

Online Resource 01 - Supplementary appendix E

How does the temperature vary over time? Evidence on the Stationary and Fractal nature of
Temperature Fluctuations

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Mariachiara Fortuna, E-mail: mariachiara.fortuna1@gmail.com (reference for code and analysis)

```

require(tempFGN)
require(tidyverse)
require(tidyr)
require(lubridate)
library(maps)

# DATA PATH
data_final_path <- file.path("data", "final")
data_supporting_path <- file.path("data", "supporting")
data_moberg_path <- file.path("data", "moberg")

# OUTPUT PATH
output_supporting_path <- file.path("output", "supporting")
output_table_path <- file.path("output", "table")
output_figure_path <- file.path("output", "figure")
output_temporary_path <- file.path("output", "temporary")
output_manipulated_path <- file.path("output", "manipulated")

# ACCESS TO ALL THE TIME SERIES
all <- read.csv(file.path(data_supporting_path, "T0.TempInfo.csv"), sep=";", dec=",")
country_all <- all$Country
station_all <- all$Station
nja <- nrow(all)
data_dir_all <- file.path(data_final_path, country_all, paste0(station_all, ".txt"))
stationname_all <- paste0(country_all, ", ", station_all)

for (j in 1:nja){

  data <- read.delim(data_dir_all[j], header=F, na.strings=99)
  dataM <- monthlyAdj(data, scale=T)
  Zm <- dataM$Zm
  Ym <- cumsum(Zm)

