Biases in precipitation records found in parallel measurements

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Content

- Motivation / POST initiative
- The conventional - automatic precipitation measurements dataset
- Results
- Summary

Motivation

- For studying climatic changes it is important to accurately **distinguish non-climatic from climatic signals**

- This can be achieved by **studying the differences between two parallel measurements**. These need to be sufficiently close together to be well correlated

- One important ongoing worldwide **transition** is the one **from manual to automated measurements**. We need to study the impact of automated measurements urgently because sooner or later this will affect most of the stations in individual national networks

- Similar to temperature series, we study the transition from **conventional manual measurements (CON)** to **Automatic Weather Stations (AWS)**, using several parallel datasets distributed over EuroAsia and America

Instrumentation, example from CZ

The METRA 886 rain-gauge

*MR3H automatic
tipping bucket rain-gauge*

Parallel Observations Scientific Team (POST)

- In this talk we deal with the **transition from conventional (manual) to automatic precipitation measurements (AWS)**

- This is another study in the framework of The Parallel Observations Scientific Team (POST, http://www.surfacetemperatures.org/databank/parallel_measurements)

- **POST is a Working Group of the International Surface Temperature Inititative (ISTI)**, which intends to contribute to the creation and delivery of reliable climate services produced with an open and transparent procedures: www.surfacetemperatures.org

- POST works to **create a global parallel dataset** to enable the **study of systematic biases** in the national, regional and global records of different Essential Climate Variables (ECVs)

Available datasets for transition between CON and AWS

- **Only a few datasets are available** so far, so our data base is not global. In this analysis, we will present series from America (Argentina, Brazil, Peru, USA), Asia (Israel, Kyrgyztan) and Europe (Slovenia, Spain, Sweden, Czech Republic).

- Data have been kindly provided by local scientists (see co-authors list). New contributions are expected and more are most welcome.

Available datasets for transition between CON and AWS

Country	Name	Count
AG	Argentina	1
BR	Brazil	4
CZ	Czech Republic	19
IS	Israel	5
KG	Kyrgyzstan	1
PE	Peru	31
SN	Sweden	8
SP	Spain	33
US	United States	6

Available datasets for transition between CON and AWS
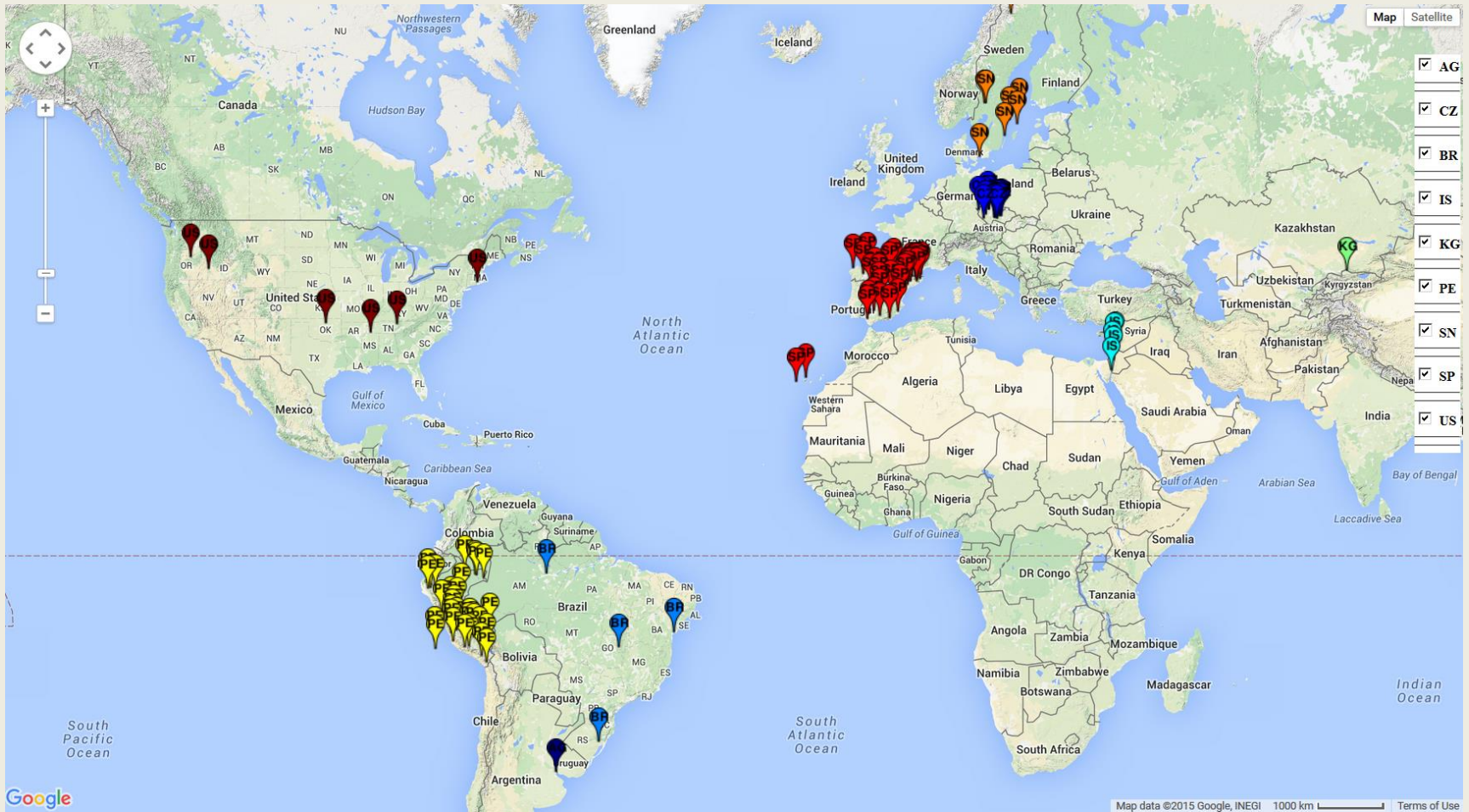
Data pre-processing

- The ratio series AWS-CON are subject to quality control, and before the analysis obvious errors are removed

