



Homogenization of Spanish mean wind speed monthly series

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8th Seminar for Homogenization and Quality Control in Climatological Databases (Budapest, 12-14 May 2014)

Motivation

- ▶ Wind is important for many economic areas:
 - ▶ Agriculture (modulating evapotranspiration)
 - ▶ Water resources (controlling evaporation from dams and natural surfaces)
 - ▶ Leisure (outdoor activities, sailing, ...)
 - ▶ **Renewable energy production**
- ▶ ⇒ Interest to study its variability and trends

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Climatol R package

- ▶ Automatic quality control (outlier correction), homogenization (shift correction), and missing data attribution
- ▶ References based on distance: Able to use nearest reference data even without any common period of observation
- ▶ Break detection by SNHT, applied in stepped windows and on the whole series to cope with multiple breaks
- ▶ Automatic computation of reference series from neighboring data
- ▶ Iterative application: from big to small corrections in successive passes
- ▶ Good results when compared with other methods: <http://www.climatol.eu/DARE/testhomog.html>
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Wind monthly series

- ▶ Selection of all Spanish monthly mean wind speed series for the period 1951-2013 (≥ 10 years of data): 233 series
- ▶ Climatol homogenizations:
 - ▶ First trials: Wind runs (km), converted to mean speeds (m/s). a) With ratio normalization; b) standardization of cubic root transformed data
 - ▶ Second trials: 07-13-18 wind speed means (8% > wind runs). (Also with both normalizations)
 - ▶ Third trials: NCEP reanalysis (alone and with 07-13-18 wind speeds)

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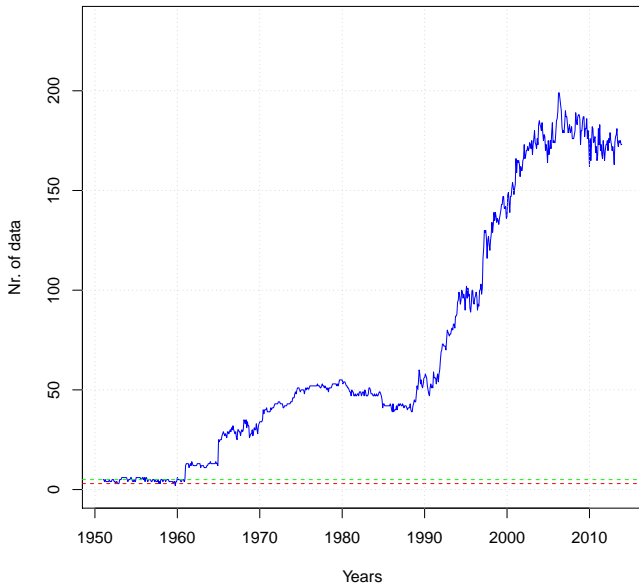
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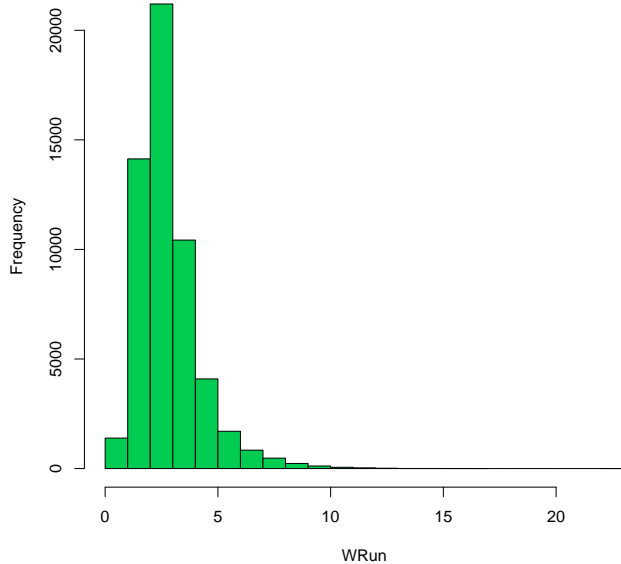
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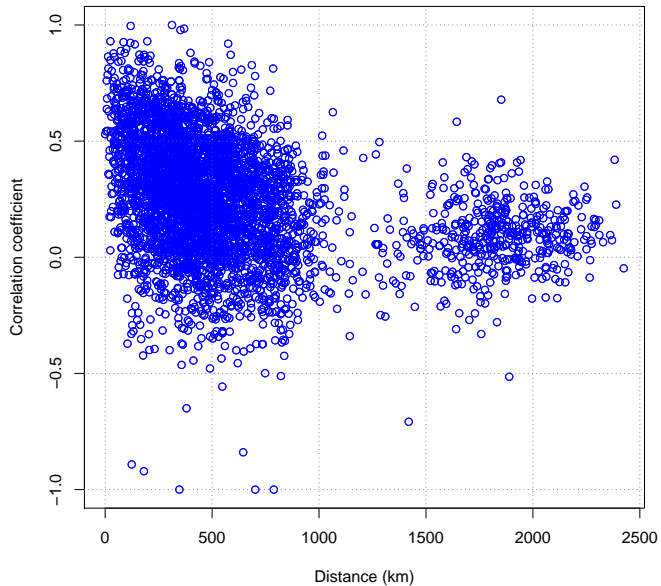
Nr. of WRun data in all stations



