Efficiency tests for automatic homogenization methods of monthly temperature and precipitation series “MULTITEST”

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Aims of MULTITEST

• Testing of monthly homogenization softwares with larg test datasets of varied climatic and inhomogeneity properties and identifying the best performing methods;

• Clarifying the relations between efficiencies and test dataset characteristics;

• Finding the minimum conditions for automatic methods in terms of the number of comparable time series, their length and their spatial correlations;

• Providing a large size benchmark dataset for the climatological community characterizing the observed climate of various geographical regions;
Scope of MULTITEST

- Efficiency tests for the homogenization of monthly temperature and monthly precipitation datasets;
- Only automatic methods or semiautomatic methods with default parameterization will be tested;
- Wide range of test dataset properties:
  - climate,
  - network density,
  - inhomogeneity properties,
  - length of time series,
  - missing data fields.
Important and timely (?)

• Variability of monthly and annual means is still an important issue;
• Methodology is better developed for monthly and annual scale data and the potential improvement of data quality is the clearest with the homogenization of annual and monthly data;
• The HOME benchmark with its 15 networks was too small and could not include the examination of the impact of various dataset properties;
• There are new softwares, which should be tested;
• Most inhomogeneities cannot be quantified with parallel measurements.
Evaluation of efficiency

- Centred RMSE of monthly values;
- Centred RMSE of annual values;
- RMSE of trend bias;
- RMSE of network mean trend bias.
Principles of methodology

• Parent networks of at least 100, spatially well correlating time series are built, then subsets of pre-set size are randomly selected;
• Both real data based and synthetic test datasets are used;
• Forms of inhomogeneities: shift, trend, platform;
• True frequency of inhomogeneities is usually higher than that of the detected frequency;
• Inhomogeneity properties are widely varied.
Homogeneous benchmark

- Regional differences of climate is more important for precipitation than for temperature;
- Real data based section of benchmark:
  - advantage: it characterizes best the spatial – temporal structures of observed data;
  - drawback: presence of residual inhomogeneities;
- Synthetic section:
  - advantage: fully homogeneous;
  - drawback: imperfect spatial-temporal structures
Homogeneous benchmark

• Temperature, real data based section
  – USA data, Rachel Warren’s dataset
  – Spanish data (AEMET)

• Temperature, synthetic section
  – Spatially correlated white noise, 3 versions of predominating spatial correlations
Homogeneous benchmark

- Precipitation, real data based section
  - Mediterranean climate: Mallorca (AEMET)
  - Oceanic climate: Ireland (Met Éireann)
  - Continental climate: CARPATCLIM gridded observational data (www.carpatclim-eu.org)

- Precipitation, synthetic section
  - Climate of northern Spain, two versions of predominant spatial correlations
  - Monsoon climate, modelling climate of India, two versions of predominant spatial correlations
### Parameterization

- Length of time series: 30yr, 60yr, 120yr
- Number of time series in network: 4, 5, 7, 10, 25, 40
- Missing data: 0%, 10%, 30%; 25 series & 70% missing data
- Form of inhomogeneities: shift, trend, platform
- Three kinds of standard dev. of inhomogeneities (low, medium, high)

<table>
<thead>
<tr>
<th>Frequency in 100yr</th>
<th>Temperature</th>
<th>Precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of shift</td>
<td>3 5 7</td>
<td>1 3</td>
</tr>
<tr>
<td>Frequency of trend</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Frequency of platform</td>
<td>1 3 10</td>
<td>1 3</td>
</tr>
</tbody>
</table>

- Seasonality of biases: - semi-sinusoid - no seasonality - other - winter biases differ
Interactive contact and transparency

• New softwares are accepted for testing until the end of 2016
• Parent benchmark will be published at the beginning of 2017
• Datasets of selected experiments will be published
Thank you for your attention!