- Further, the series are inspected for internal inhomogeneities and– if necessary –the records are split into two or more homogeneous segments
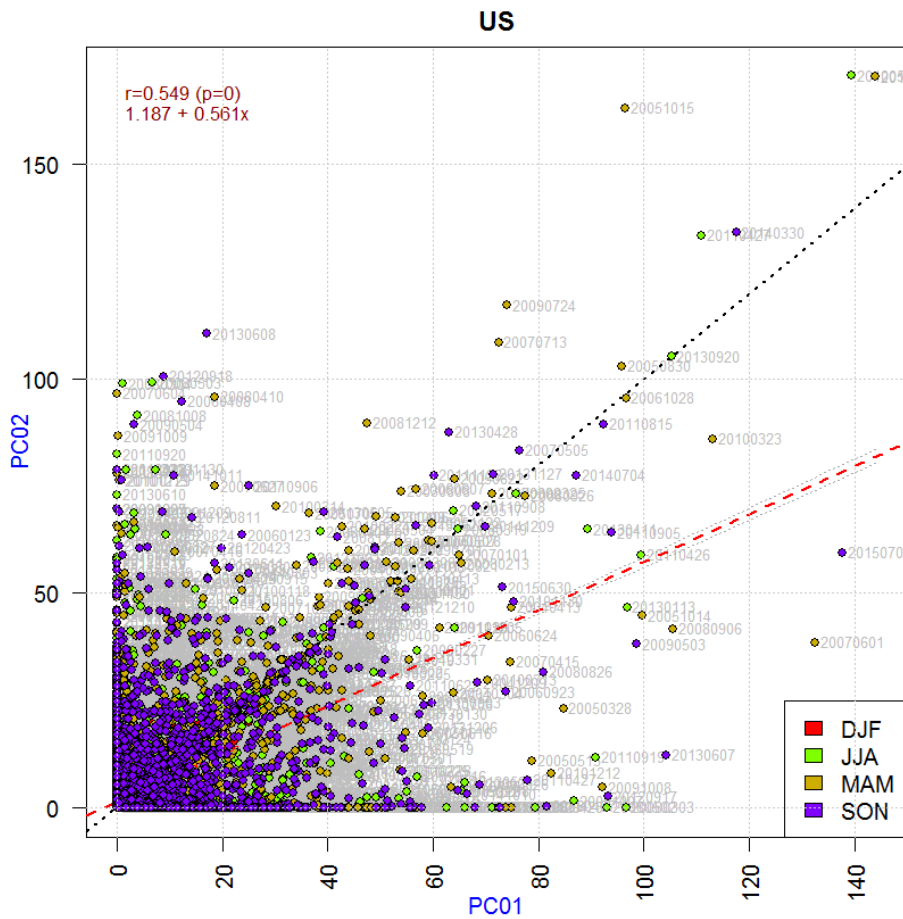
Different quality of datasets in individual countries
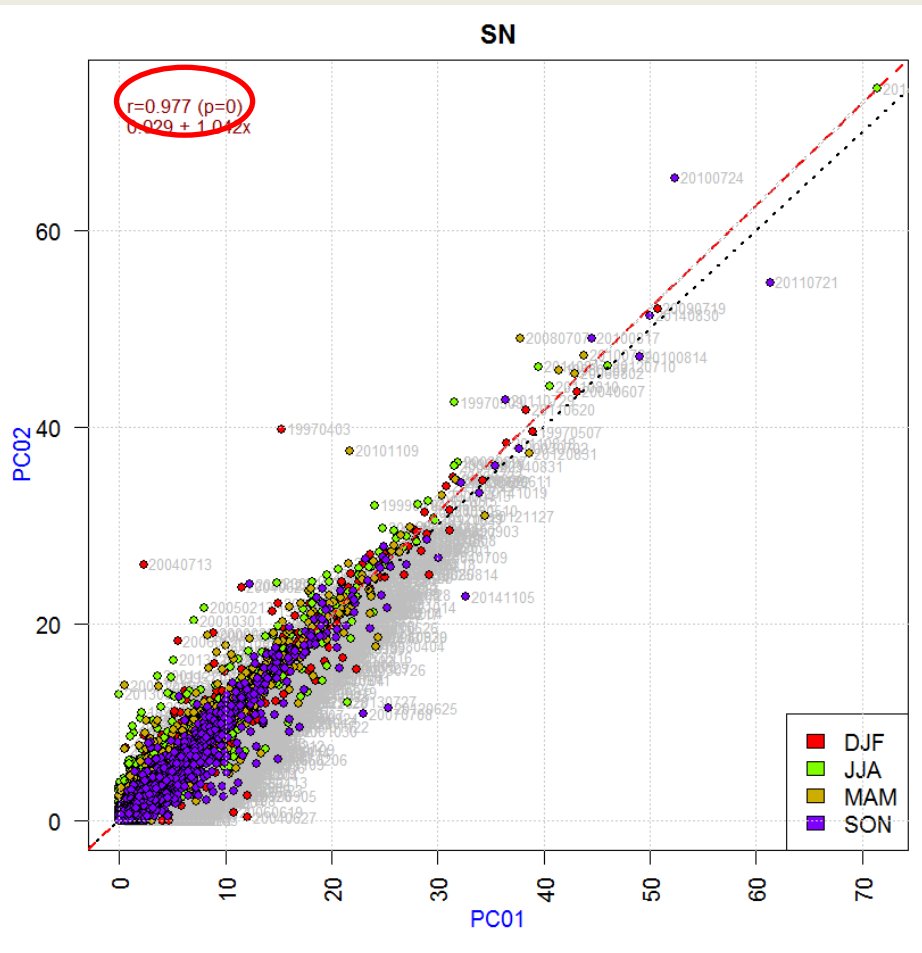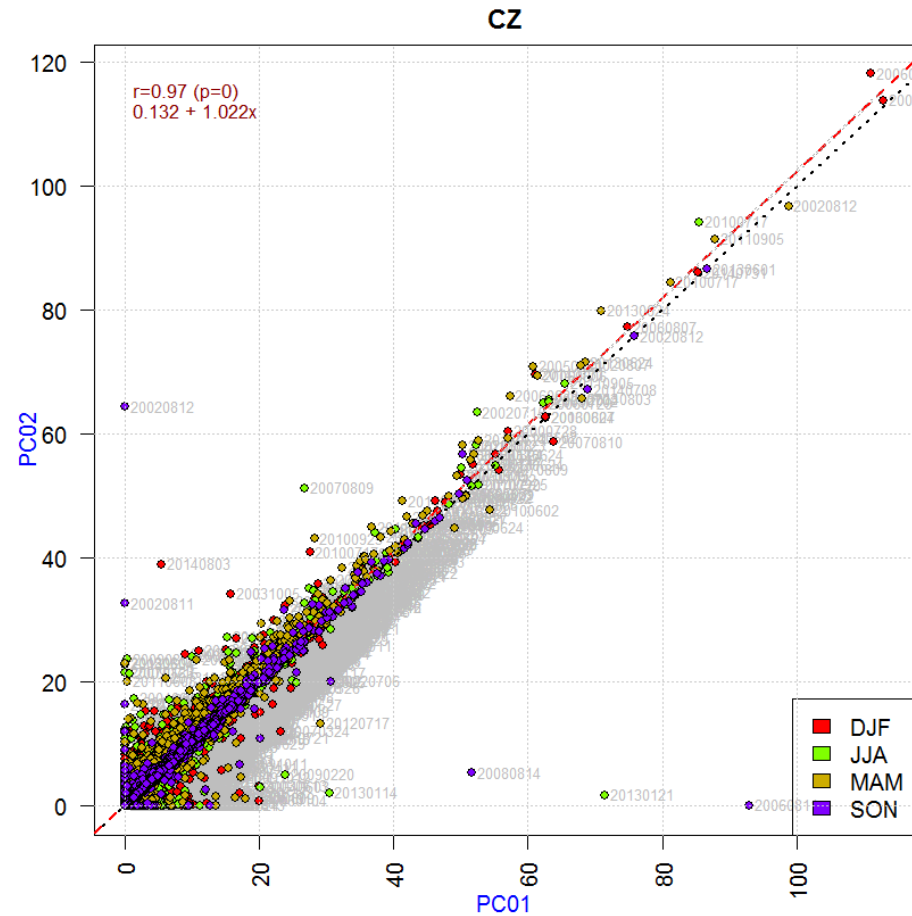
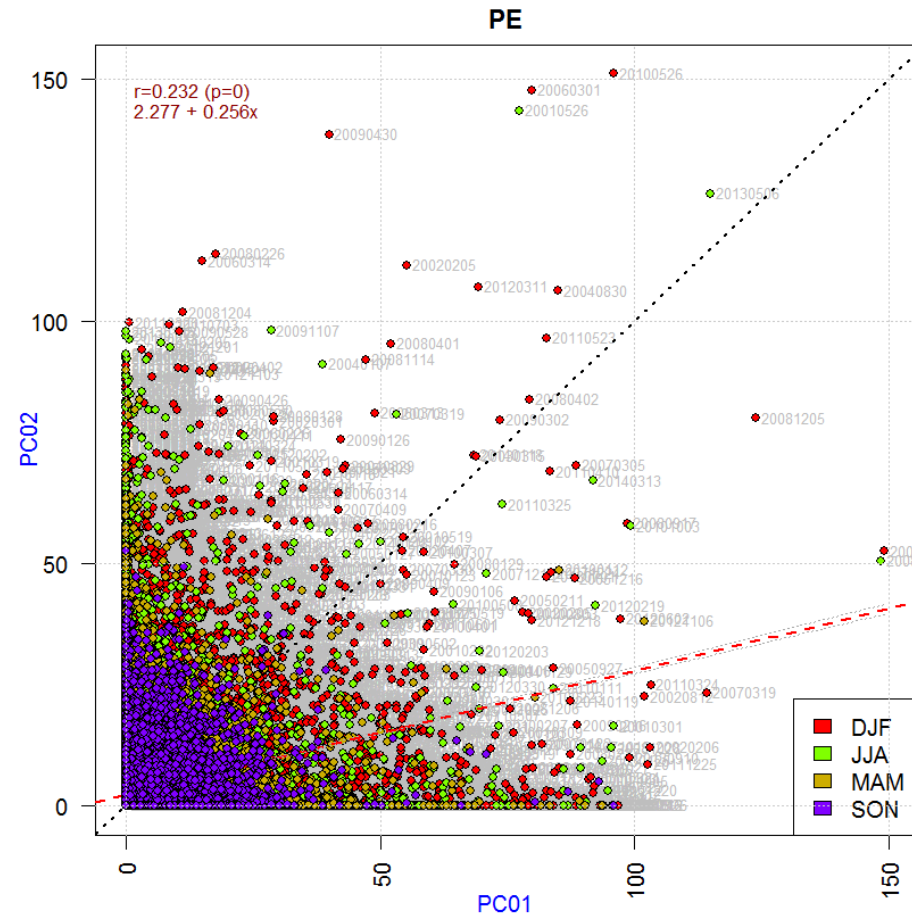Daily sums for AWS (PC01) and CON (PC02) measurements