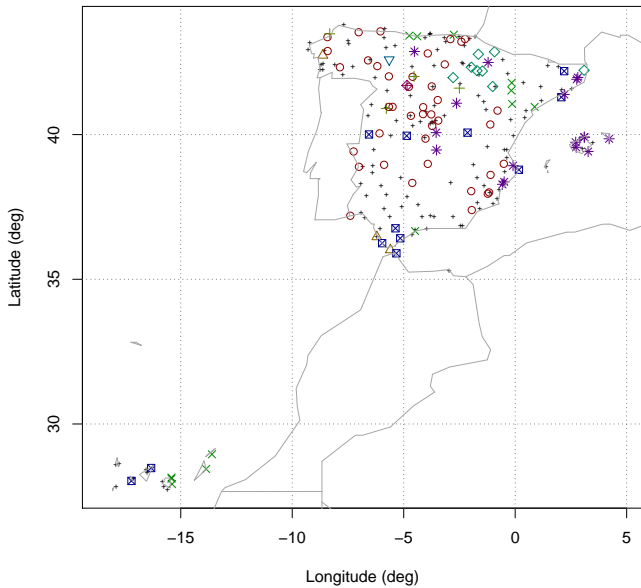
Histogram of all data



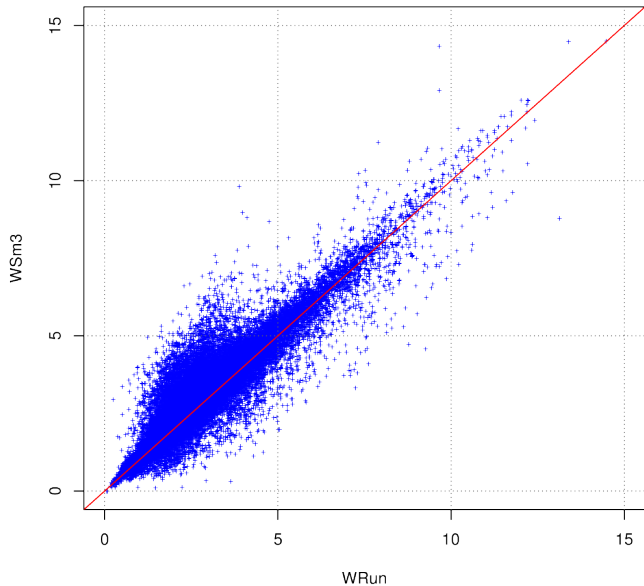
Correlogram of first difference 100 sampled series



