Quantifying and reducing uncertainties

Work package 4

DWD, ECMWF , FFCUL, RIHMI,
UNIBE, UNIVIE, UVSQ

ERA-CLIM2 Review Meeting Jan 19, 2017

Status of Deliverables

Deliverable number	Deliverable title	Delivery date
D4.1	RS bias adjustments (UNIVIE)	20
D4.2	Updated RS bias adjustments (UNIVIE)	48
D4.3	QC for observations from FFCUL (FFCUL)	48
D4.4	Visualization tool for QC (FFCUL)	12
D4.5	QC for upper-air, surface, and snow obs. (RIHMI)	36
D4.6	Methodology for quantifying obs error (UBERN)	36
D4.7	Verification of precipitation against GPCC (DWD)	48
D4.8	Global energy, water, carbon cycles (ECMWF,UNIVIE, UVSQ)	48
D4.9	Upper air data qc (UBERN, RIHMI)	24
D4.10	Comparison with other reanalyses (UNIVIE; ECMWF)	48
D4.11	Low frequency variability and trends (ALL)	48
D4.12	Uncertainty of input parameters for carbon budget (UVSQ)	20
D4.13	Confidence intervals on carbon fluxes (UVSQ)	48
D4.14	Comparison of CTESSEL, ORCHIDEE flux estimates (ECMWF, UVSQ, UNIVIE)	48

D4.2
Updated Radiosonde bias adjustments

- Improvements on RS-T in various aspects
  - Smaller trend heterogeneity, more stations, extension back to 1939
  - Annually varying adjustments
  - Adopted for ERA-5, paper in preparation
- Humidity adjustments
  - Back to 1979, not yet all stations included
  - paper to be submitted