Different quality of datasets for individual countries

Daily sums for AWS (PC01) and CON (PC02) measurements
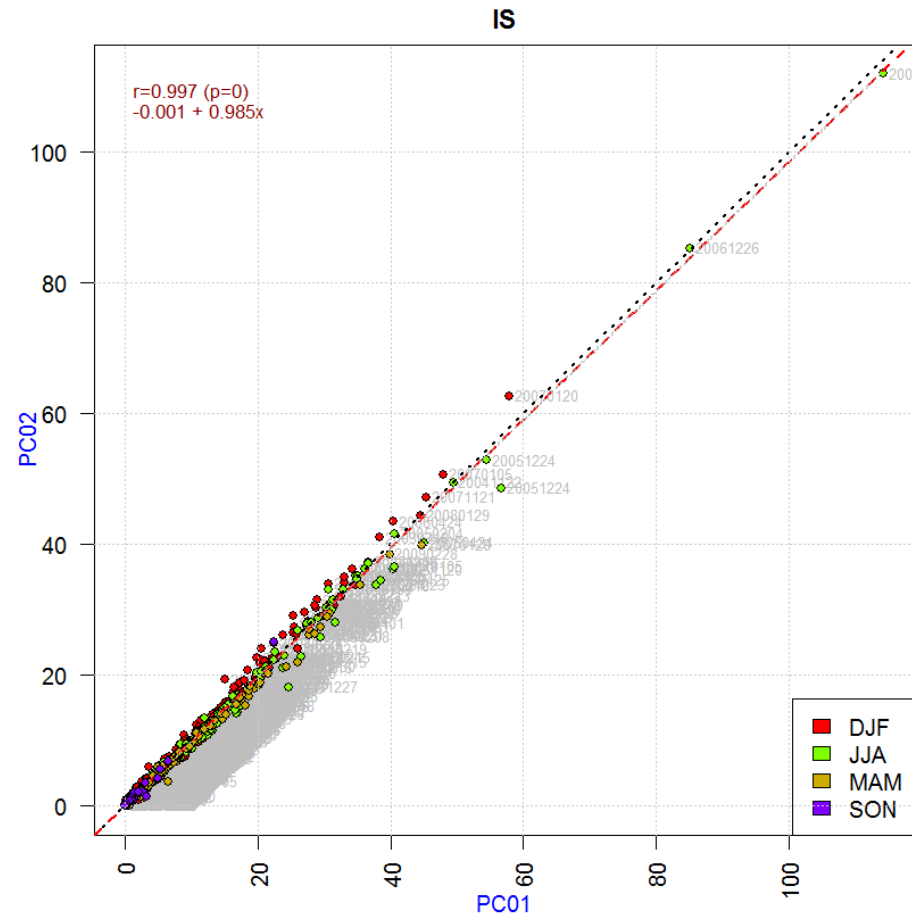
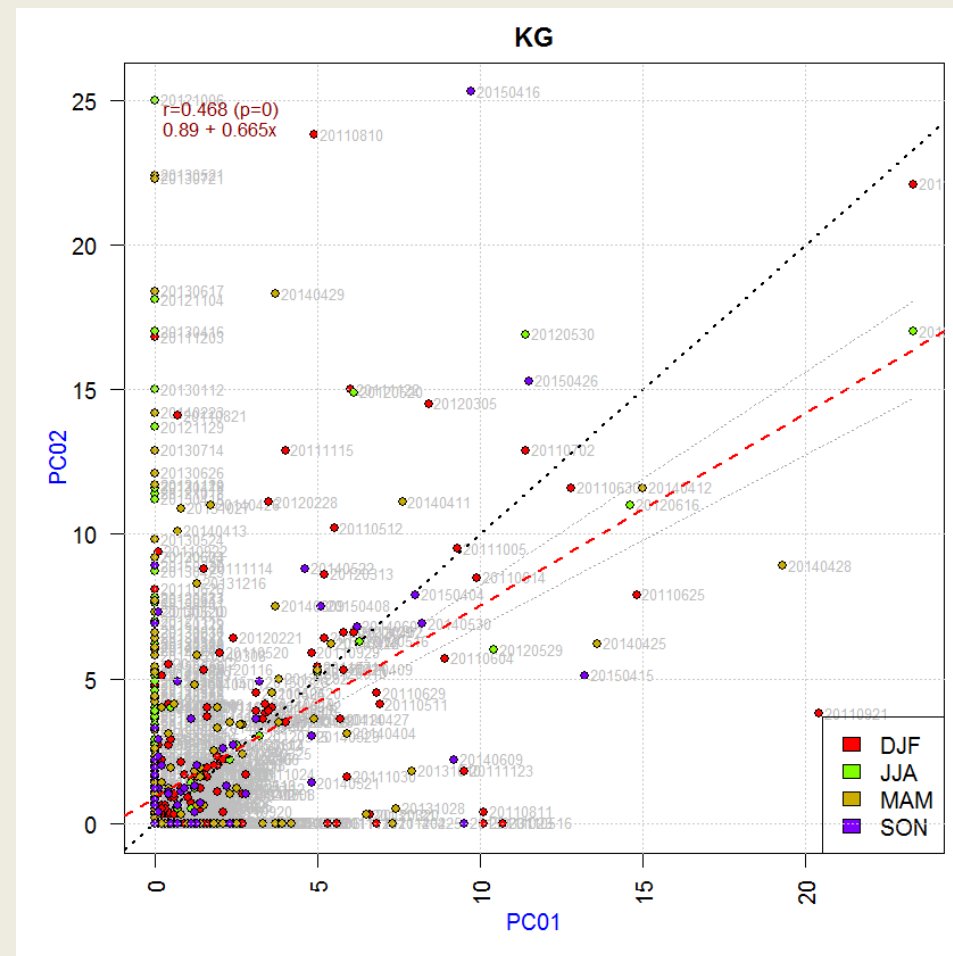# Different quality of datasets for individual countries
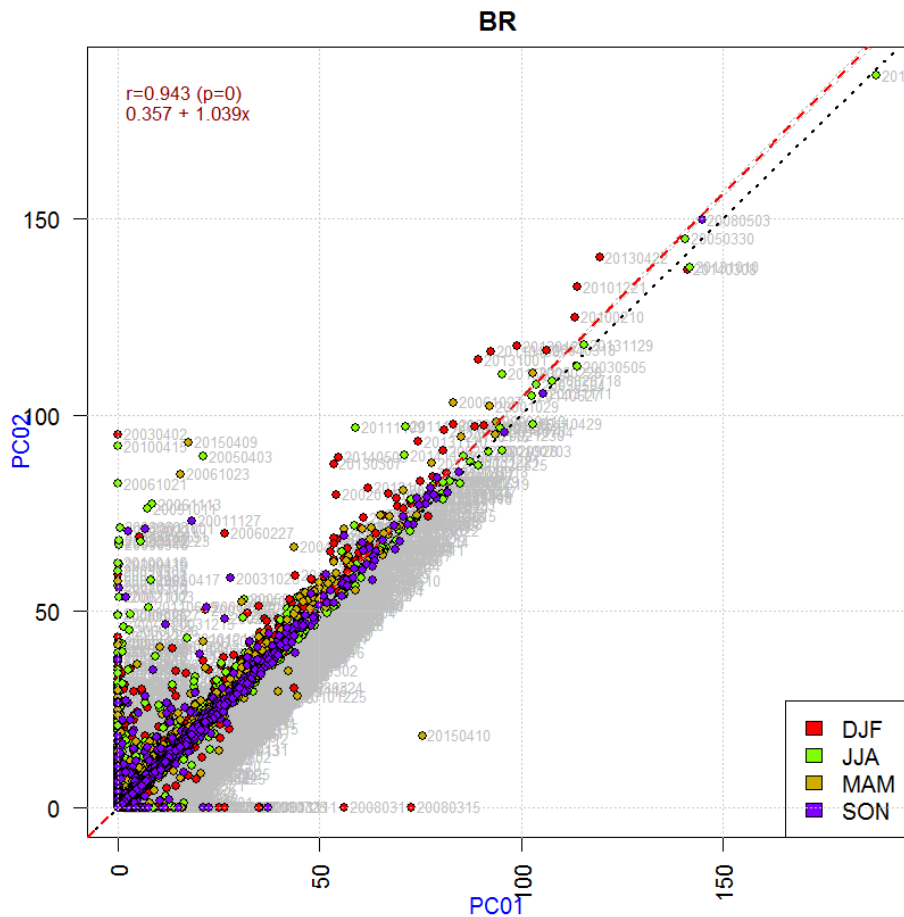
Daily sums for AWS (PC01) and CON (PC02) measurements
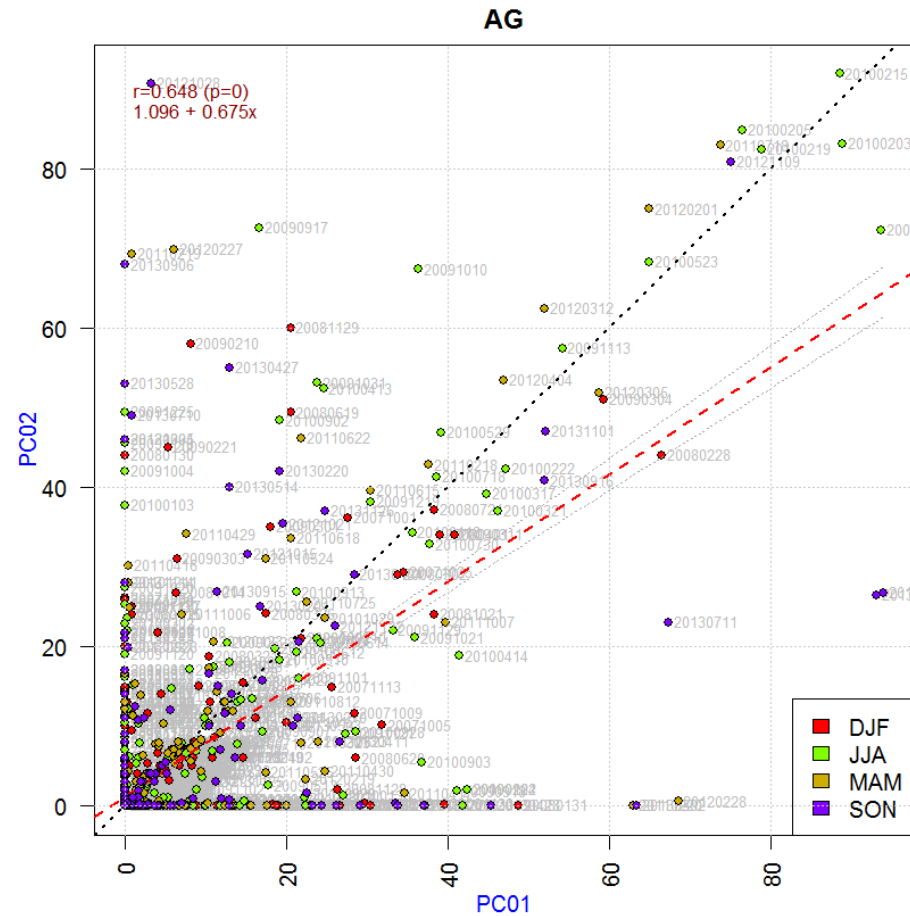
Different quality of datasets for individual countries