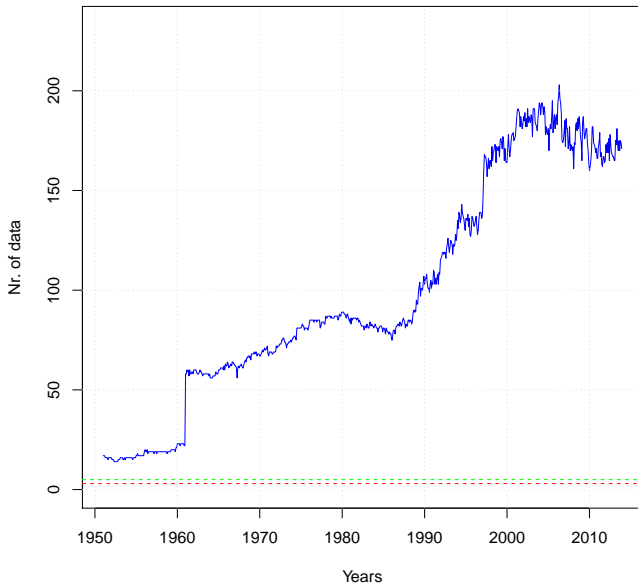
WRun station locations (9 clusters)



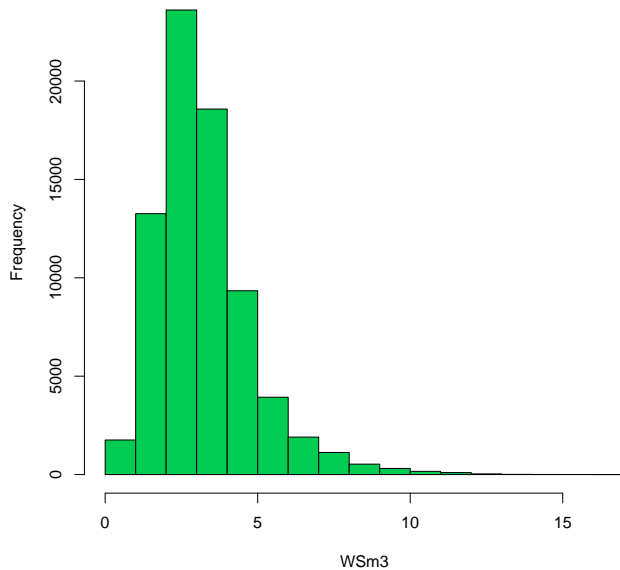
Monthly average wind speed (m/s)