  par(oma=c(0, 0, 2, 0))

  par(fig=c(0, 0.5, 0.66, 0.96), cex=0.6)
  maps::map('world', ylim=c(-60,90), mar=c(2,2,2,2))
  points(all$Lon[j], all$Lat[j], col=2, pch=16, cex=2)

  par(fig=c(0.5, 1, 0.62, 0.98), cex=0.6,
       bty="l", mar=c(6,4,5,2), new=T)
  autocorrPlot(Zm, H="cfH",
               cex.axis=1, cex.lab=1, cex.main=1.1, cex.dots=1.2)$plot

  par(fig=c(0, 1, 0.33, 0.63), mar=c(3,4,5,2), bty="l", cex=0.7, new=T)
  blueRedPlot(Time=dataM$Time, Zj= Zm, break.val=1960, ic=NULL)

  par(fig=c(0,0.5,0,0.33), cex=0.7, new=T)
  fgtSelfSim(Yj=Ym)$plot

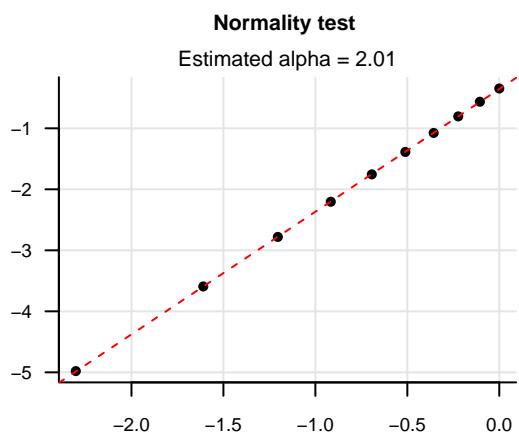
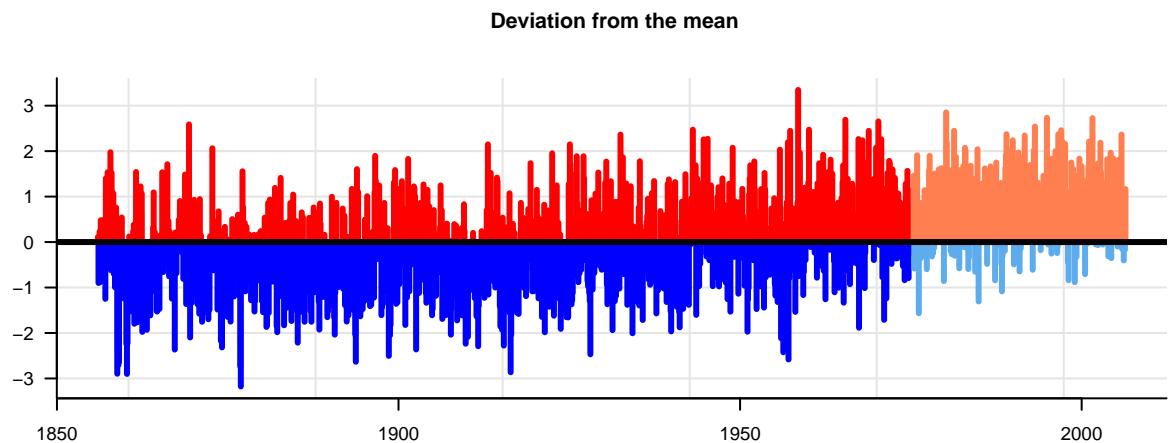
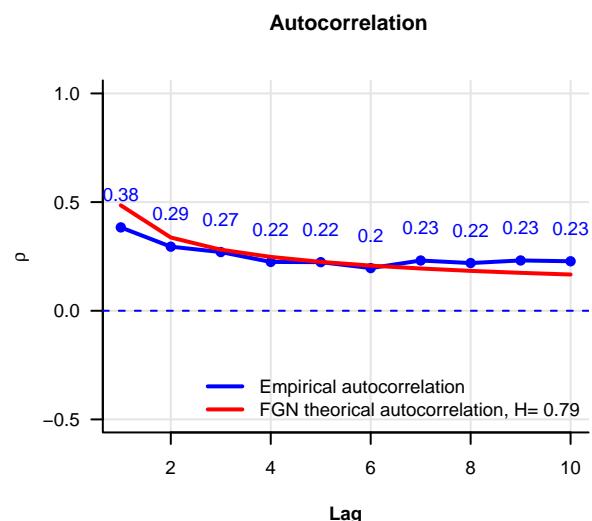