Daily sums for AWS (PC01) and CON (PC02) measurements

Different quality of datasets for individual countries

Daily sums for AWS (PC01) and CON (PC02) measurements

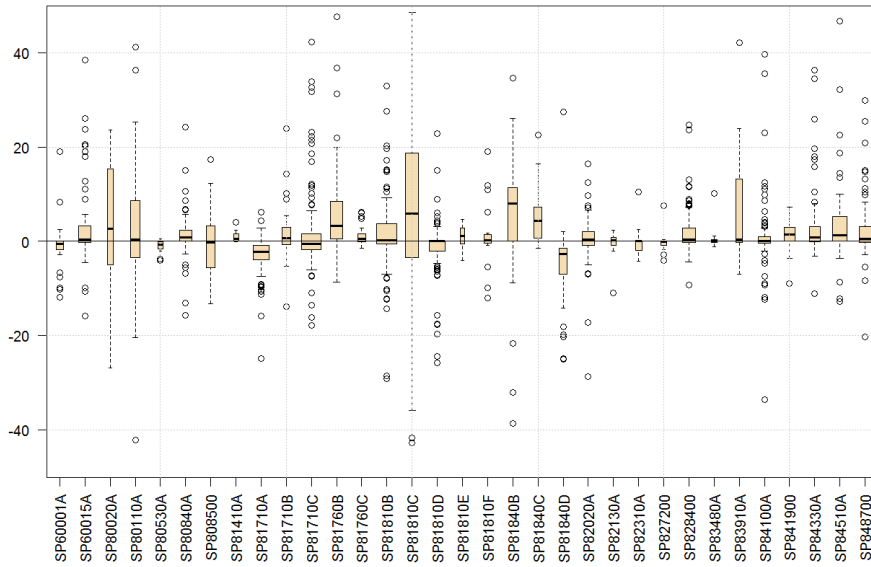# Differences in CON-AWS Monthly Sums for individual regions
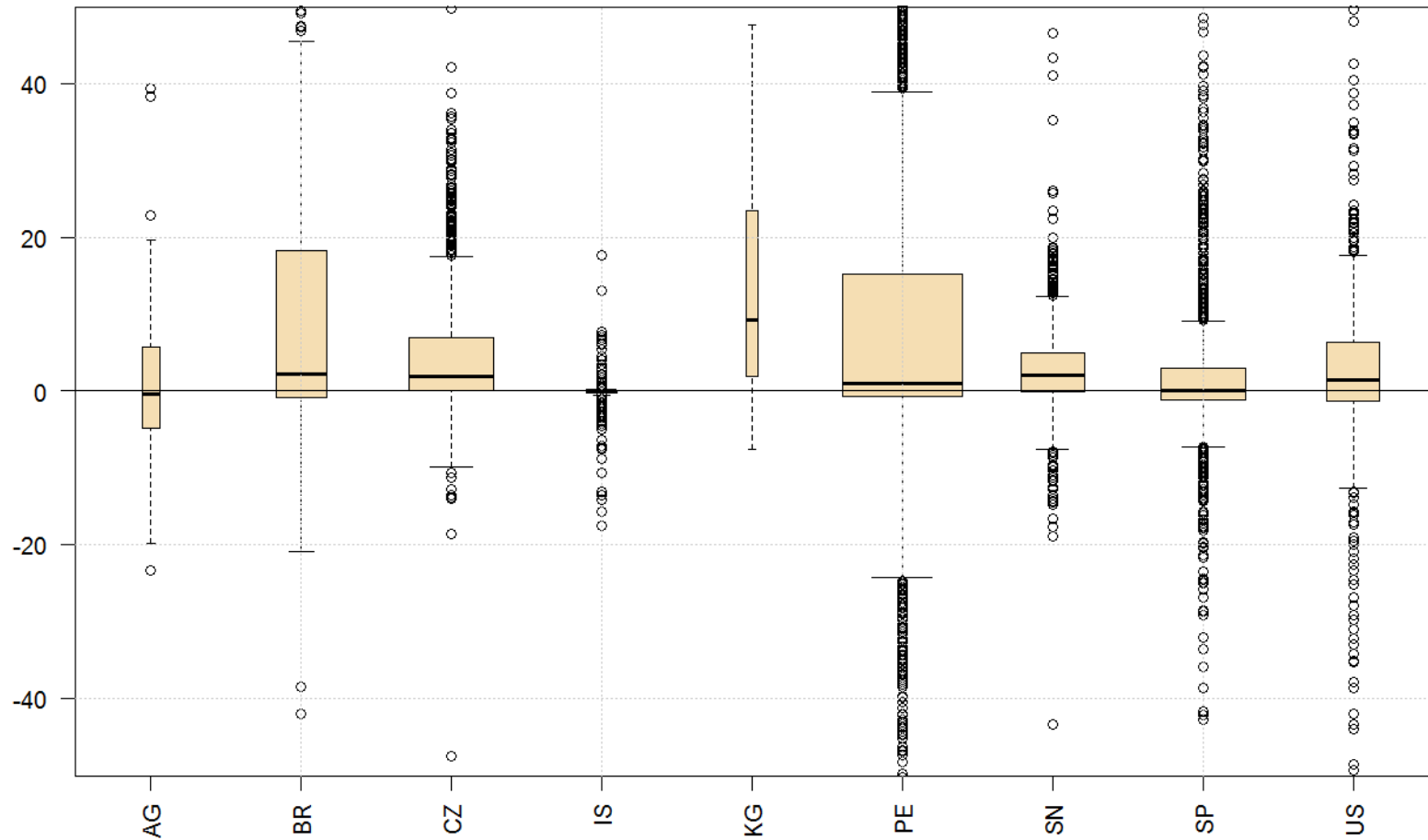
Note: boxplot width differs with number of available stations

