



# Long-range correlations of ERA-40 temperature data: Geographic patterns and height dependence

Andrea Király \*, Imre M. Jánosi

Department of Physics of Complex Systems, Loránd Eötvös University  
Pázmány P. s. 1/A, H-1117 Budapest, Hungary

\* E-mail address: kiralya@lecco.elte.hu



## 1. Motivation:

Long-range correlations are detected for several atmospheric parameters (screen temperature, SST, pressure anomaly, ozone concentration, etc.)

Present work:

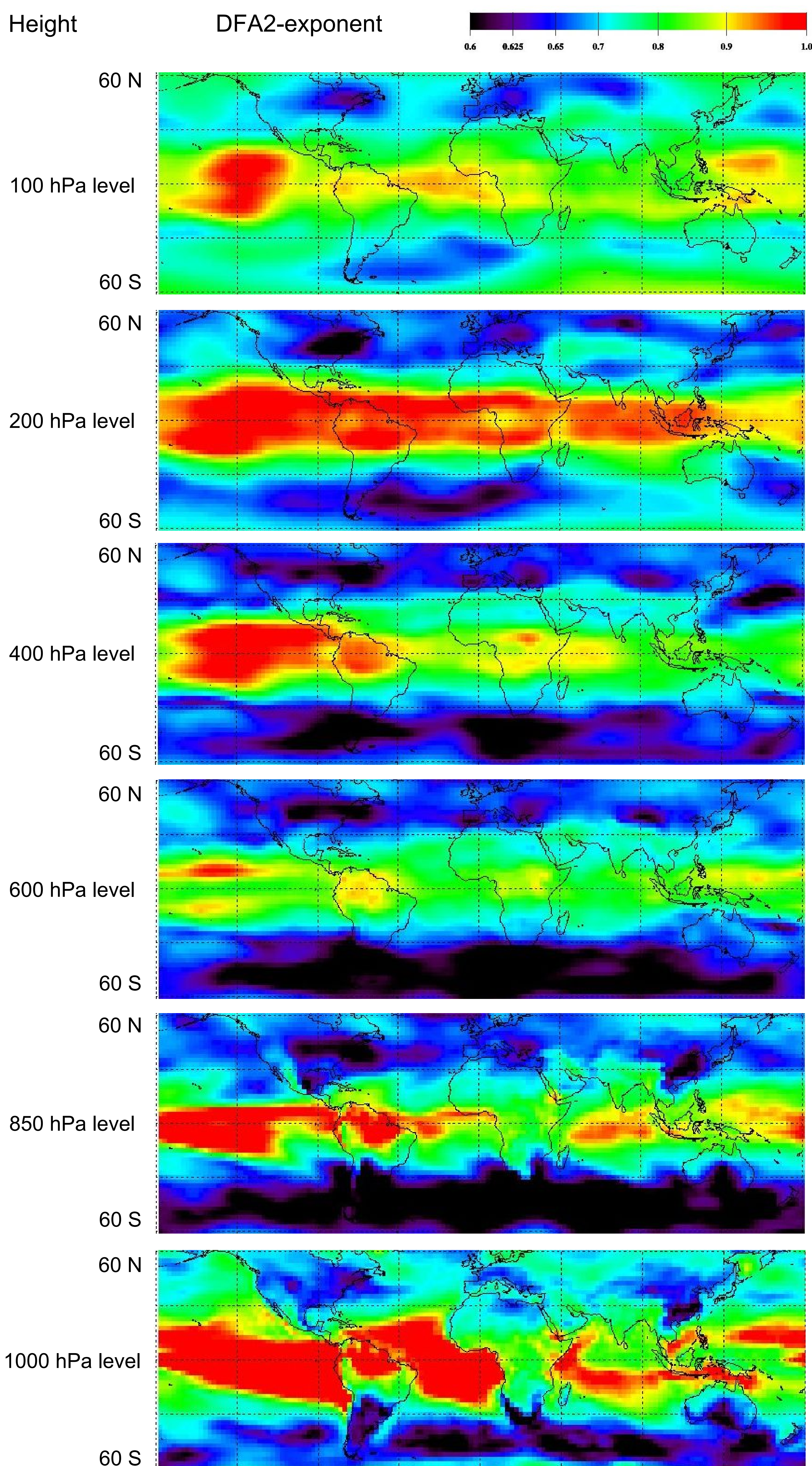
- Global analysis of temperature time series in the ERA-40 data base
- Temporal resolution: 6 hours, spatial resolution:  $2.5^\circ \times 2.5^\circ$  latitude/longitude, covered interval: 45 years, height: 6 pressure levels (see below).
- Empirical geographic patterns
- Comparing with the results for the surface air temperature in the GDCN data base