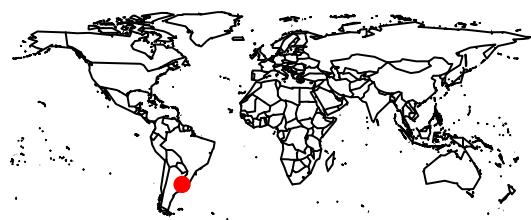
  par(fig=c(0.5,1,0,0.33), cex=0.7, new=T)
  fgtNormality(Yj=Ym)$plot

  title(stationname_all[j], outer=T, cex.main=1.5)
}

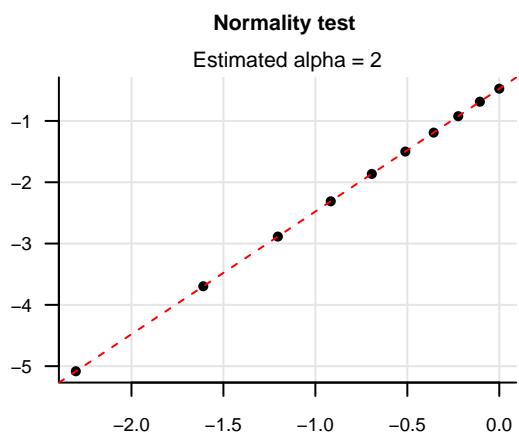
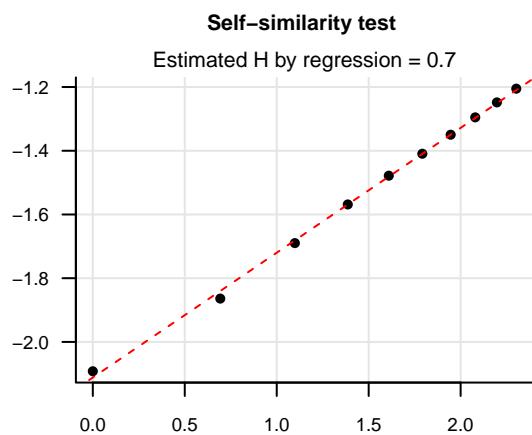
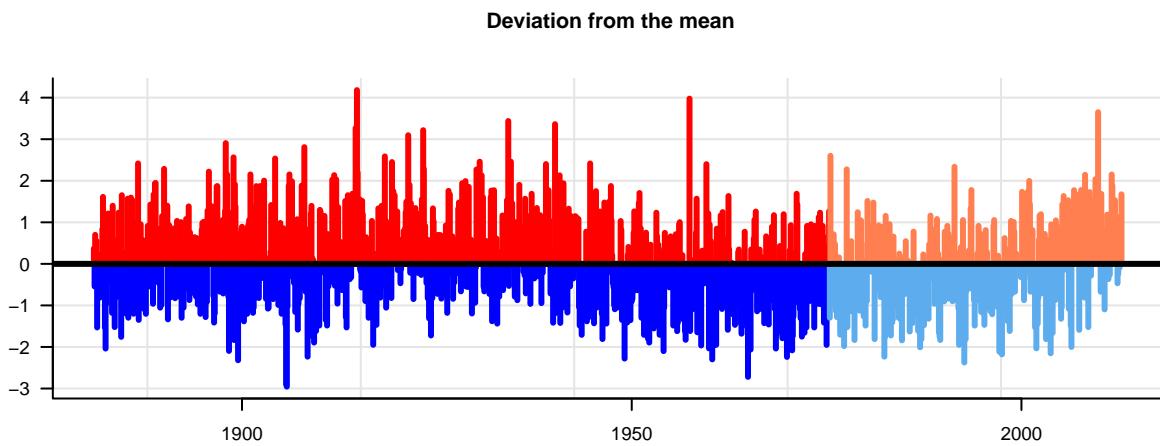
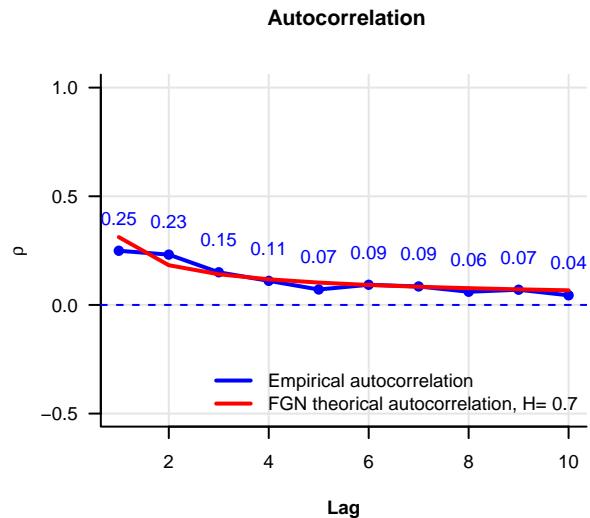
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}

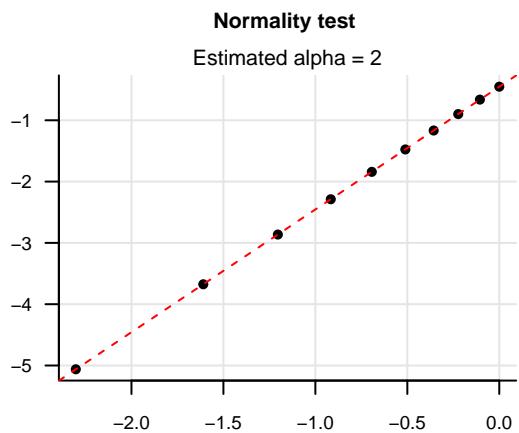
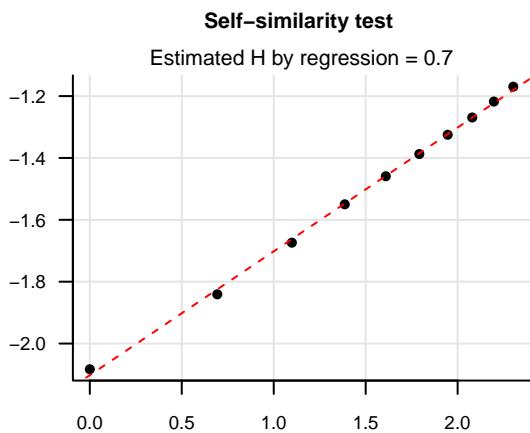
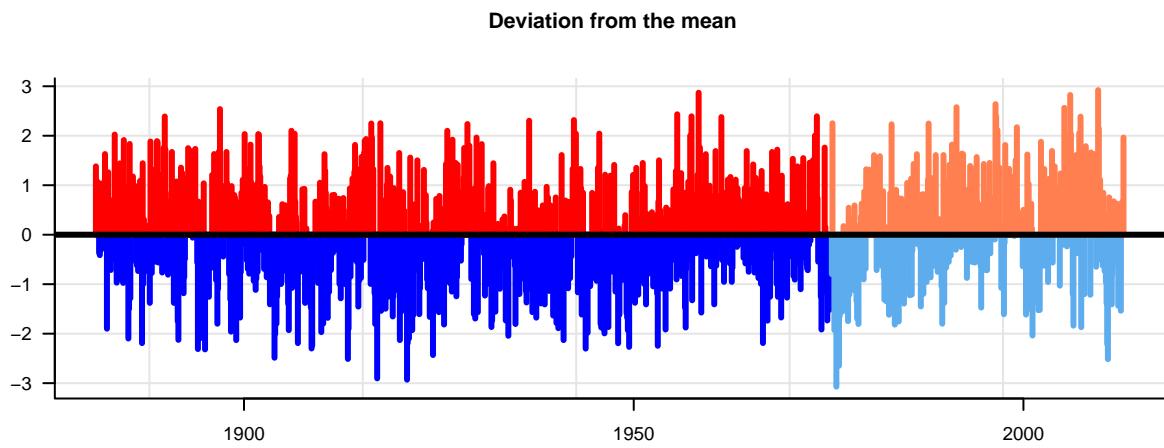
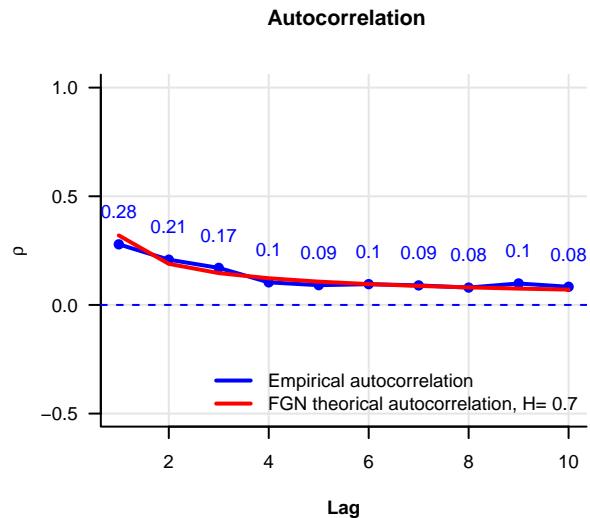
Argentina, Buenos Aires



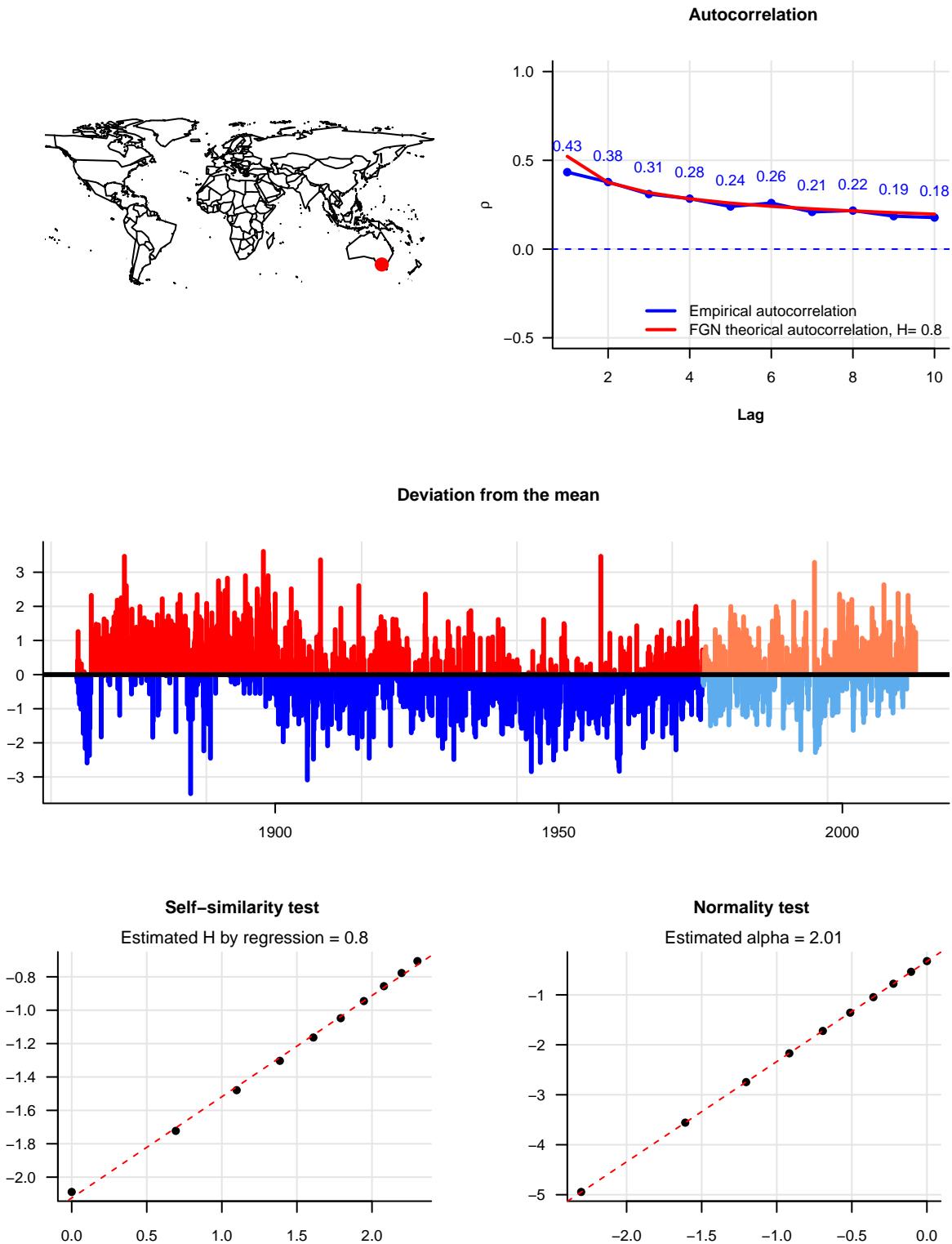
Australia, Adelaide



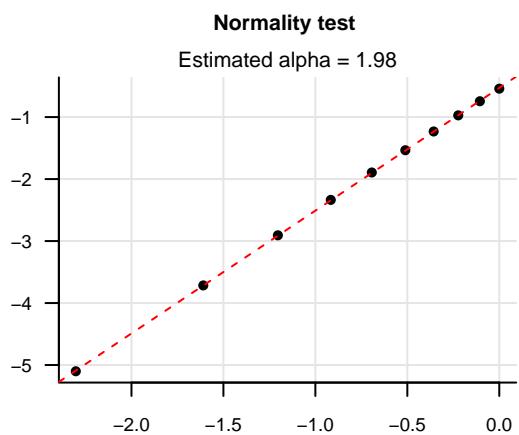