RAOBCORE/RICH Visualization

universität wien

Time Series

027459	LongType	21
027595	bgdep	22
027612	rcorr	23
027707	rio	24

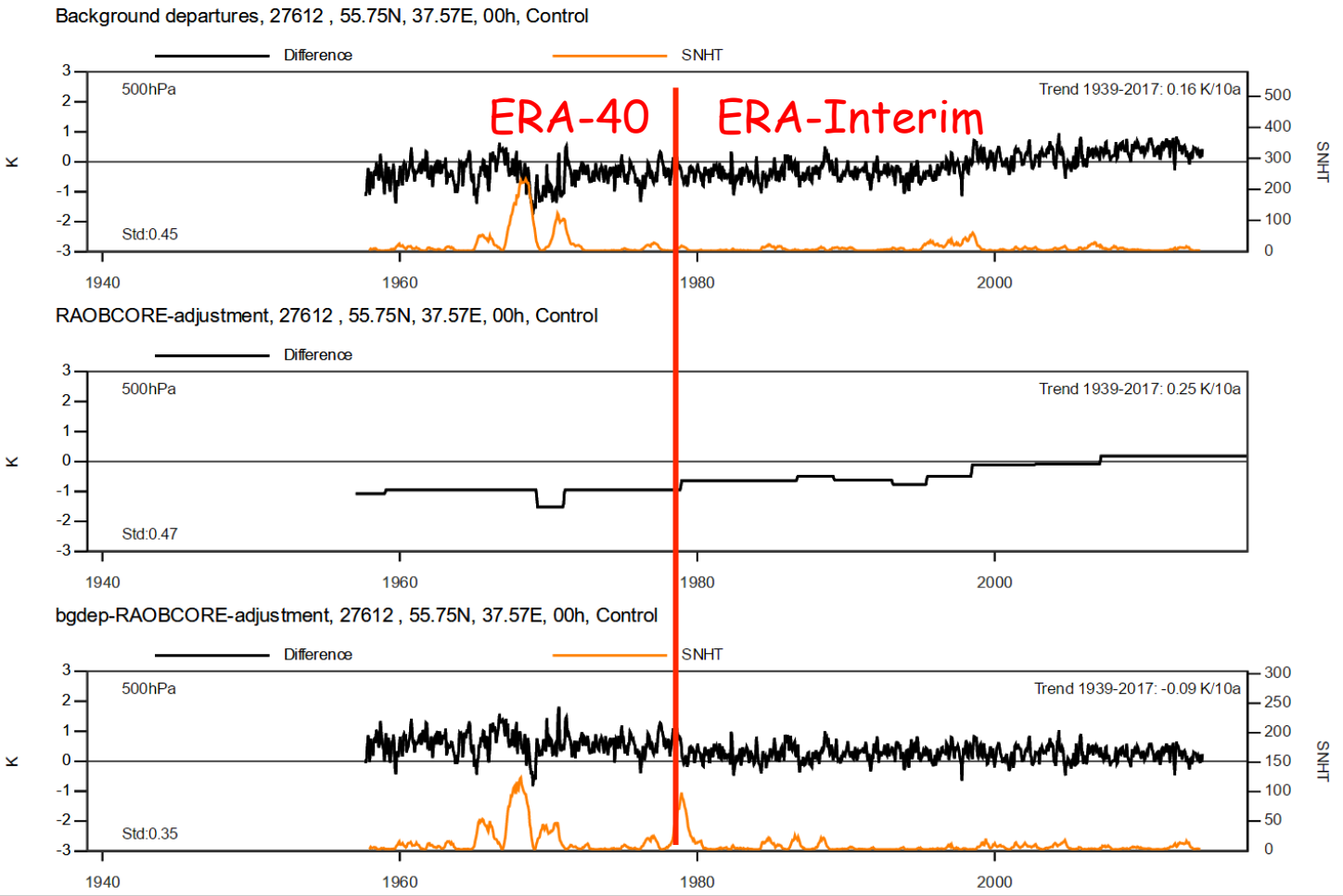
1939 - 2017

Experiment
Control
exp00
exp01
exp02
exp03
exp04
exp05
exp06
exp07

PressureLevel
10
20
30
50
70
100
150
200
250
300
400
500
700
850
925
1000

Time
00
12

Version
1.0
1.1



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Time Series

Experiment
Control
exp00
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exp06
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PressureLevel
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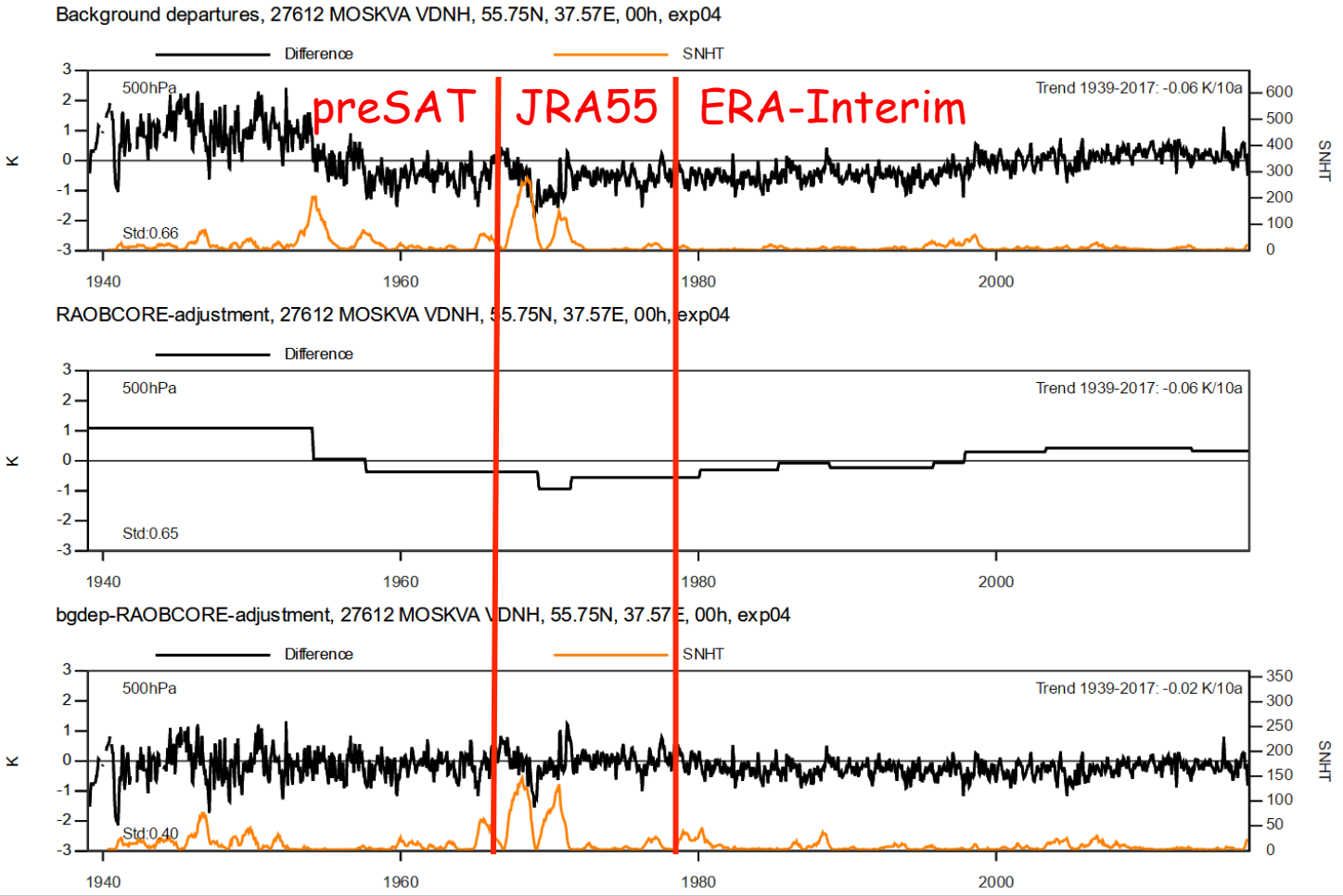
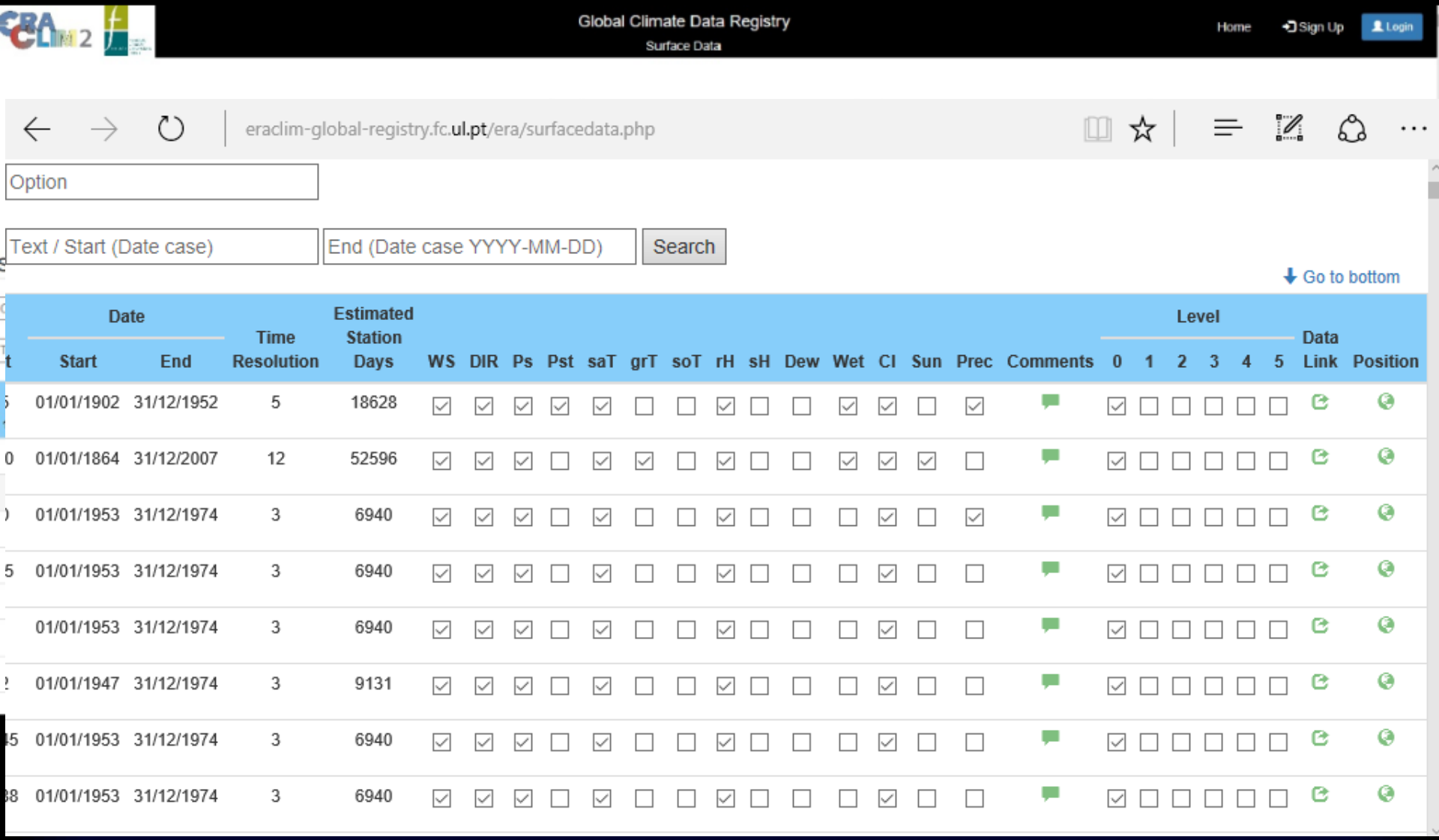


D4.3,4.5,4.6,4.9
Quality Control Activities

- Reports almost completed (4.5 by end of January)
- Essential to feed back flags, corrections into source data sets
- Not only data but also metadata
- 6-monthly update cycle agreed