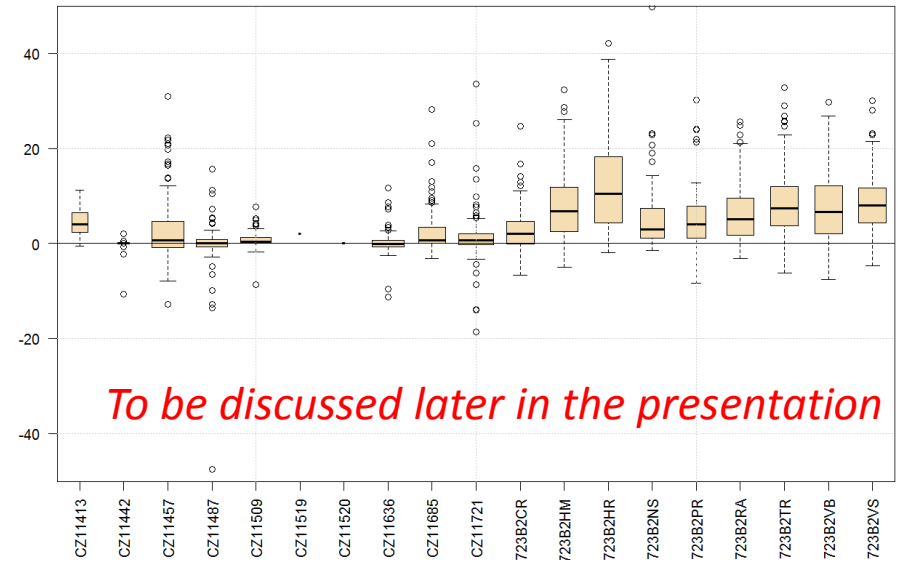# Differences in CON-AWS Monthly Sums for individual regions and seasons
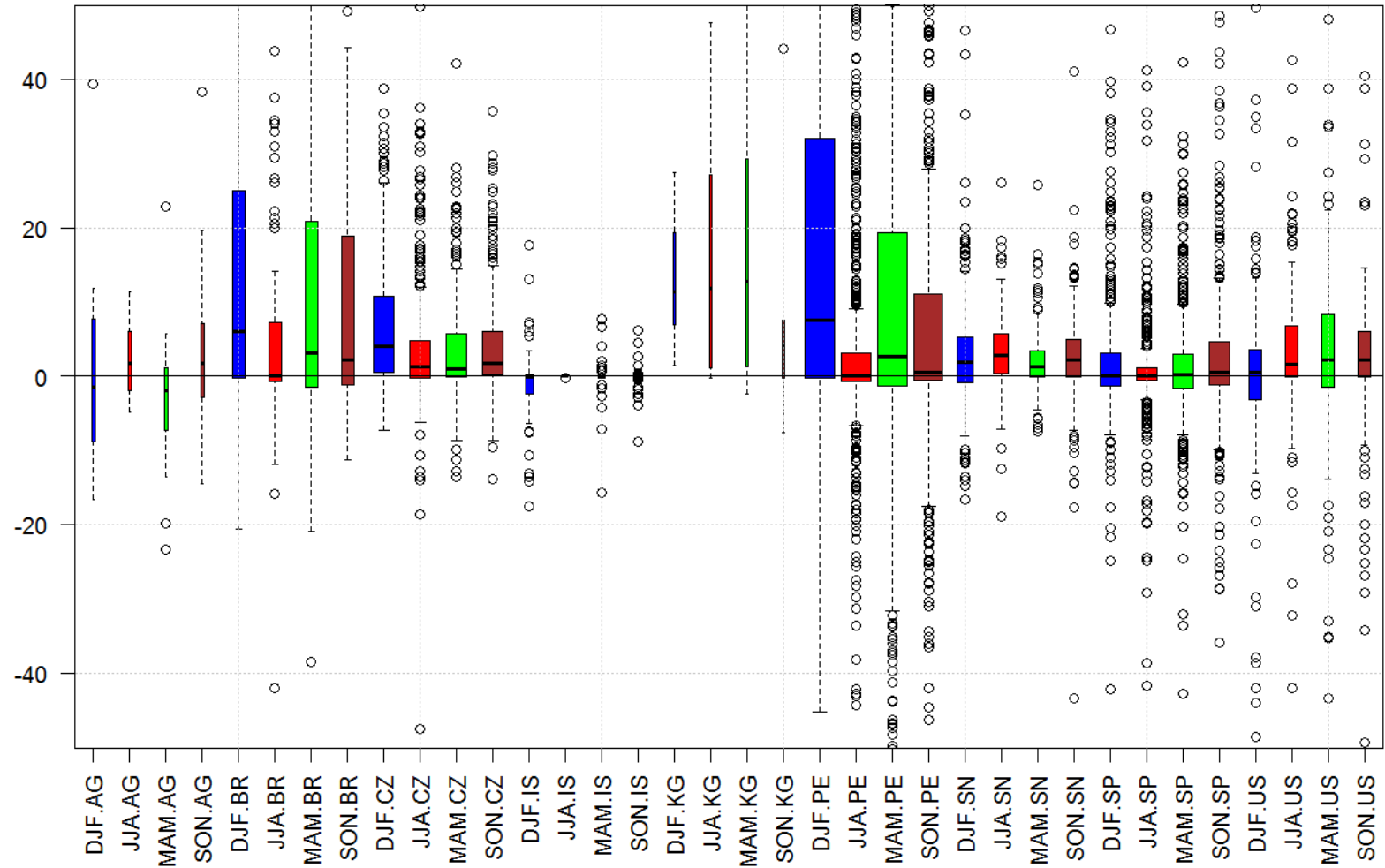
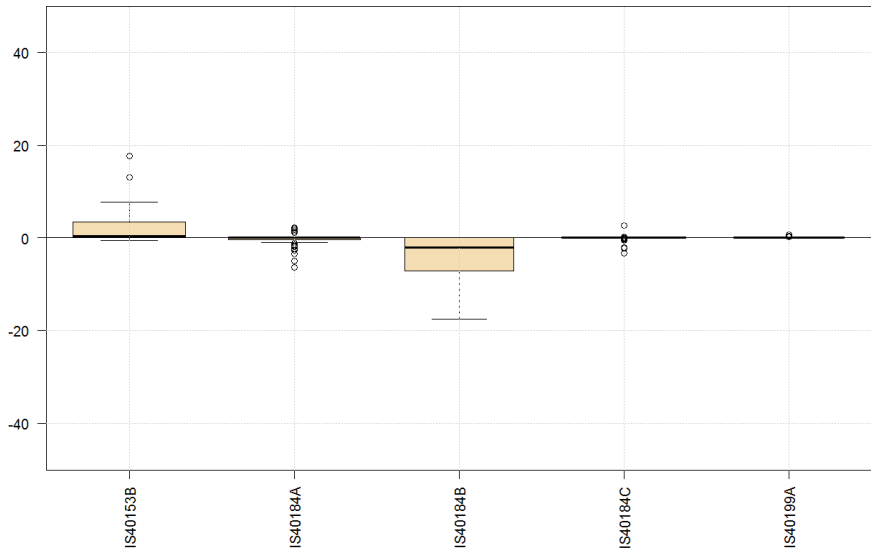