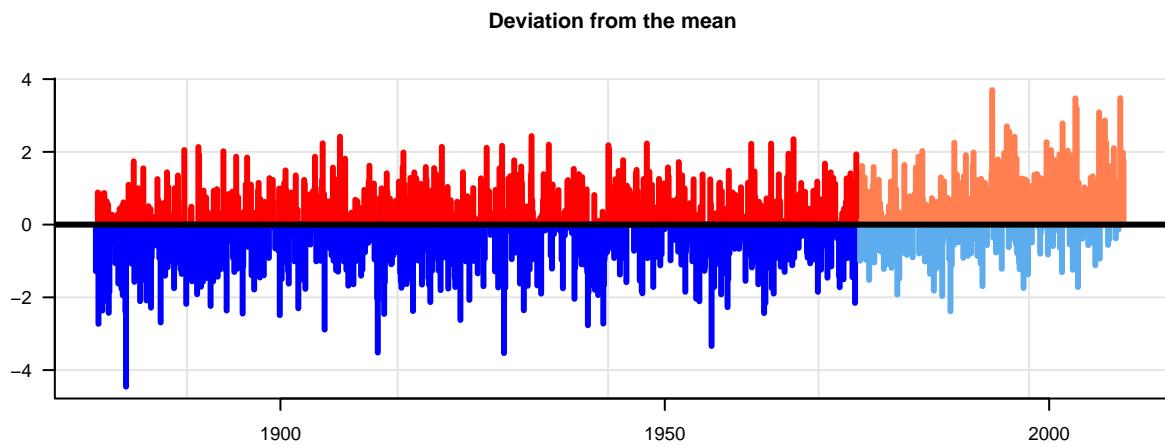
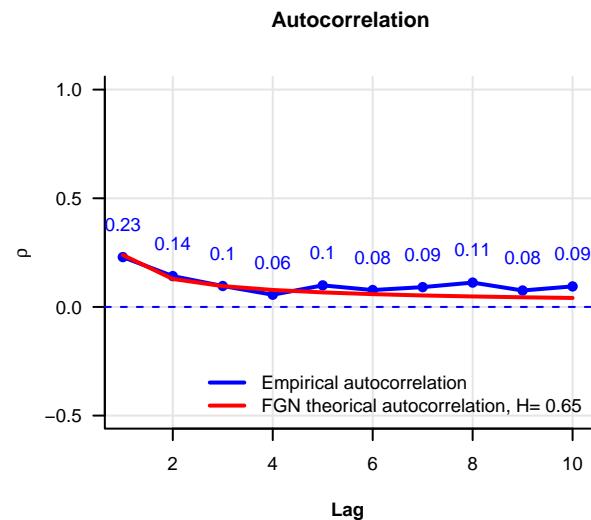
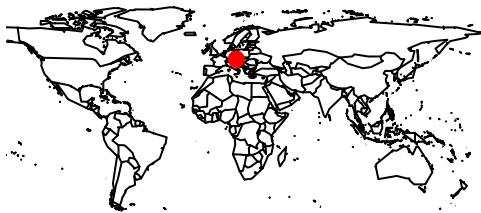
Australia, Alice Springs



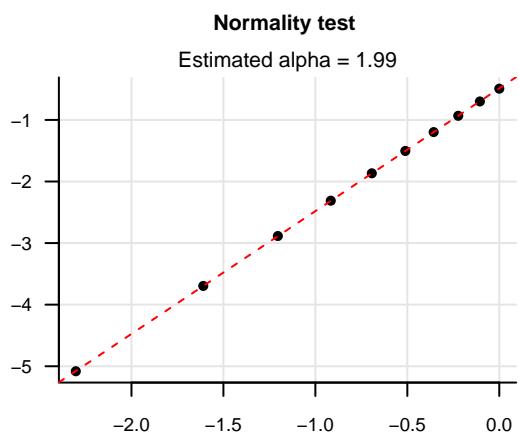
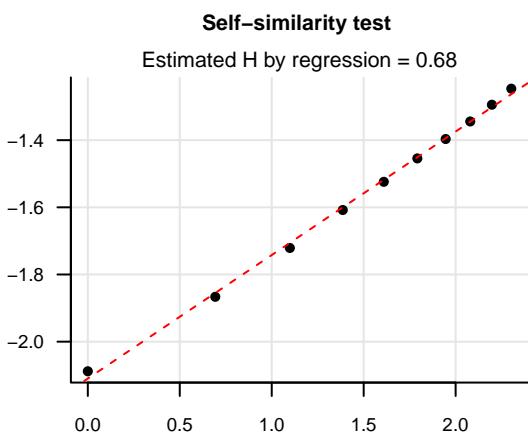
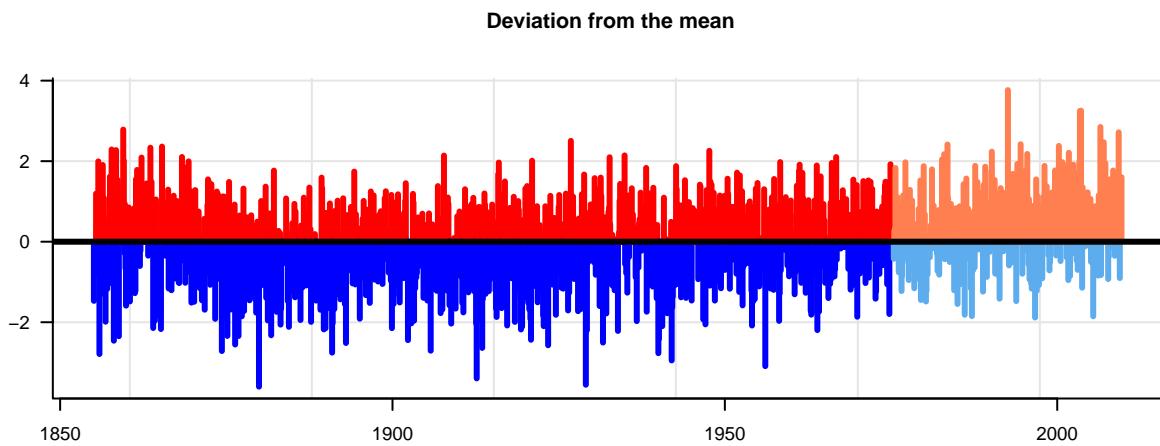
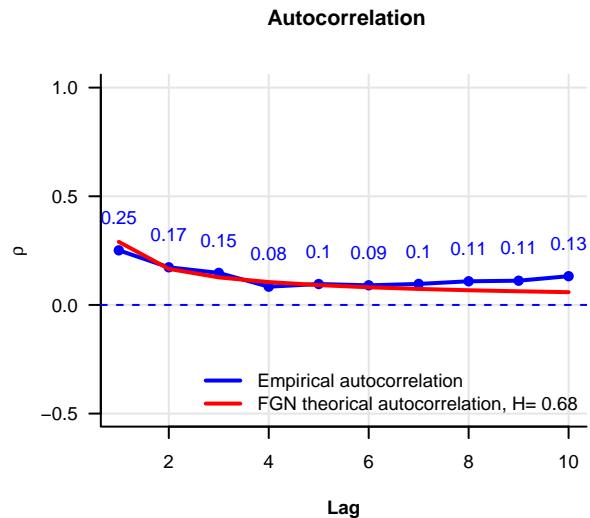
Australia, Cap Otway



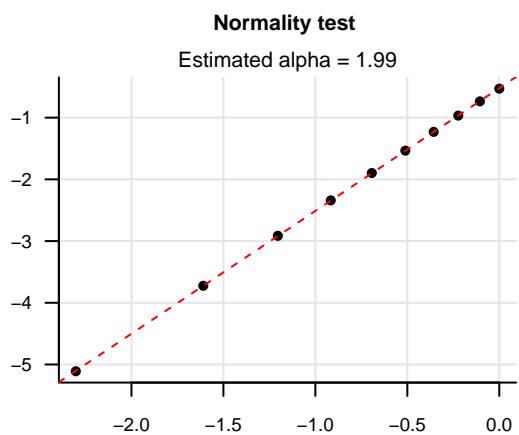
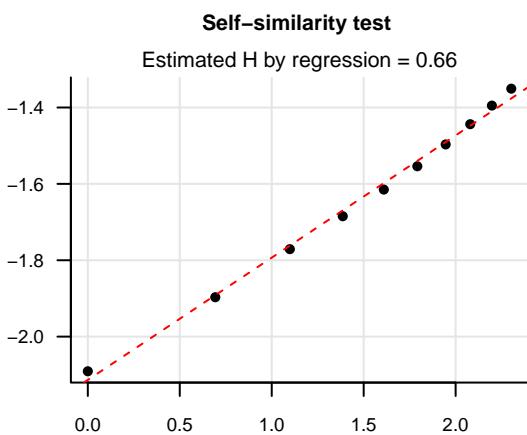
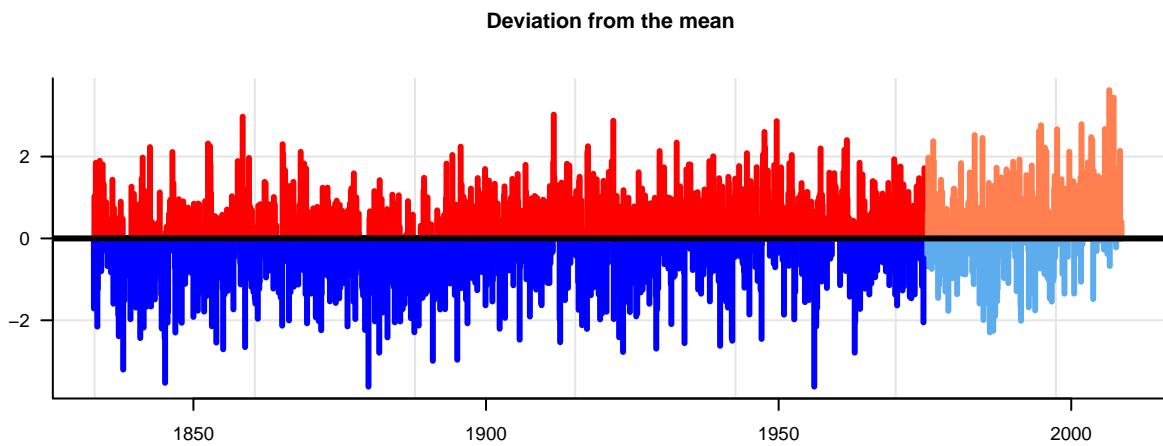
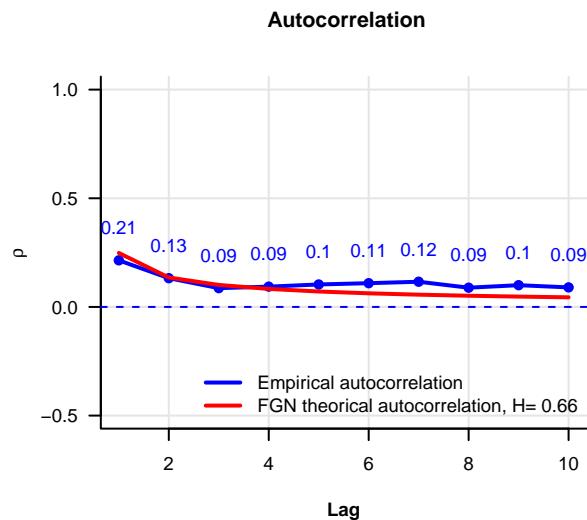
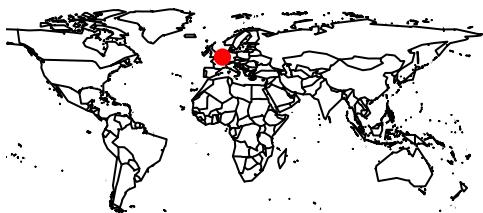
Austria, Kremsmunster



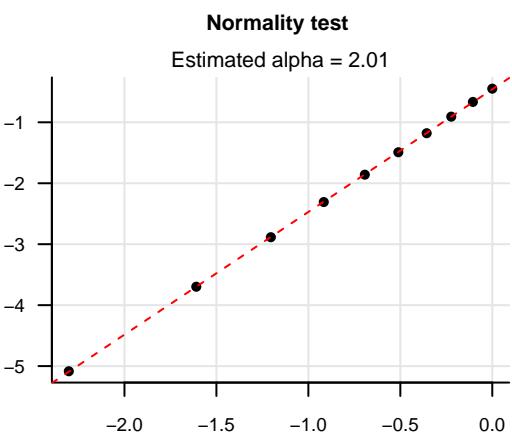
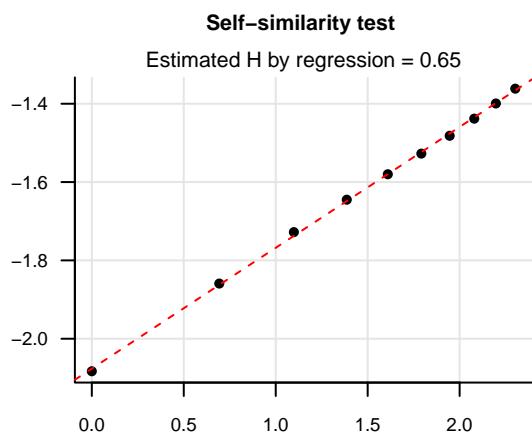
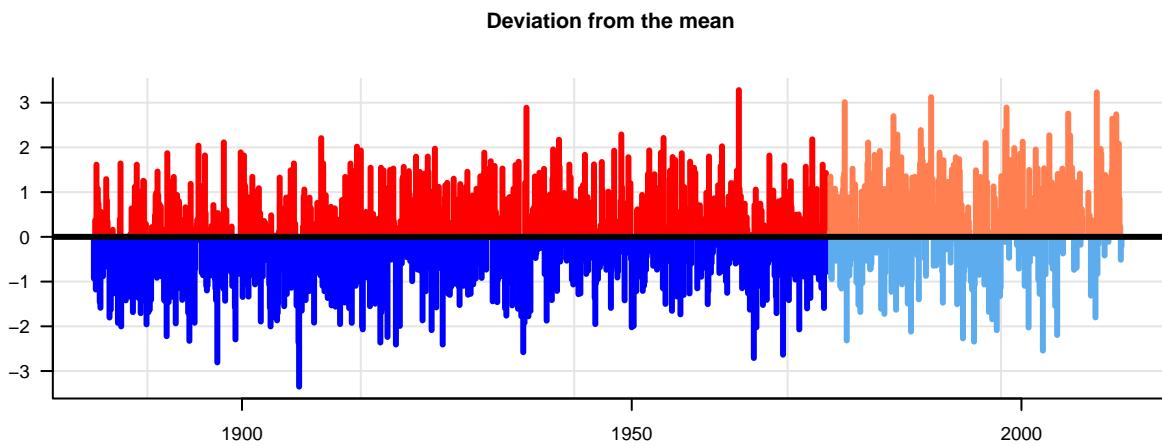