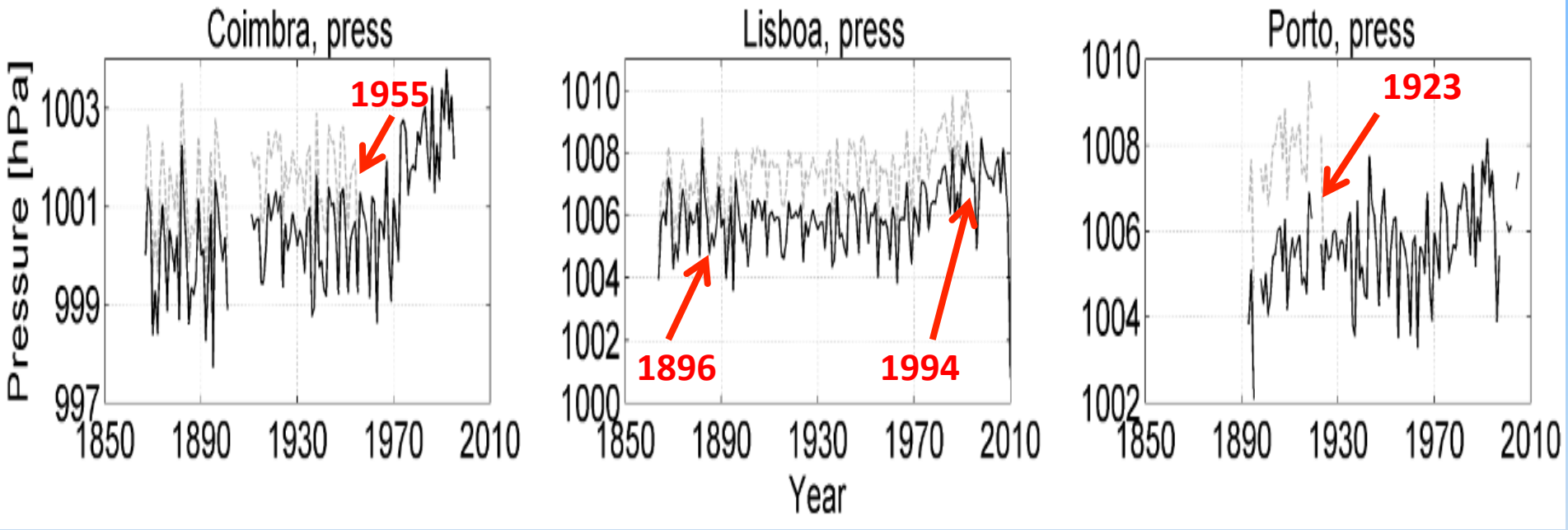
ERA-CLIM Metadata-Base (surface stations)



Date		Time Resolution	Estimated Station Days	WS	DIR	Ps	Pst	saT	grT	soT	rH	sH	Dew	Wet	Cl	Sun	Prec	Comments	Level						Data Link	Position
Start	End																		0	1	2	3	4	5		
01/01/1902	31/12/1952	5	18628	☑	☑	☑	☑	☑	☐	☐	☑	☐	☐	☑	☑	☐	☑		☑	☐	☐	☐	☐	☐		
01/01/1864	31/12/2007	12	52596	☑	☑	☑	☐	☑	☑	☐	☑	☐	☐	☑	☑	☑	☐		☑	☐	☐	☐	☐	☐		
01/01/1953	31/12/1974	3	6940	☑	☑	☑	☐	☑	☐	☐	☑	☐	☐	☐	☑	☐	☑		☑	☐	☐	☐	☐	☐		
01/01/1953	31/12/1974	3	6940	☑	☑	☑	☐	☑	☐	☐	☑	☐	☐	☐	☑	☐	☐		☑	☐	☐	☐	☐	☐		
01/01/1953	31/12/1974	3	6940	☑	☑	☑	☐	☑	☐	☐	☑	☐	☐	☐	☑	☐	☐		☑	☐	☐	☐	☐	☐		
01/01/1947	31/12/1974	3	9131	☑	☑	☑	☐	☑	☐	☐	☑	☐	☐	☐	☑	☐	☐		☑	☐	☐	☐	☐	☐		
01/01/1953	31/12/1974	3	6940	☑	☑	☑	☐	☑	☐	☐	☑	☐	☐	☐	☑	☐	☐		☑	☐	☐	☐	☐	☐		
01/01/1953	31/12/1974	3	6940	☑	☑	☑	☐	☑	☐	☐	☑	☐	☐	☐	☑	☐	☐		☑	☐	☐	☐	☐	☐		

Surface Pressure Breakpoints

FFCUL QC'd pressure data in ISPD V3 have been and homogenized (bold black line) using the breakpoints obtained

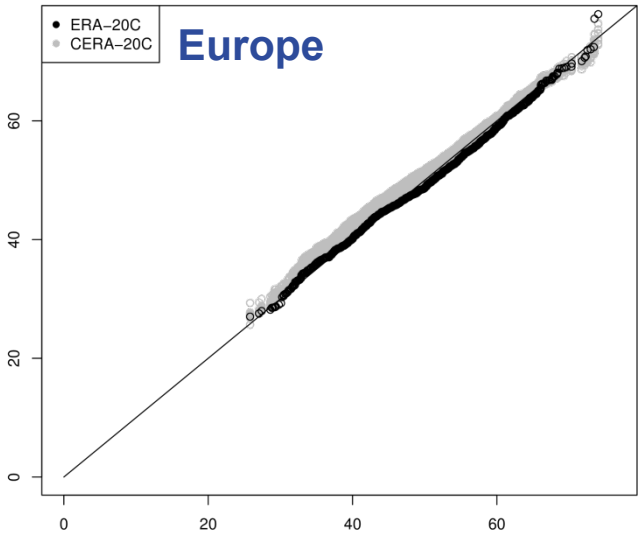


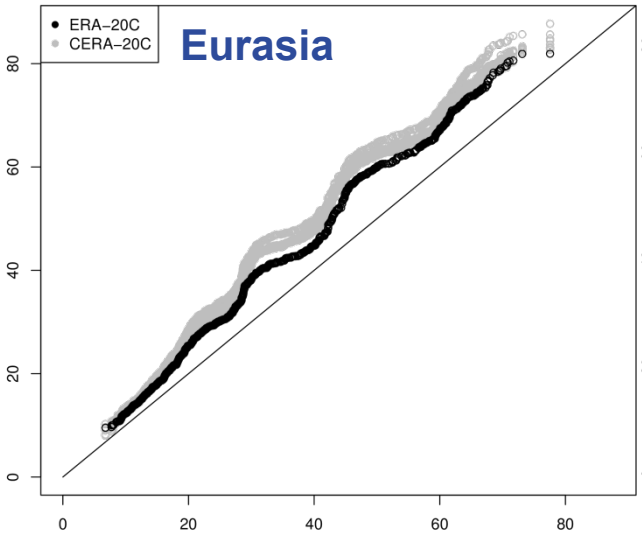
Coimbra: 1955 – Change of barometer
Lisbon: 1896, 1994 – Change of barometer
Porto: 1923 – Station closed during 1920-1922 – probable change of barometer