Importance:

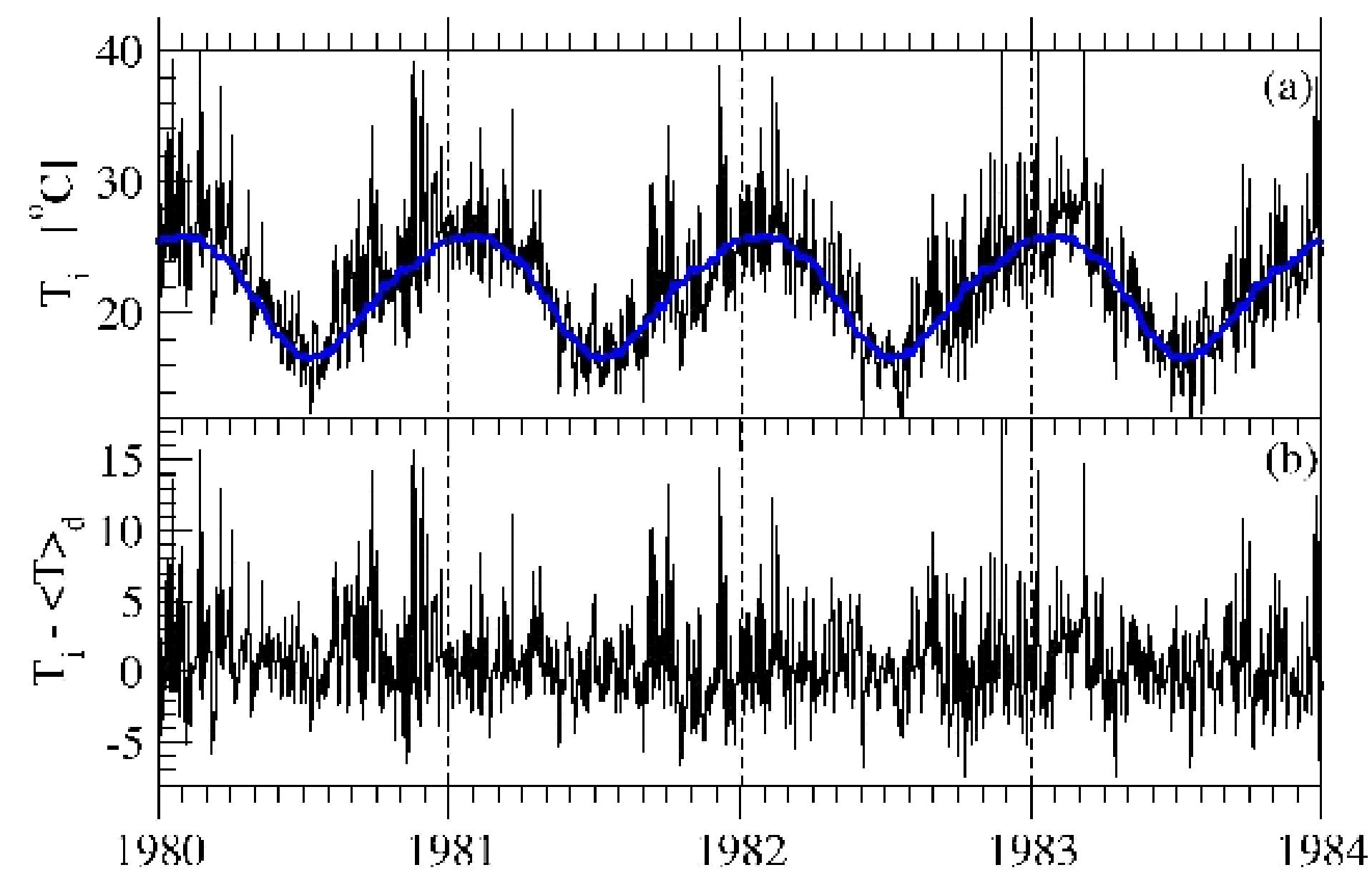
- Understanding long-range memory in the atmosphere
- Providing testbed for globally coupled numerical models