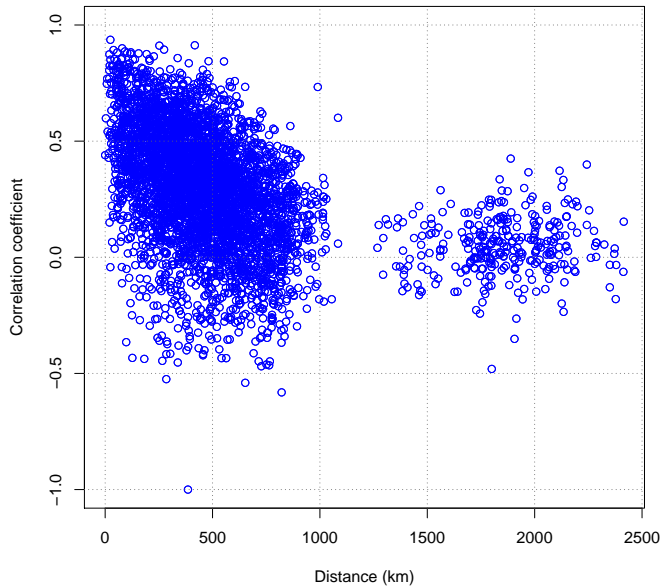
Nr. of WSm3 data in all stations



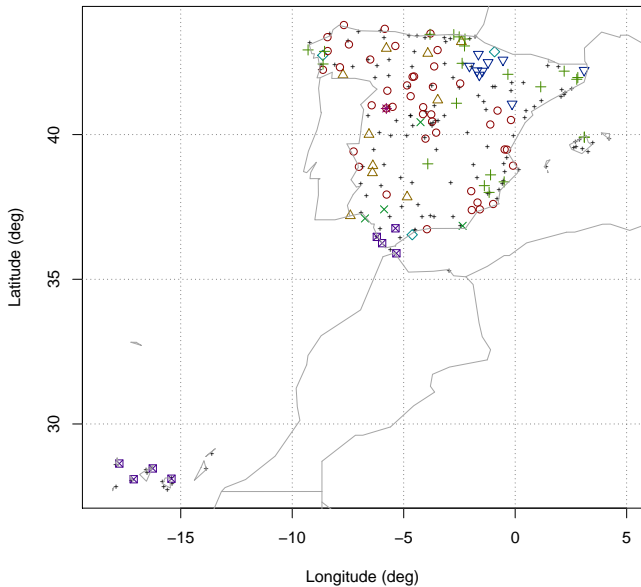
Histogram of all data



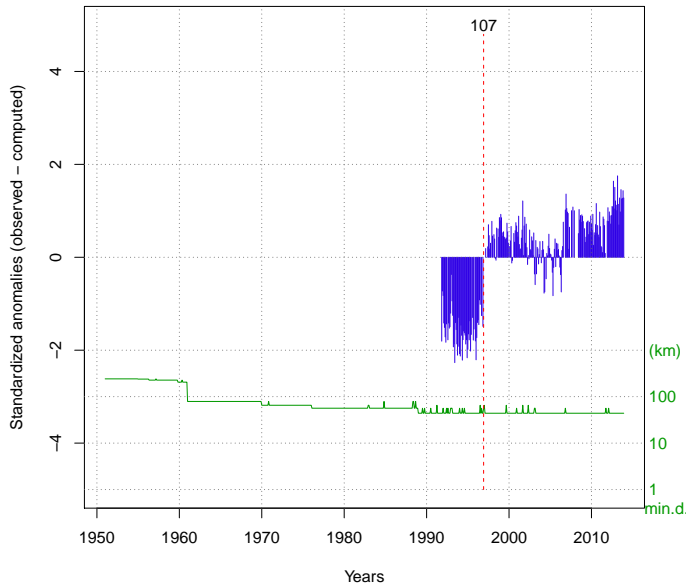
Correlogram of first difference 100 sampled series



WSm3 station locations (8 clusters)



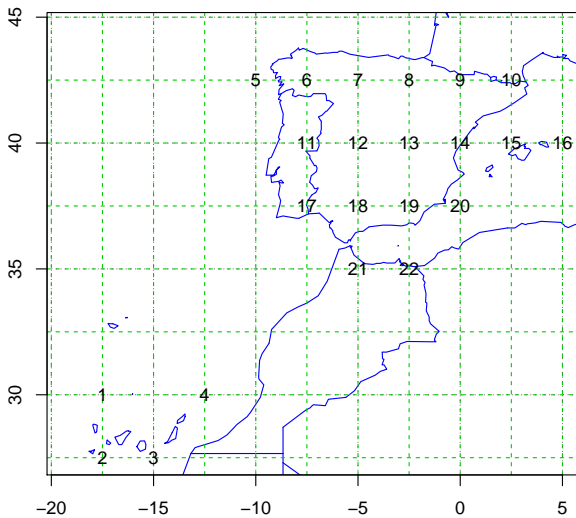
WSm3 at 2916A(82), VITIGUDINO



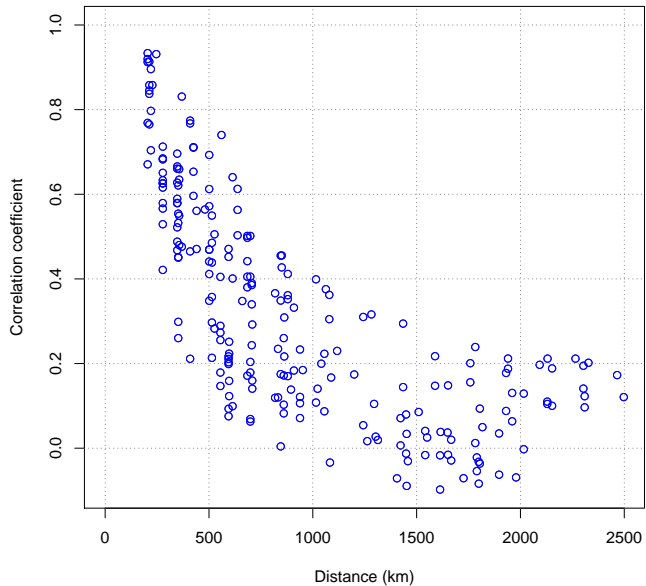
Homogenization results

	Outliers	Breaks	mRMSE	mSNHT
Wind runs (WRun):				
Ratios	71	268	0.3795	8.297
$z(x^{1/3})$	75	240	0.4062	9.242
07-13-18 means (WSm3):				
Ratios	38	360	0.4638	10.640