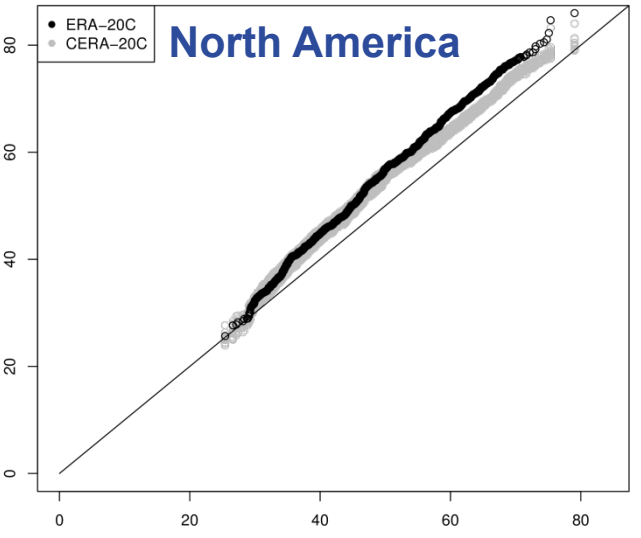
The list contains the breakpoints that coincide with metadata changes and one for which we can make a case for a non-documented metadata change (1923 in Porto is not documented).

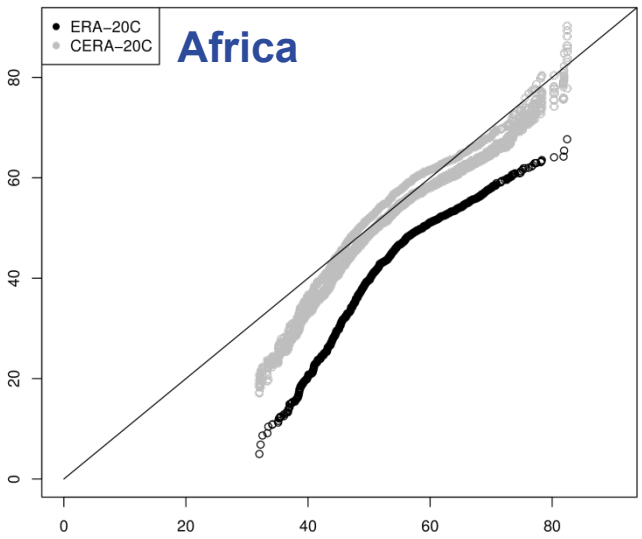
D4.7 Verification of Precipitation

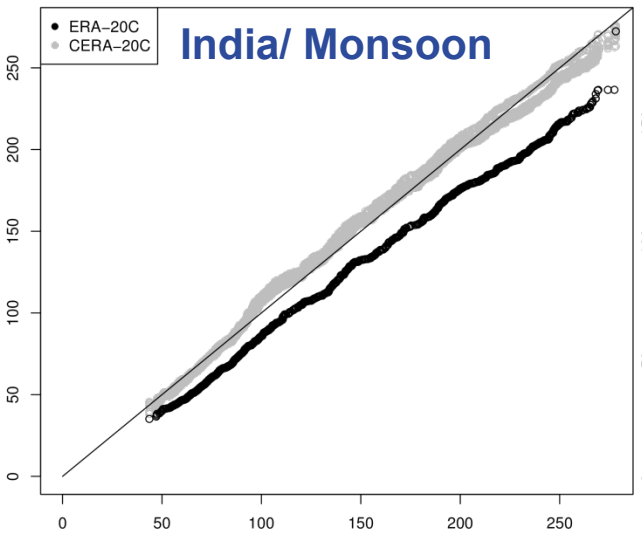
Deutscher Wetterdienst
Wetter und Klima aus einer Hand