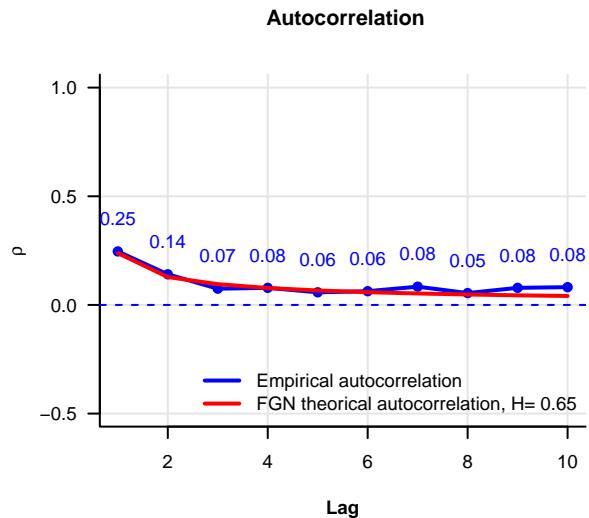
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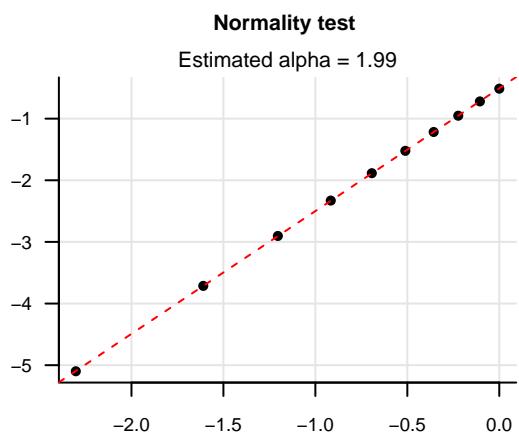
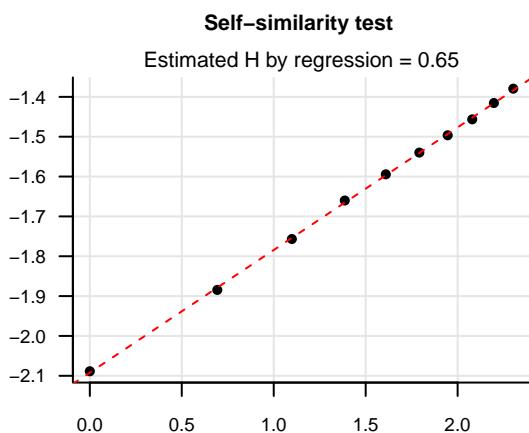
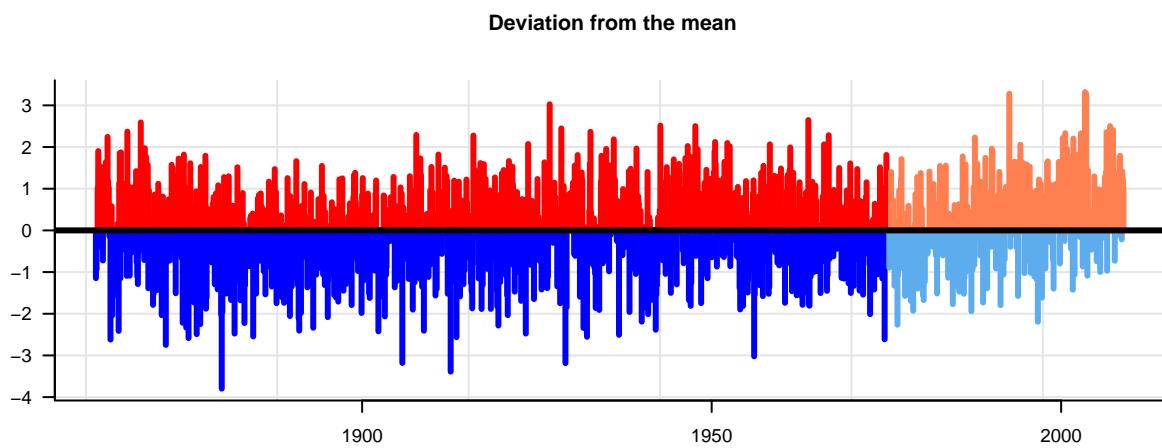
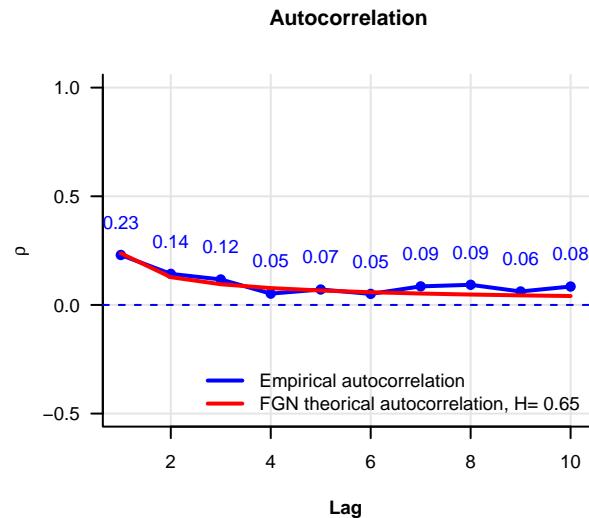
Belgium, Uccle



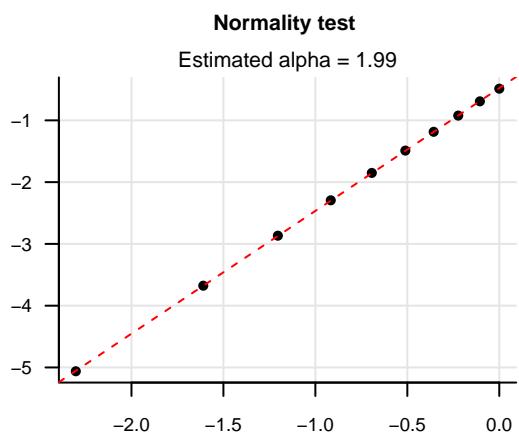
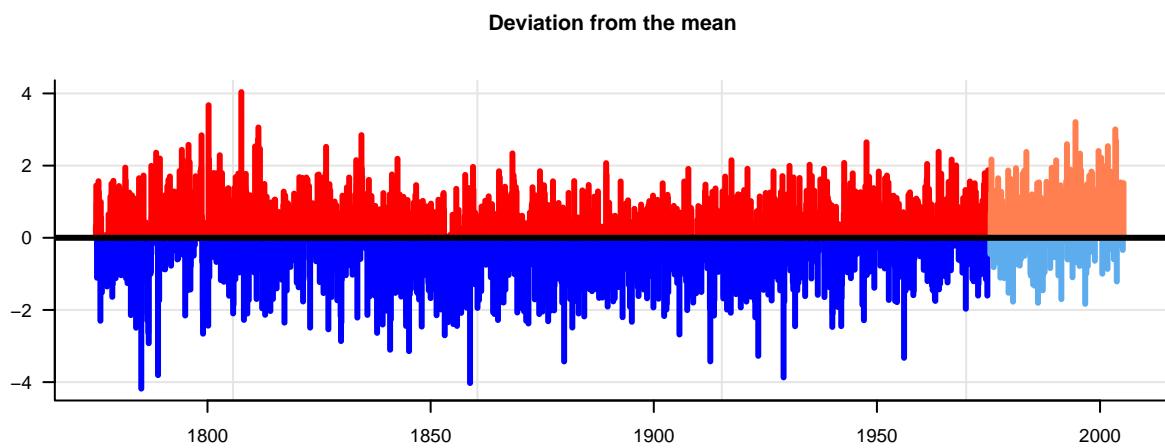
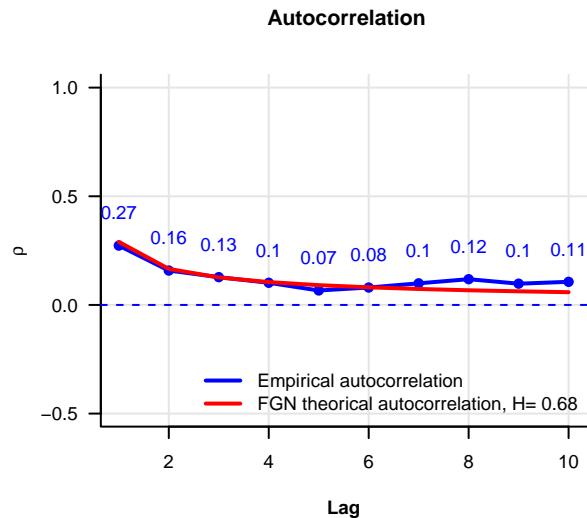
Canada, Winnipeg



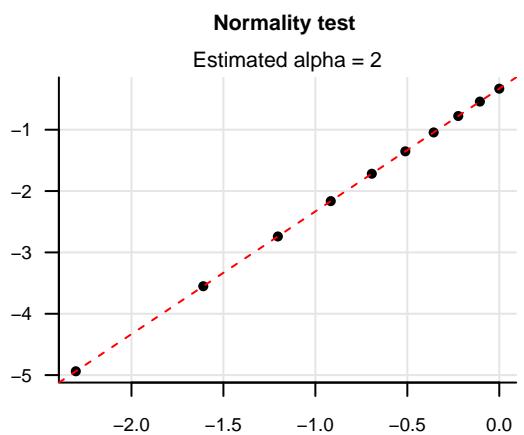
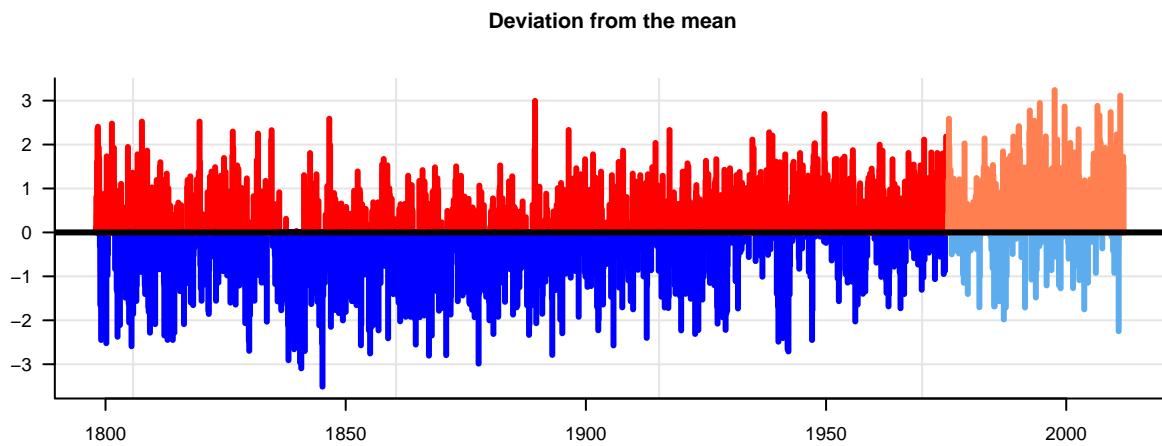
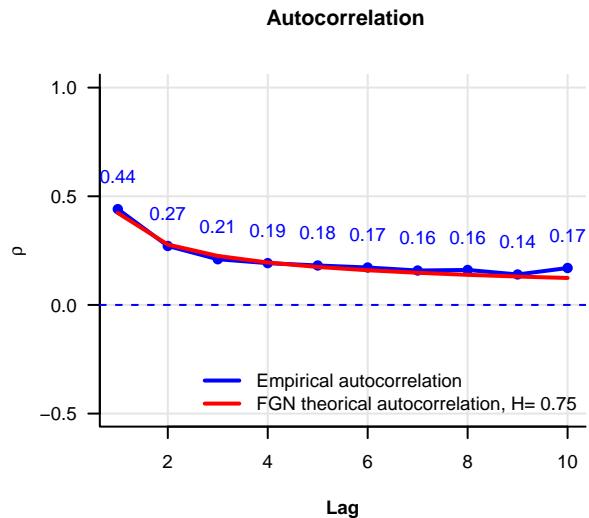
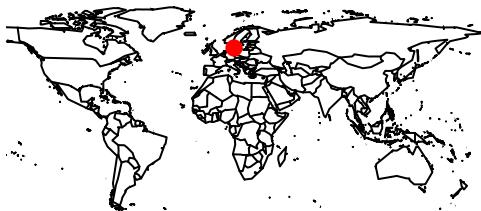
Croatia, Zagreb



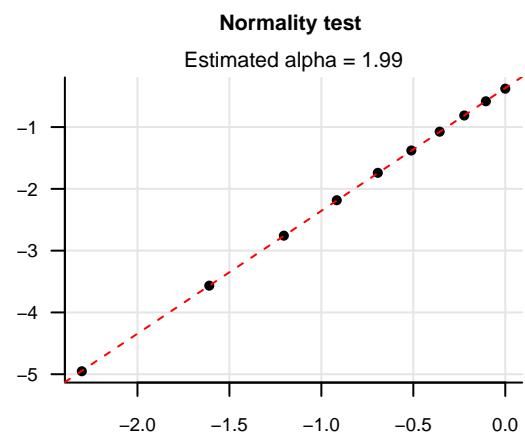
