEC by EUV