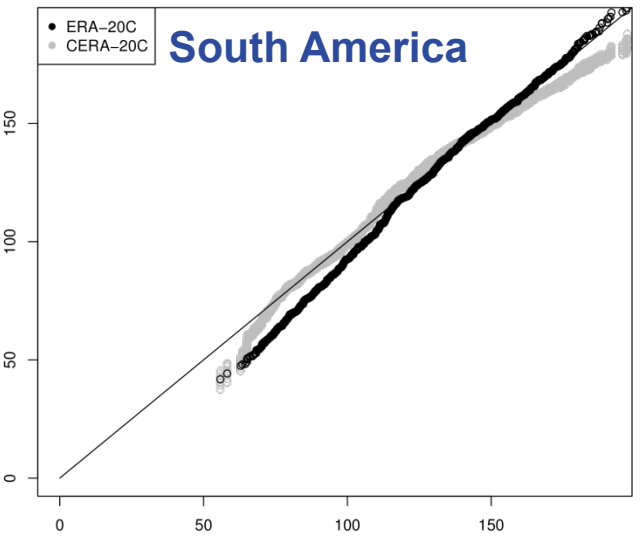








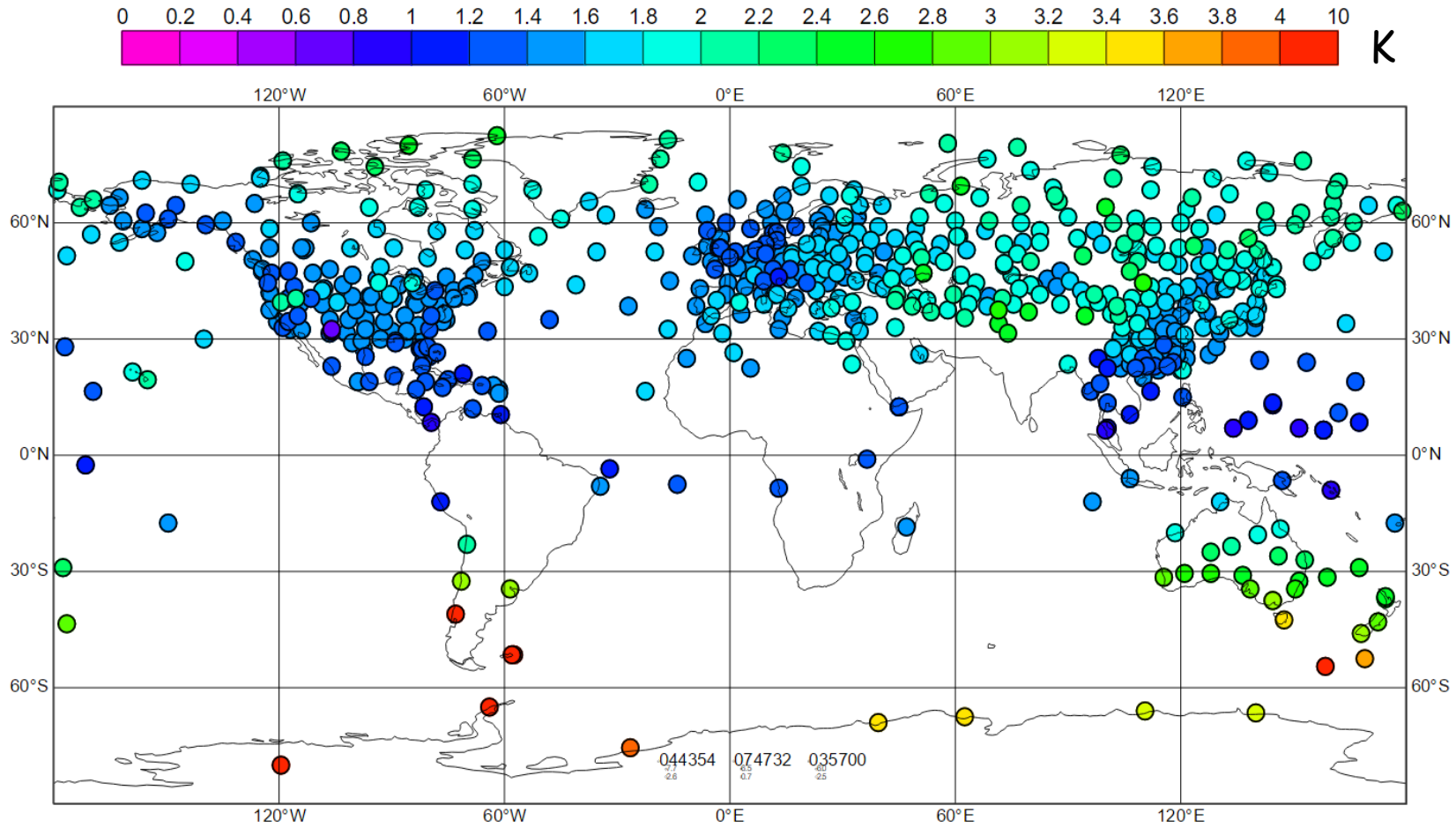




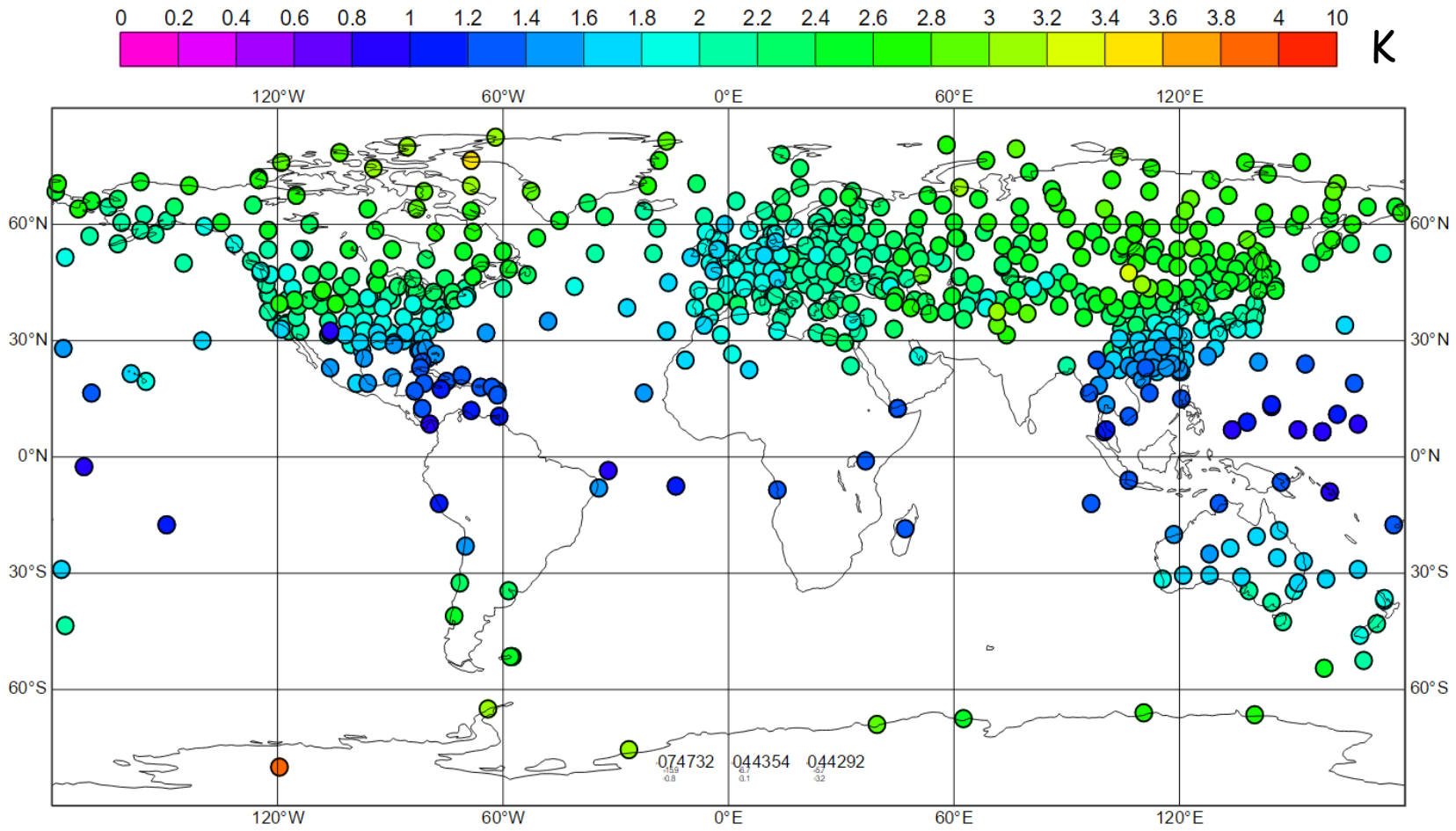
D4.8,D4.10,D4.11
Global energy, water, carbon cycles
Comparison with other reanalyses
Low frequency variability and trends

- 5-6 papers on coupled energy budgets
- Carbon cycle diagnostics using CERA20C as driving input
- Story line for reports prepared by UNIVIE
- CERA20C quite competitive