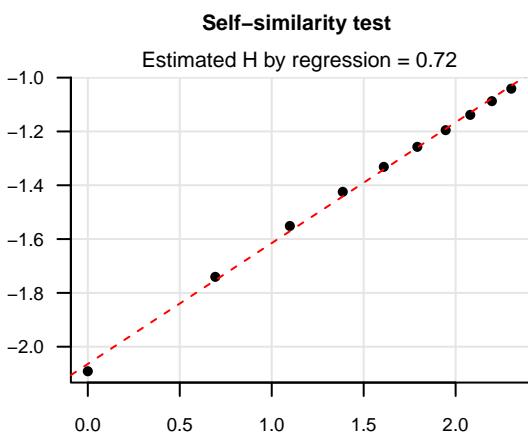
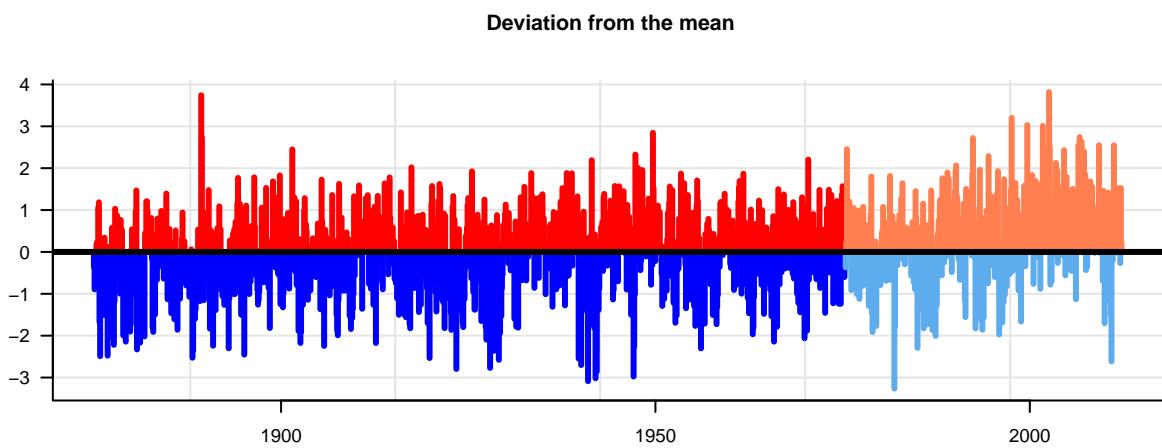
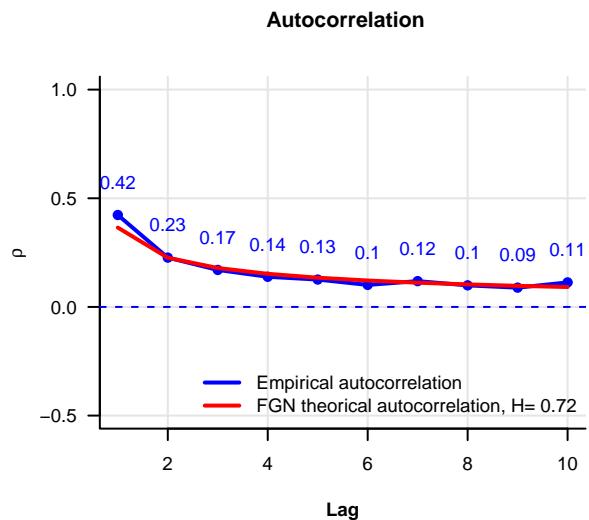
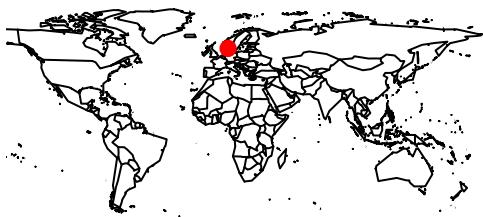
Czech Republic, Prague



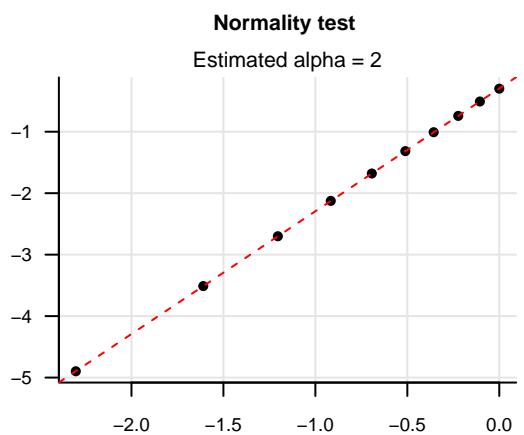
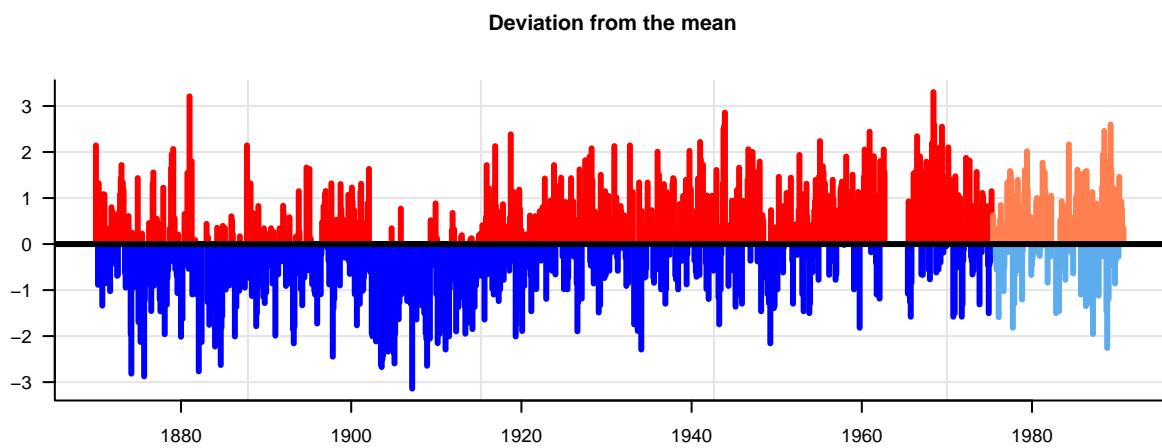
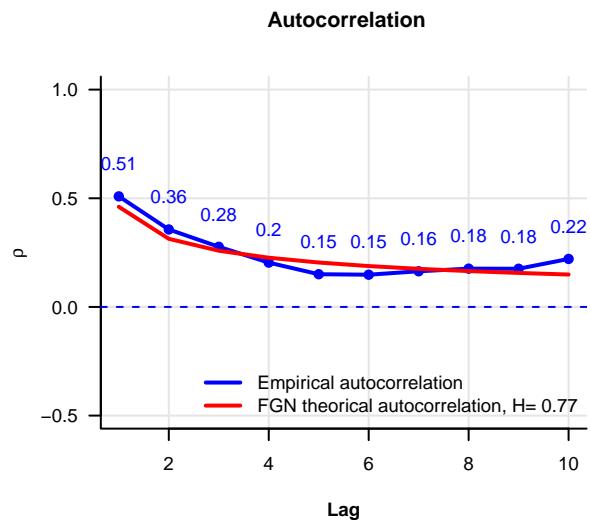
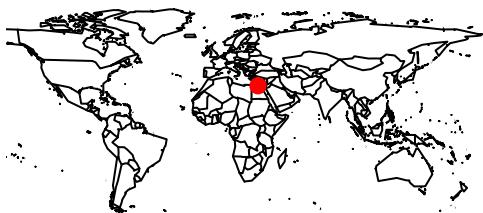
Denmark, Copenhagen



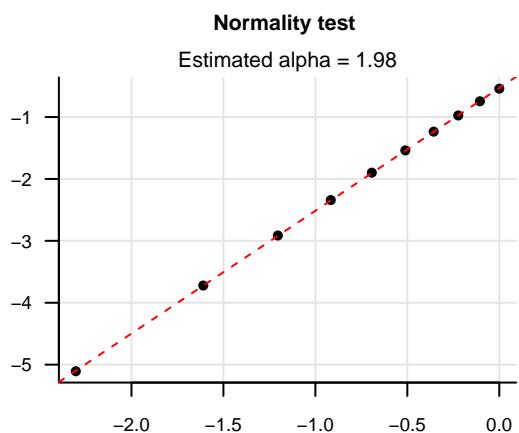
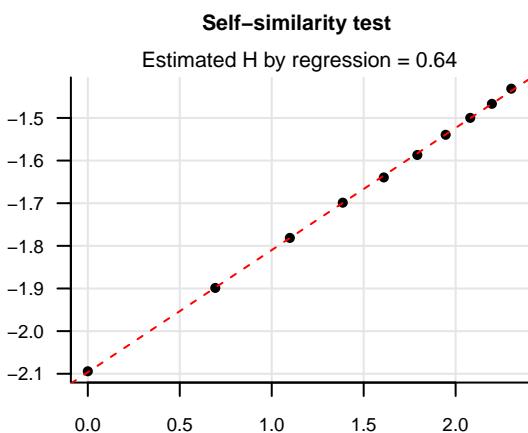
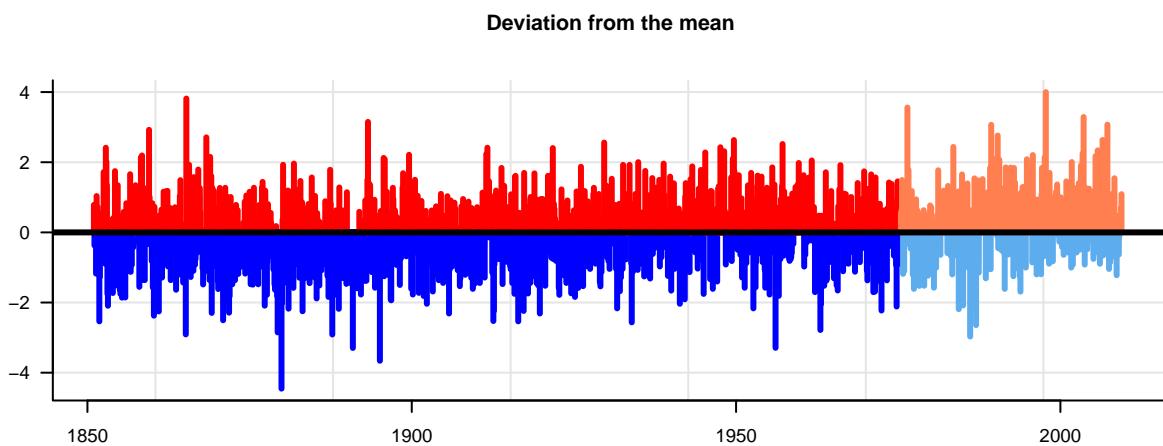
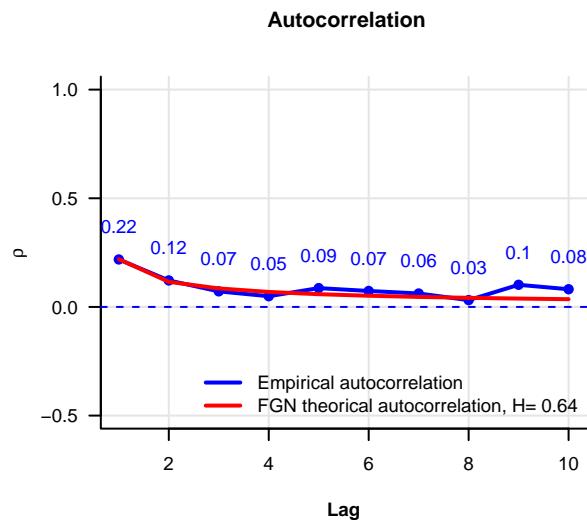
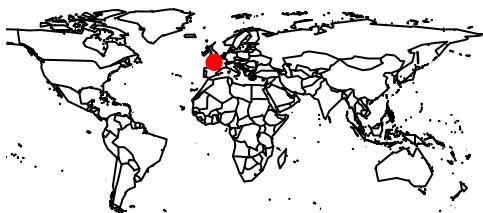
Denmark, Vestervig



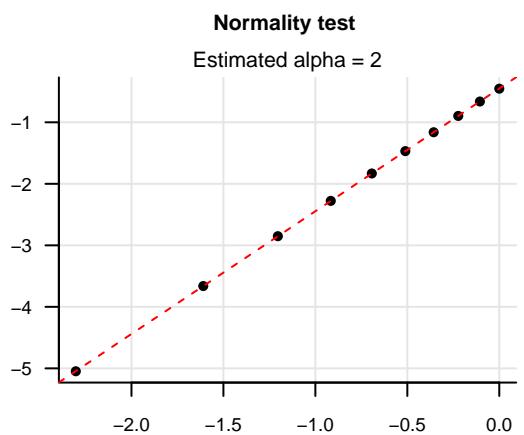
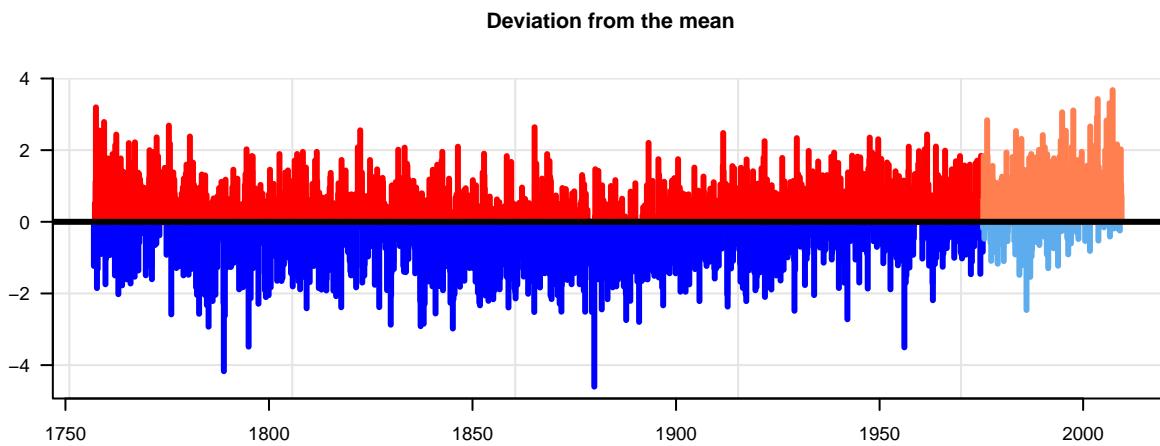