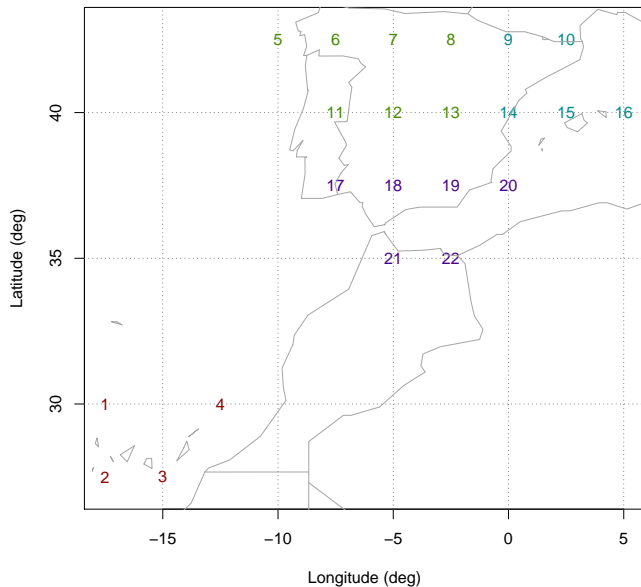
Selected reanalysis grid points



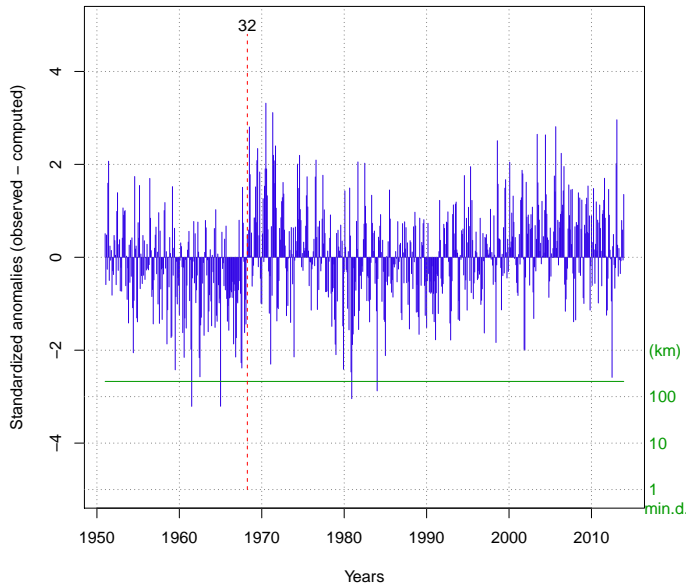
Correlogram of first difference series



WSRe station locations (4 clusters)



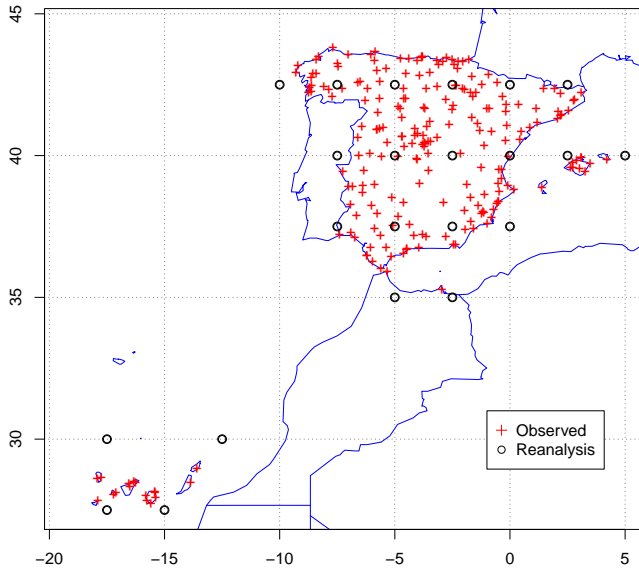
WSRe at GR13(13), GR13



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NCEP reanalysis (WSRe, only 3 refs.):				
Ratios	0	31	0.4184	10.170
$z(x^{1/3})$	0	36	0.3986	8.276