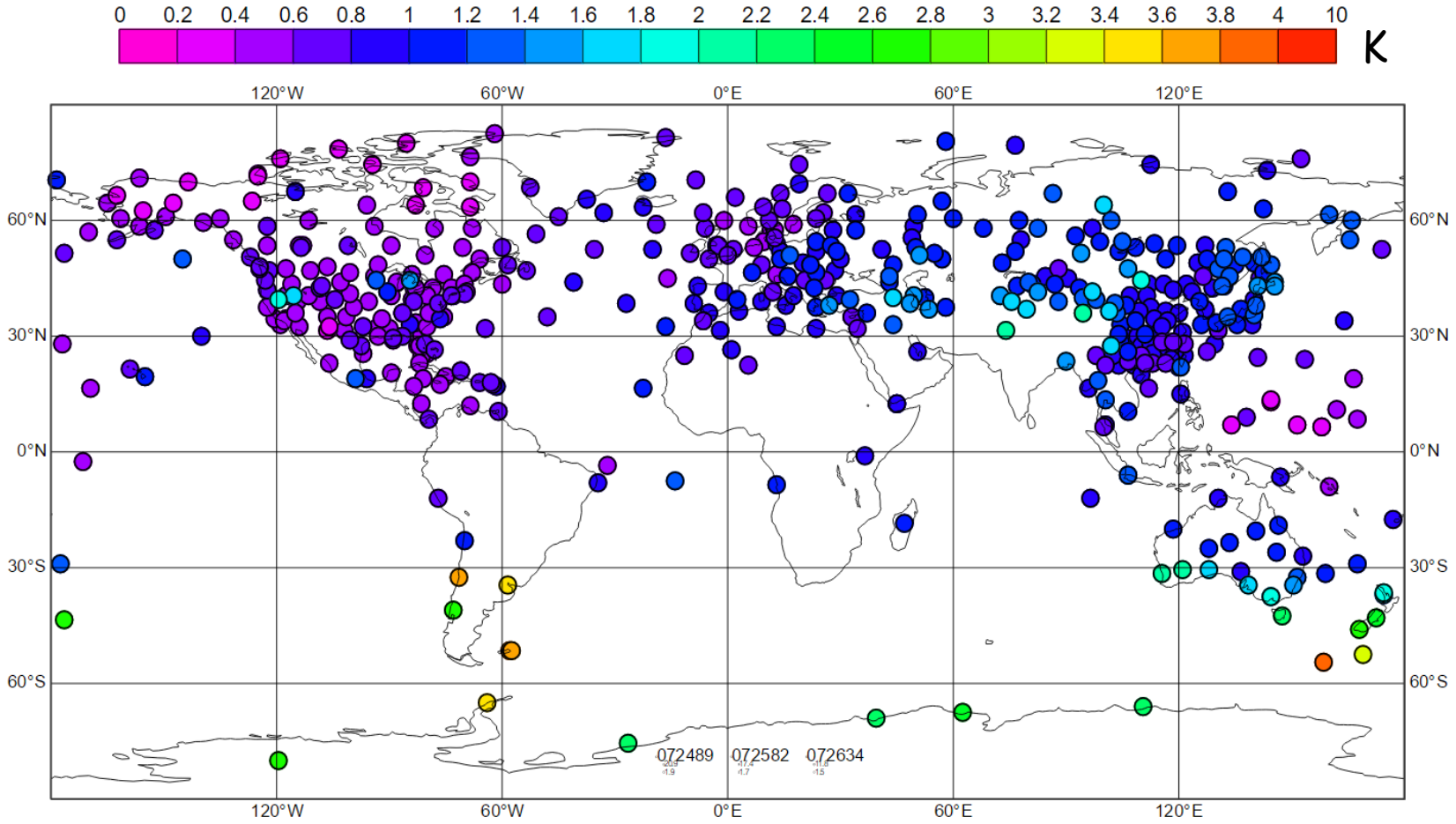
Obs-CERA20C standard dev. 700 hPa 1959/60, from 00h,12h launches