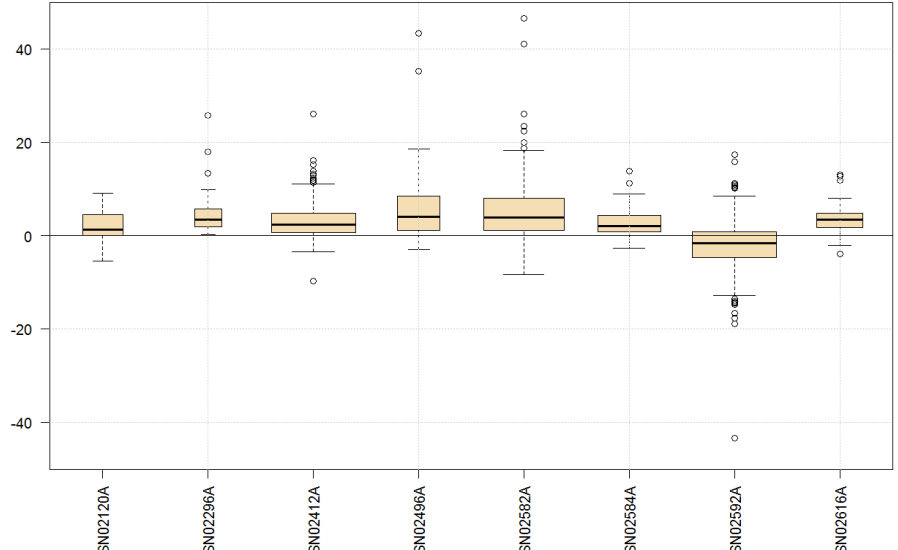# Differences in CON-AWS Monthly Sums for individual stations, by countries
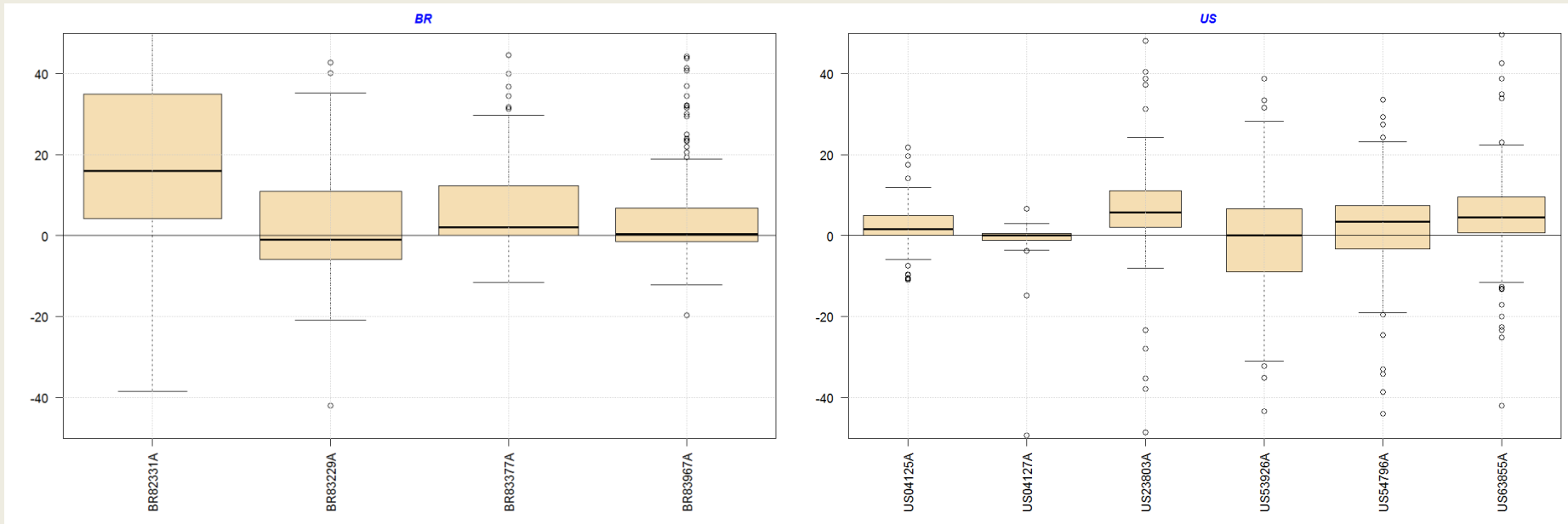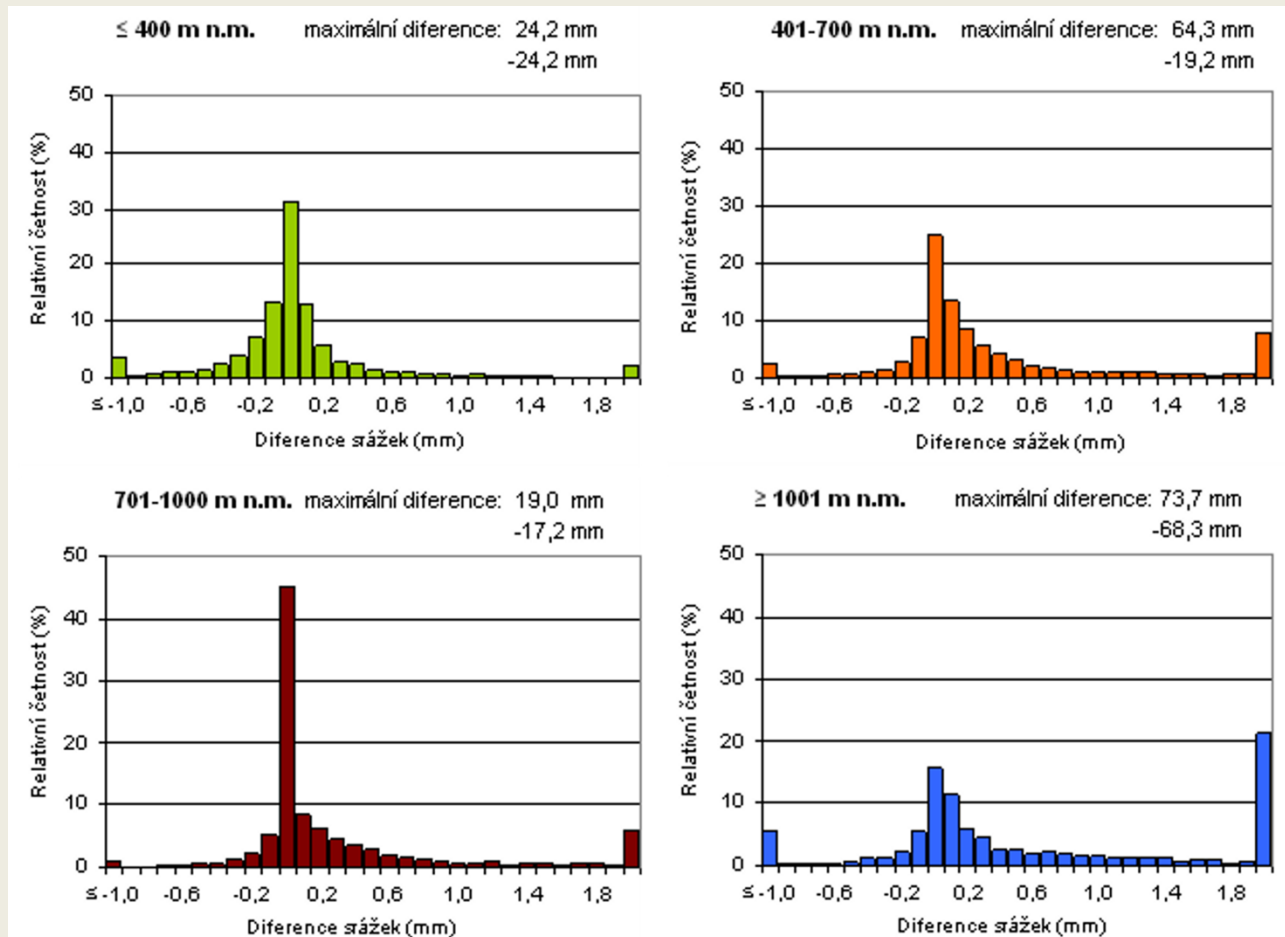