## 3. Results:

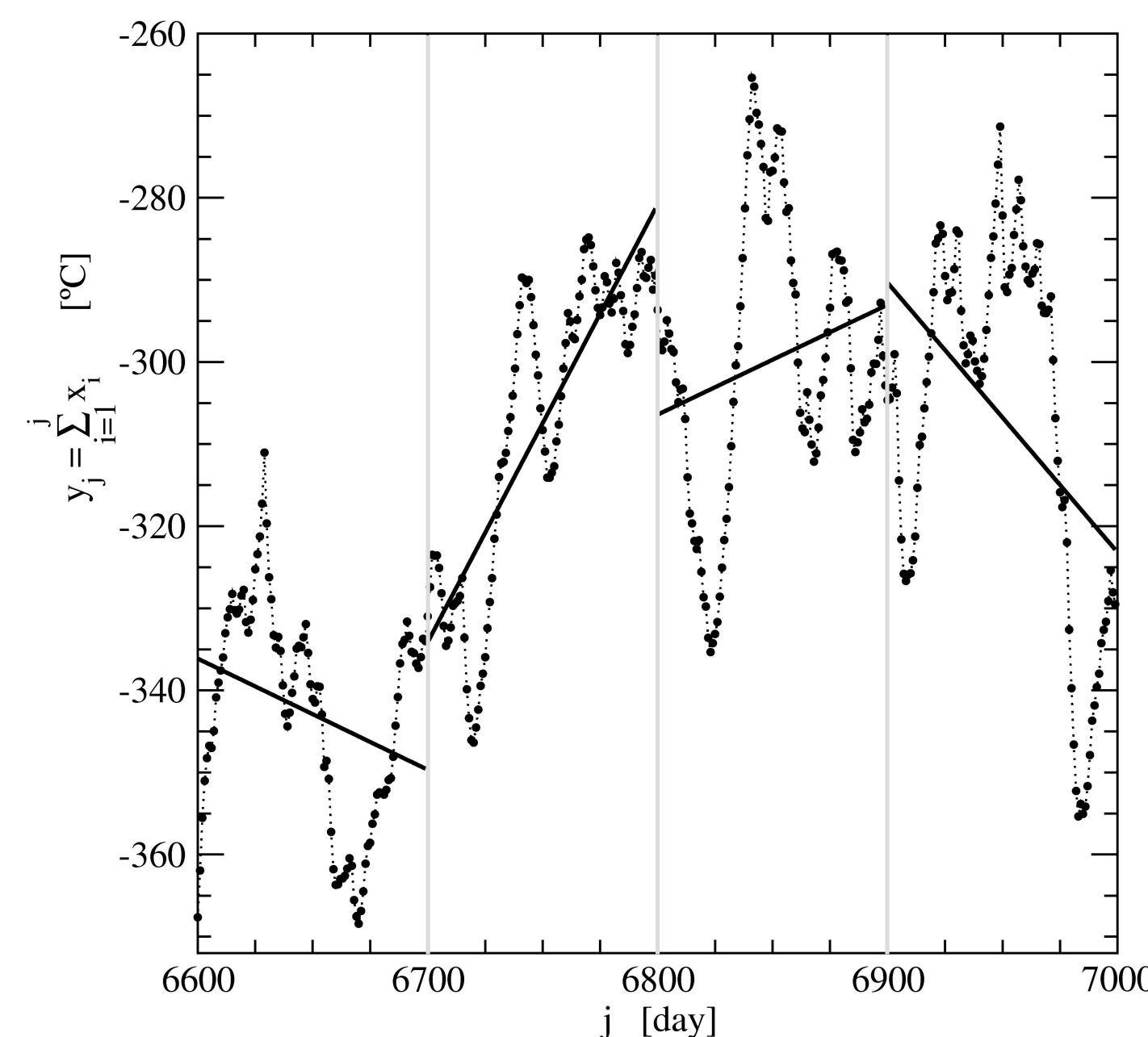
### ERA-40 data – geographic distribution