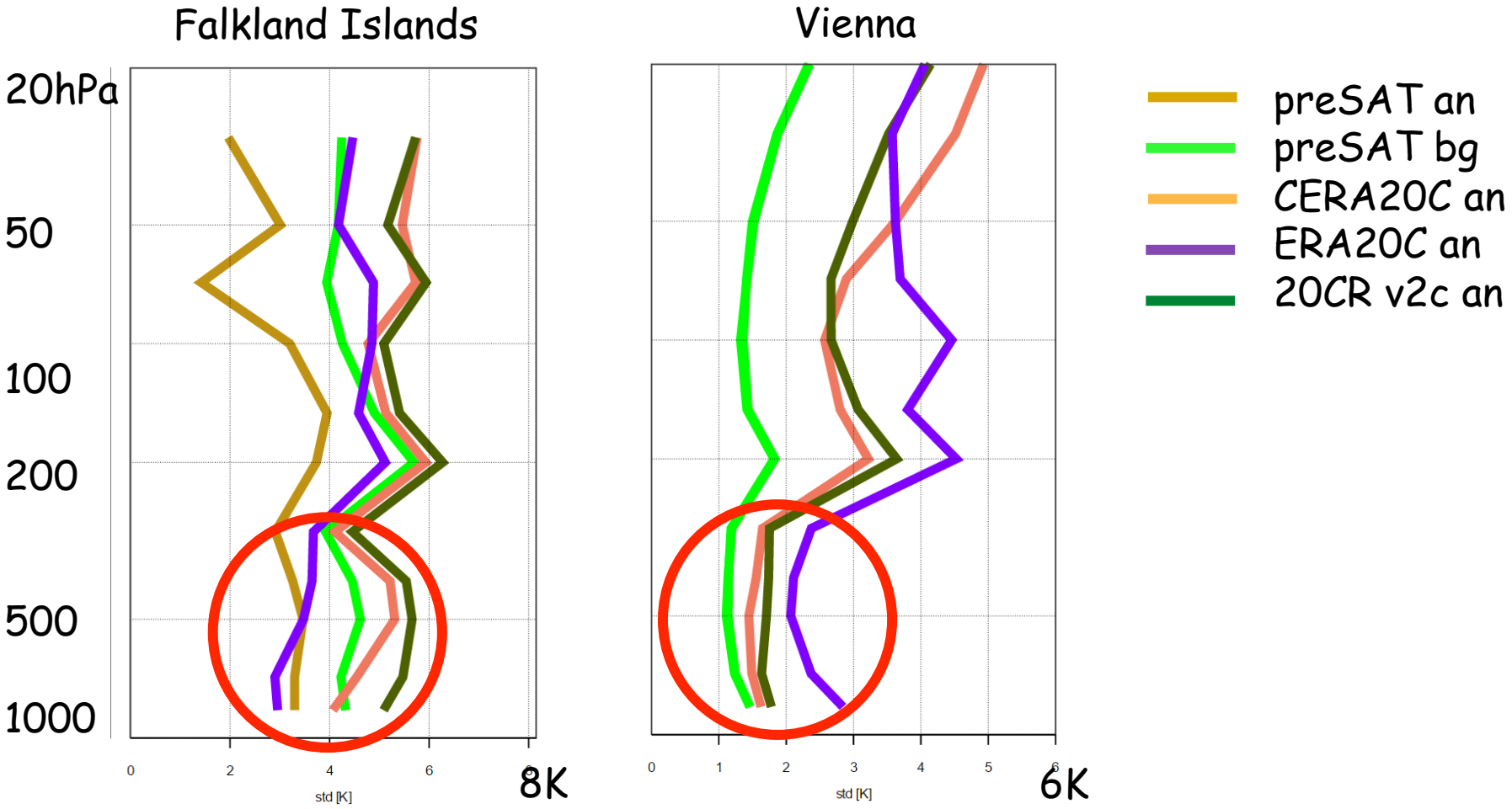
Same for Obs-NOAA 20CR V2c



Same for Obs-ERApreSAT



Obs-Reanalysis departure
Standard deviation profiles 1959/60



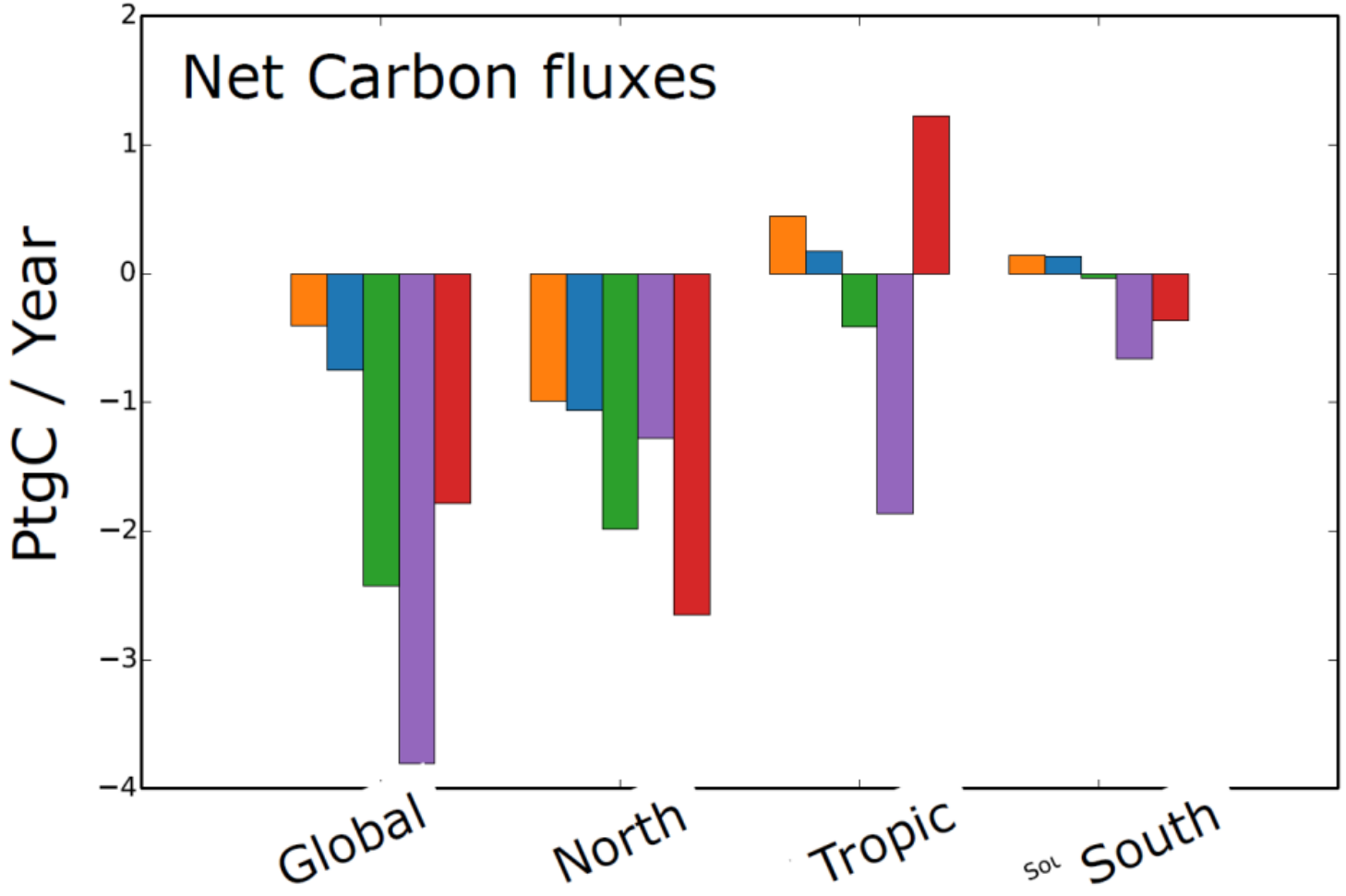
Carbon reanalysis: evaluation of CERA-20C ORCHIDEE simulation