Differences in CON-AWS monthly sums for individual stations, by countries
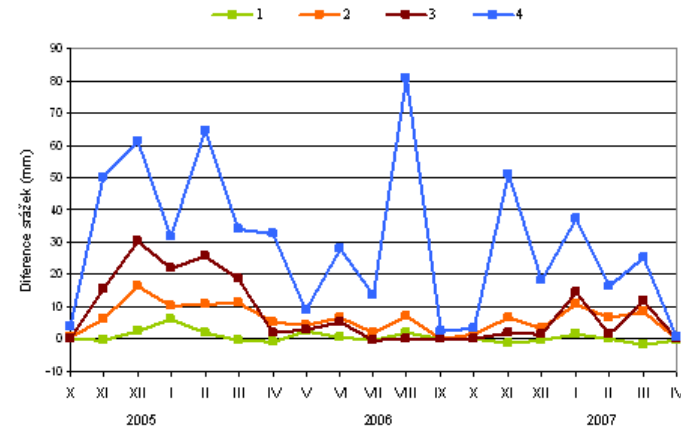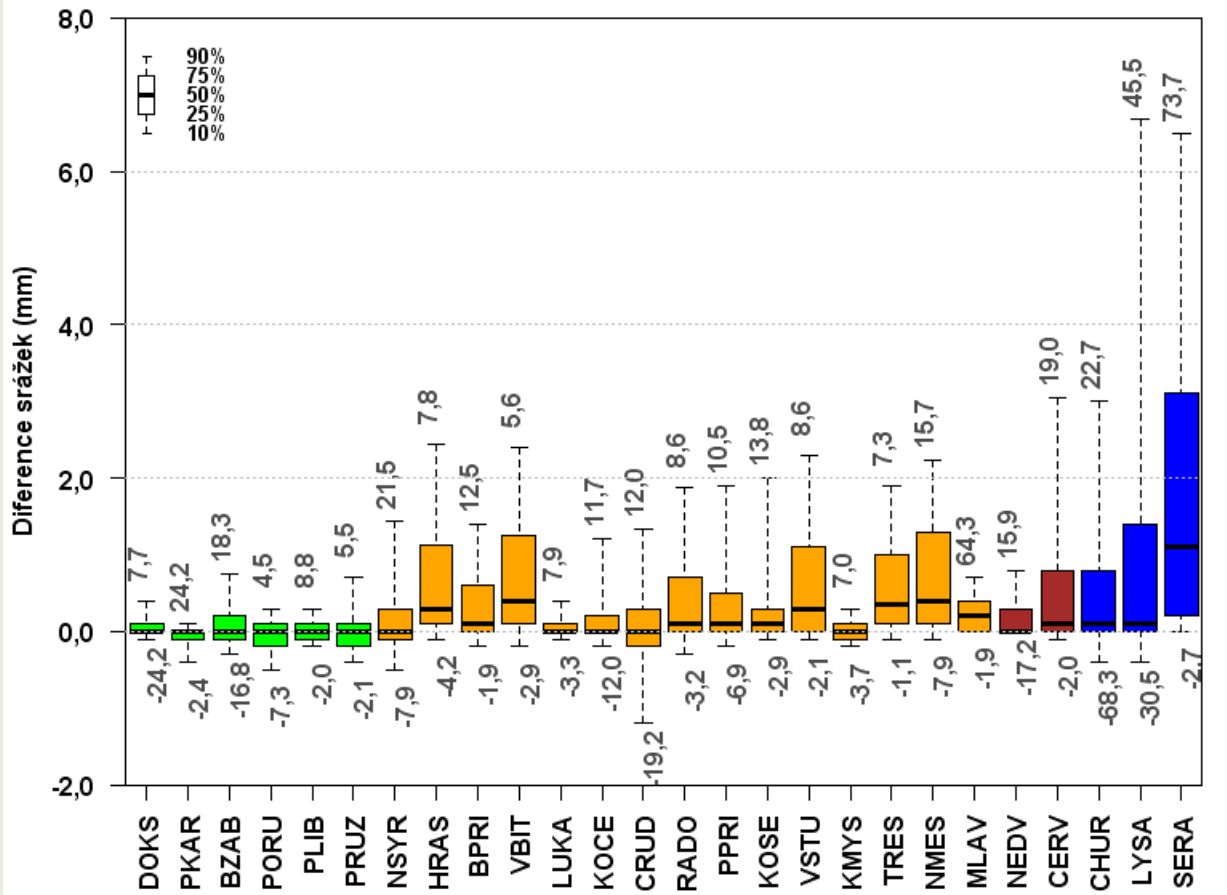
Differences in CON-AWS montly sums for different altitudes, example from CZ