## 2. Method: Detrended Fluctuation Analysis (DFA)

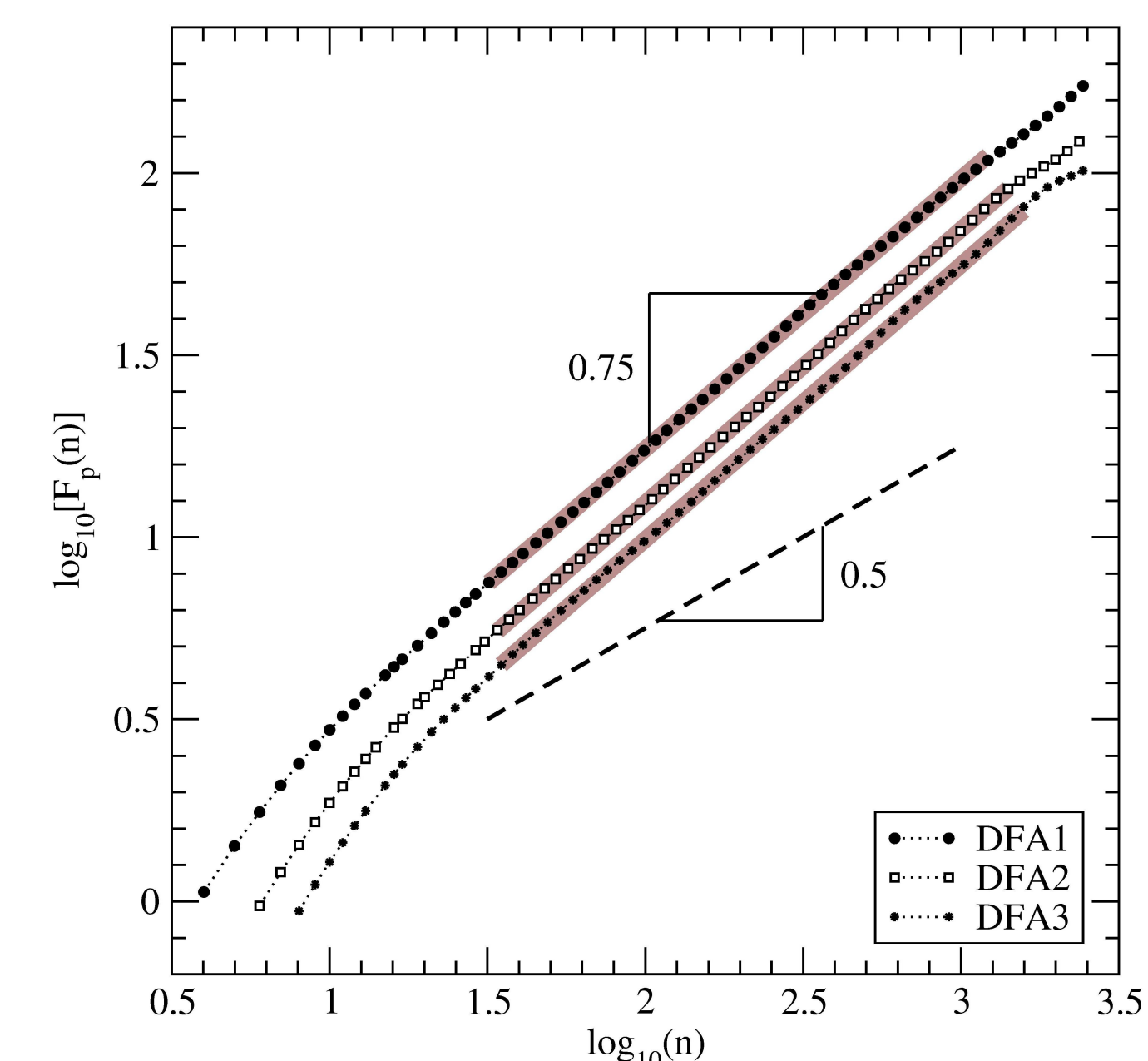


Step 1:  
Remove annual periodicity  $\rightarrow$   
temperature anomaly



Step 2: Integrate series  $\rightarrow$  Profile

Step 3: Divide the profile and fit local trends with a polynomial of order  $p$



Step 4: Measure average fluctuations around local trends  $\rightarrow F_p$

Step 5: Determine scaling as a function of segment size  $n \rightarrow$  DFA-exponent  $\delta$

### GDCN data

#### DFA2-exponent

The Global Daily Climatology Network, produced by the Climate Analysis Branch, National Climatic Data Center, <http://www.ncdc.noaa.gov/oa/ncdc.html>