Land Use variant
LUCMIP6 LUCMIP5

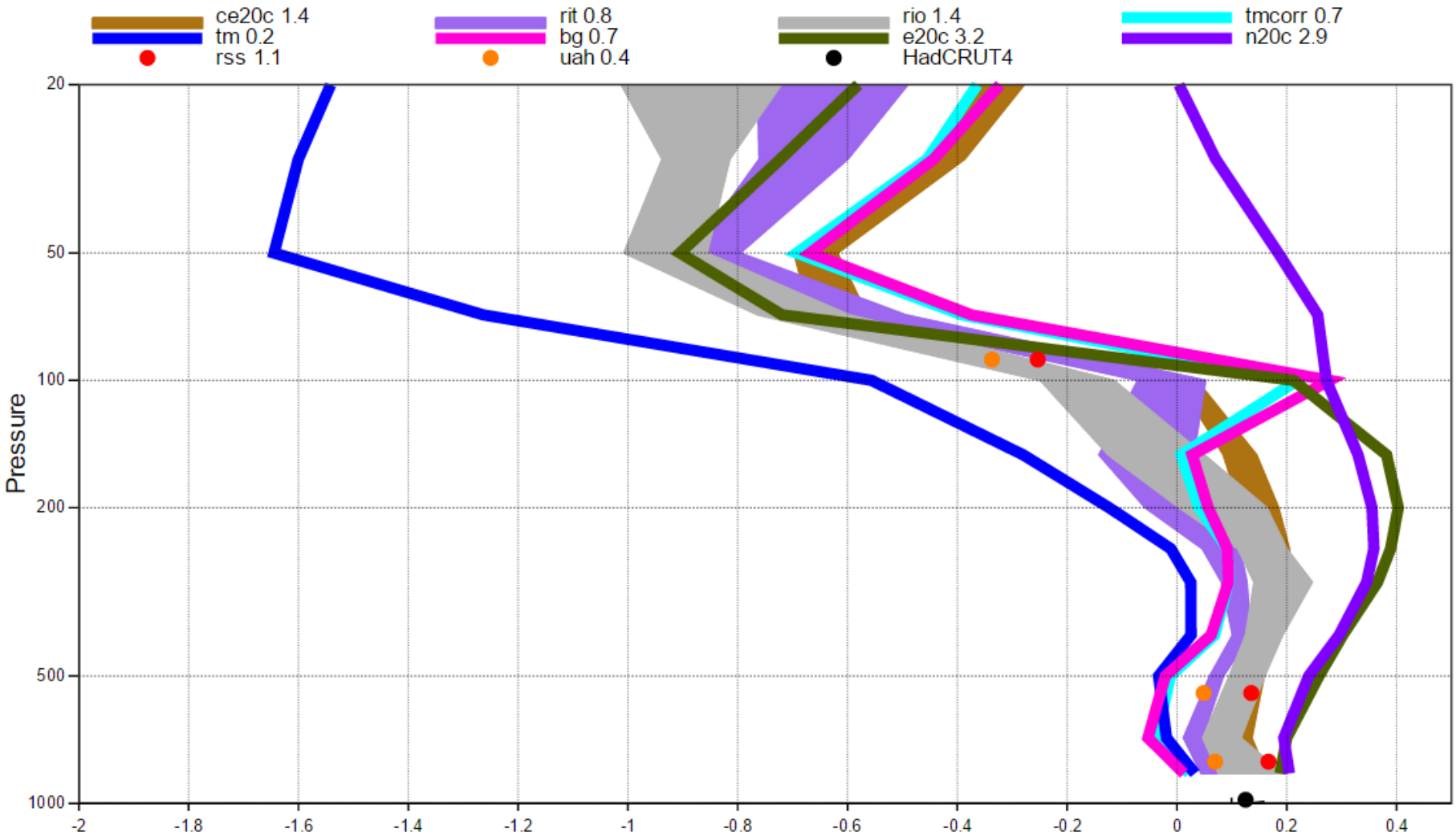
Meteo Forcing
CRUNCEP

Model version
ORC-CMIP5

CO_2 Inversion
MACC2



Tropical Temperature Trends 1979-1999



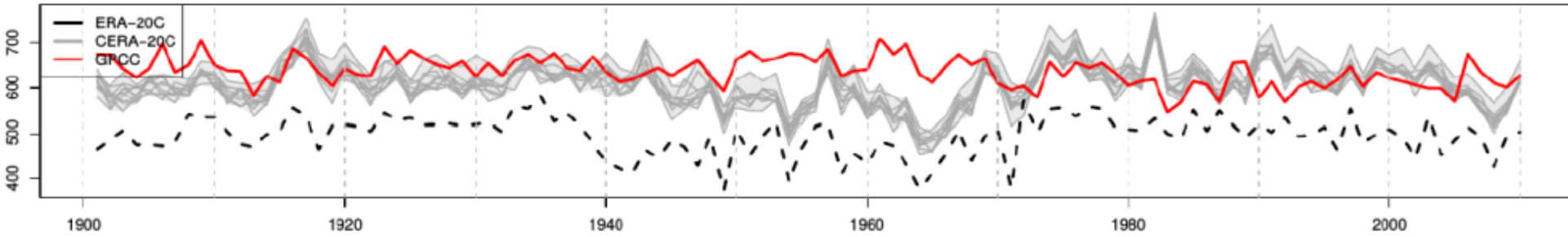


***Fig.** Annual time series **Africa**.*

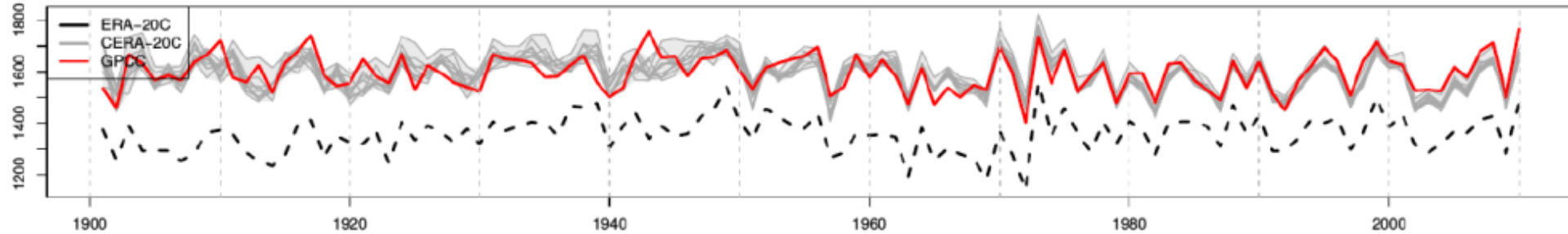


***Fig.** Annual time series **India and Monsoon** area.*

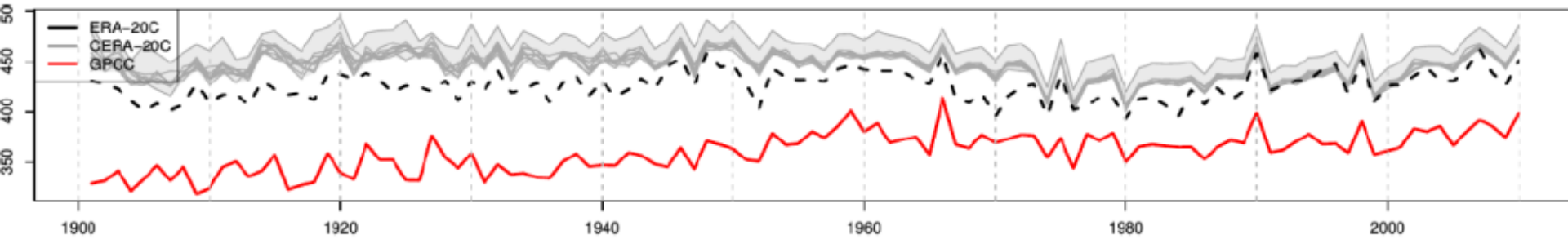


***Fig.** Annual time series **Eurasia**.*

Data portals, visualization tools

- Continuous development until end of project

- http://www.ecmwf.int/en/research/climate-reanalysis
- http://transcom.globalcarbonatlas.org/
- http://srvx1.img.univie.ac.at/raobvis/
- http://eraclim-global-registry.fc.ul.pt/era/index.html

Conclusion

- High capacity has been built for
  - for full coupled reanalysis of 20th century
  - Correcting data and metadata errors
  - Evaluation of fluxes through climate system
  - Including carbon cycle for long reanalysis
  - Answering pressing research questions (e.g. low frequency variability
- Full reanalysis of 20th century will harvest the seeds planted
  - EU should do the harvest!
  - Support via research projects needed

Upper air data base

- Ensure continuous updating, versioning
- Data format should be fit for Copernicus Climate Data Store and for assimilation into reanalyses
- Upper air data inventory at FFCUL, METEO-France

Rationale for EU follow on project

- Assimilation in presence of strong observation density gradients
- Coupled diagnostics, flux validation
- „Ultimate" solution for RS-T using GPS-RO as reference – GAIA-CLIM
- Evaluation of ensembles
  - apply EMOS, BMA to reanalysis ensembles, observation ensembles?
- Prove positive impact of rescued data

continued

- Update and include new ISPD version
- Continue data rescue (e.g. METEOSAT1 images, whaling log books) and feedback analysis
- Rescued data often not in shape to be assimilated or not CDR
- Carbon data assimilation? Feasible?
- Coupled long term SST assimilation

Achievements to be promoted into Copernicus

- Homogenized UA data consistent with GPS-RO – consistent anchor back to beyond 2001
- Energy budget diagnostics
- After further tests: RH and wind homogeneity adjustments.
- Feed QC flags into sources

- WP2-WP4 interaction
- Meteorological input for carbon models crucial
- CRUNCEP increases Primary production fluxes by 50% compared to CERA20C, net fluxes sometimes opposite
- Soil freezing important for co2 fluxes in extratropical boreal regions