*Relative frequencies (%) of the distribution of **differences** in **daily** precipitation totals measured by **CON** (METRA 886) and **AWS** (MR3H) rain-gauges for groups of stations at **different altitudes** in the period 1999–2007.*

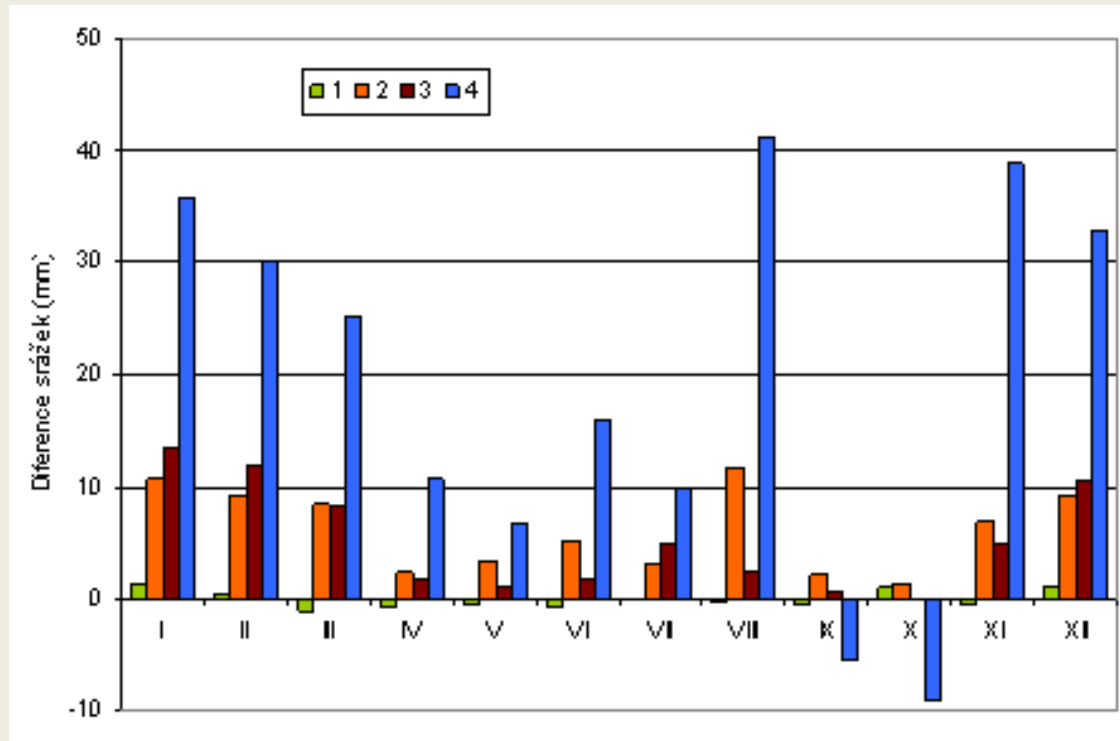# Differences in CON-AWS montly sums for different altitudes, example from CZ

*Variation of mean **differences** in **monthly** precipitation totals (mm) for groups of stations at **different altitudes**:*
1 – ≤400 m; 2 – 401–700 m, 3 – 701–1000 m, 4 –≥1001 m a.s.l.

*Groups of stations at **different altitudes**: ≤ 400, 401–700, 701–1000, ≥ 1001 m a.s.l.*

Differences in CON-AWS montly sums for different altitudes, example from CZ

*Annual variation of **differences** in **monthly** precipitation totals (mm) measured by **CON** (METRA 886) and **AWS** (MR3H) rain-gauges for groups of stations at **different altitudes** 1 – ≤400 m; 2 – 401–700 m; 3 – 701–1000 m; 4 – ≥1001 m) in the period 1999–2007.*

Summary

- Different datasets poses different data quality (compare e.g. PE vs. BR)
- AWS generally underestimate precipitation compared to CON, this effect can be seen throughout the world
- There are differences between individual seasons
- Additional variables helps to understand seasonal differences
- Higher differences (biases) occur in connection with: solid precipitation, higher wind speeds (winter), thunderstorms (summer)

Acknowledgements And Further Work

- This study has been possible thanks to the kind contributions of many coauthors and their institutions.
- It will continue under the guidance of POST. More info about POST:

  http://tinyurl.com/ISTI-Parallel

- Interested in joining us? Please Contact Victor Venema (Victor.Venema@uni-bonn.de)
- Can you contribute with dataset? Please contact Enric Aguilar (Enric.Aguilar@urv.cat)