Observed + reanalysis joint series

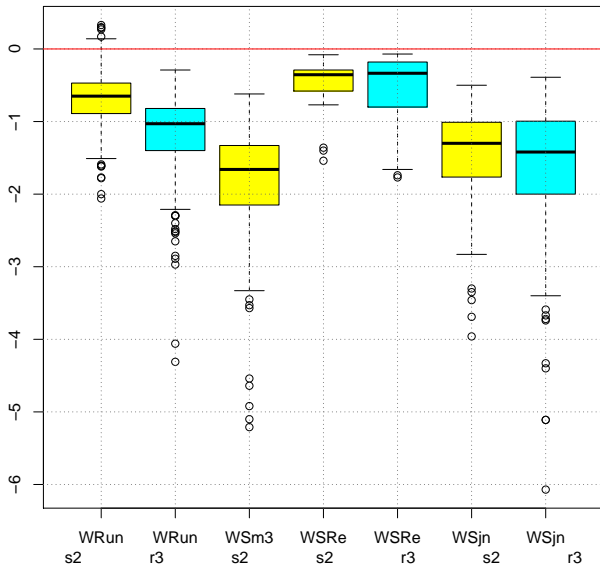


Show 07-13-18 + Reanalysis (WSjn) results

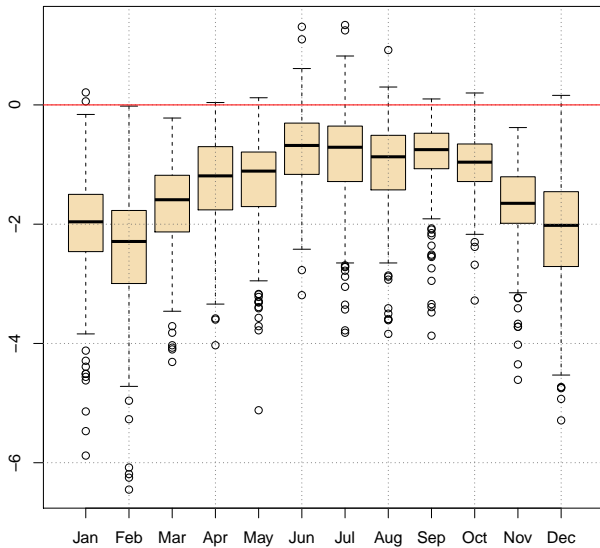
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07-13-18 + NCEP (WSjn):				
Ratios	38/0	356/26	0.5272	10.510
$z(x^{1/3})$	110/3	362/31	0.5608	10.390

Annual trends (m/s/century)



WSjn-s2 monthly trends (m/s/century)



Wind speed homogenization JoC paper

- ▶ Azorin-Molina C *et al.* (2014): Homogenization and Assessment of Observed Near-Surface Wind Speed Trends over Spain and Portugal, 1961-2011.
- ▶ 76 (68 + 8) series for 1961-2011
- ▶ 68 were 00,07,13,18 means, and 8 wind runs
- ▶ SNHT by means of AnClim, with MM5 reference series (parallel months)
- ▶ 14 series (18%) found inhomogeneous (all from AEMET)
- ▶ -.54 (-.54) m/s/Cent in Winter and .09 (.25) in Summer

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Conclusions and future work

- ▶ Climatol application has allowed an easy homogenization of 233 wind speed Spanish series (~ 10 times!)
- ▶ Wind appears to be a tricky element to homogenize
- ▶ Most trends are negative, especially in winter. (But less in NCEP series)
- ▶ Future work includes:
 - ▶ Study of 07-13-18 means / Wind runs relations in AWS 10' data
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