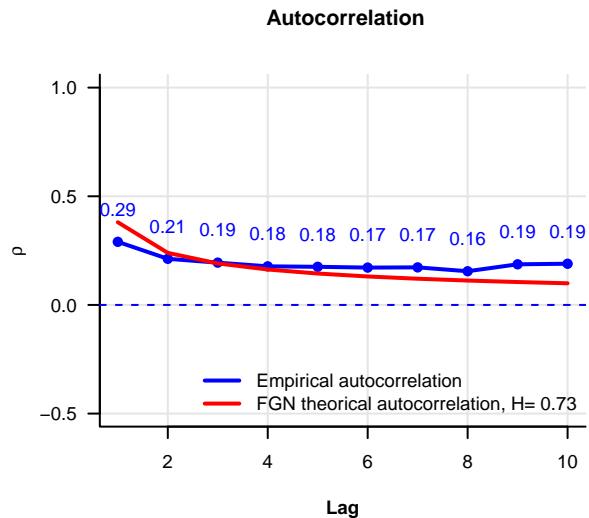
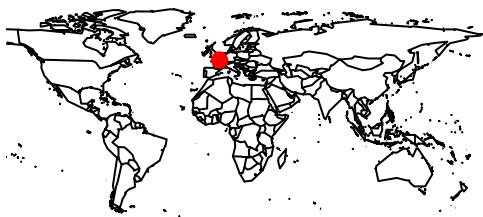
Egypt, Alexandria



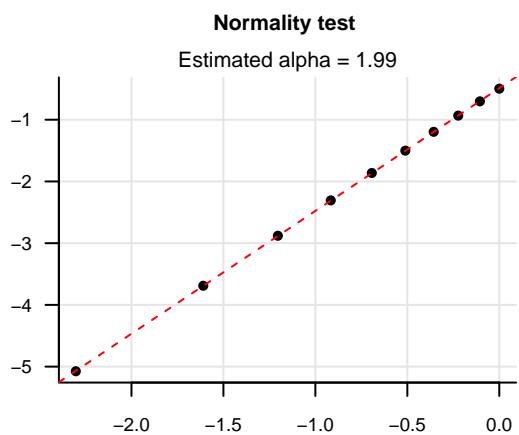
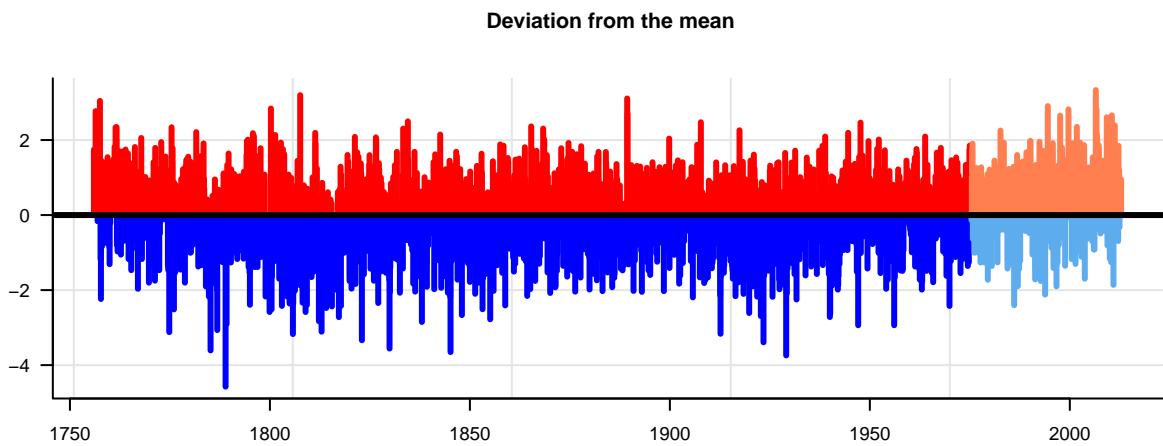
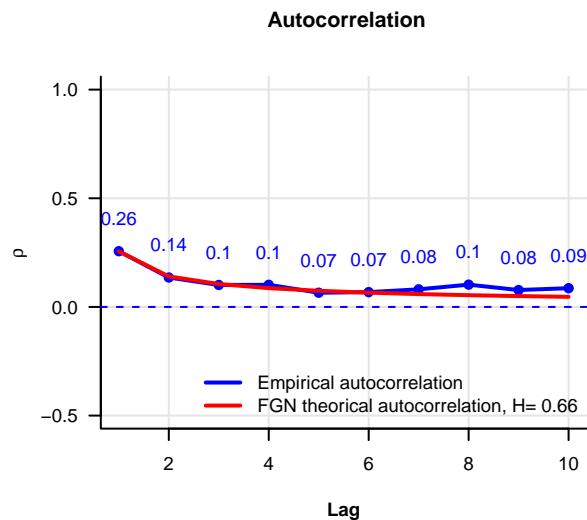
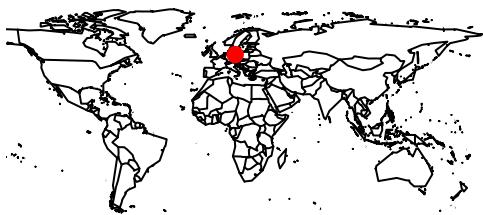
France, Nantes



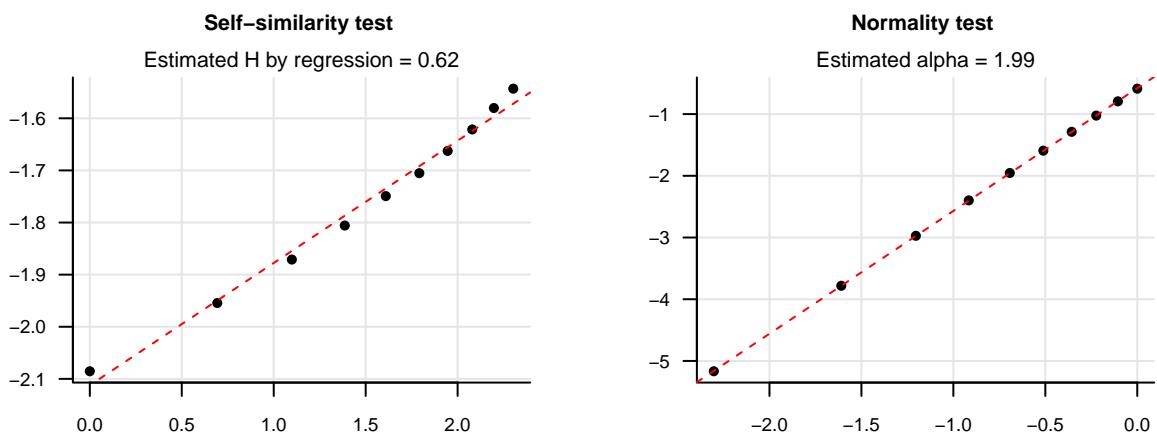
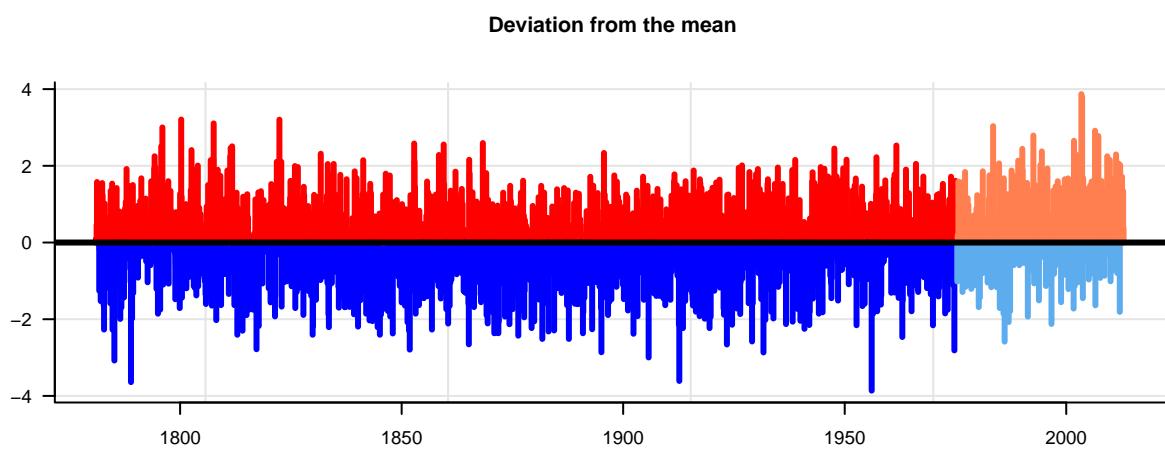
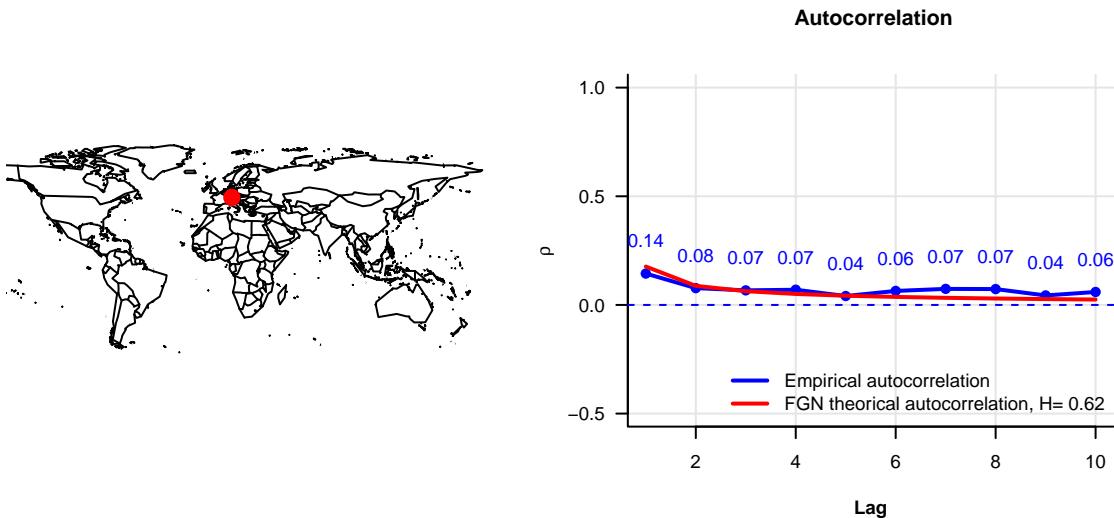
France, Paris



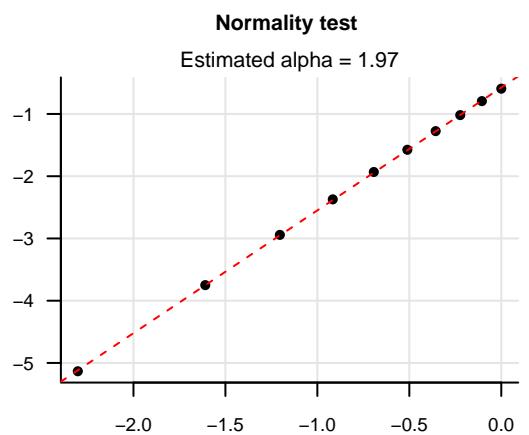
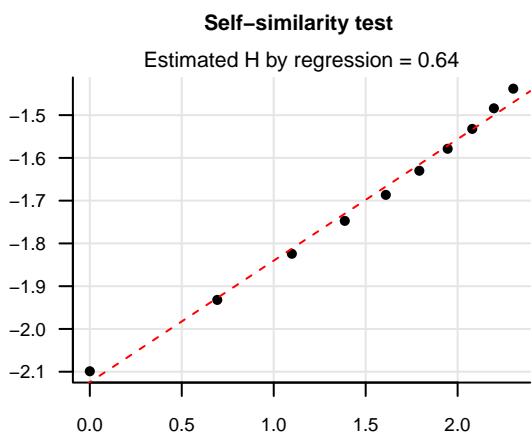
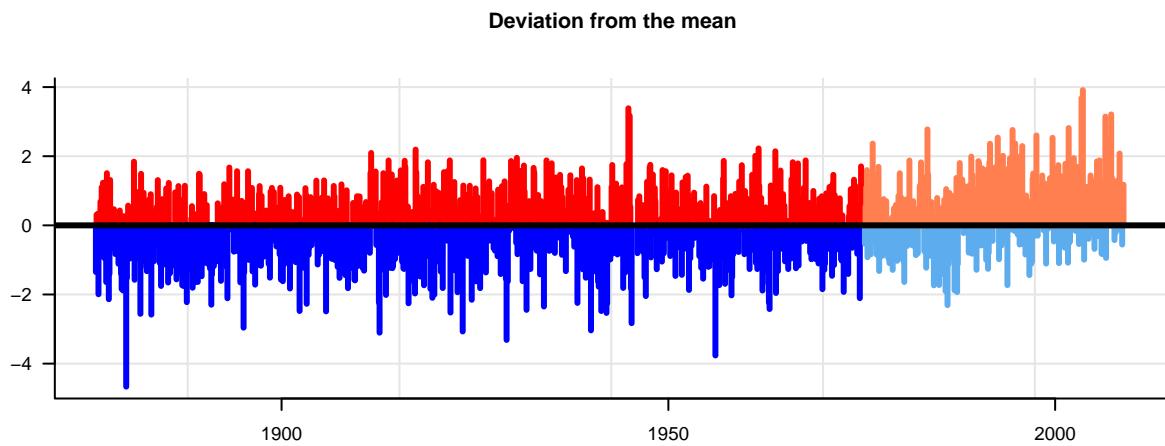
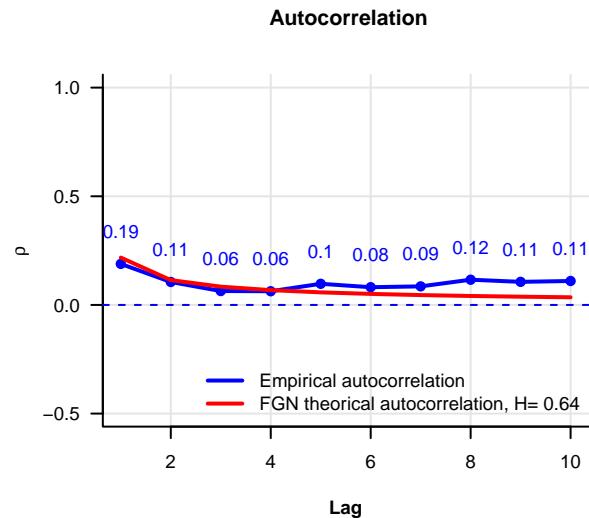
Germany, Berlin



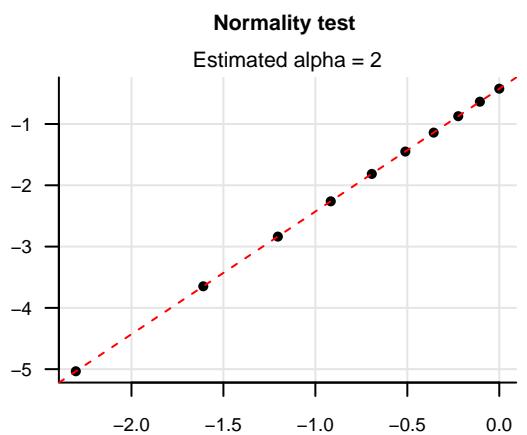
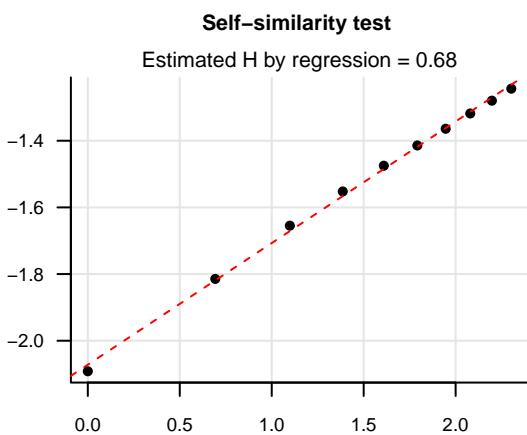
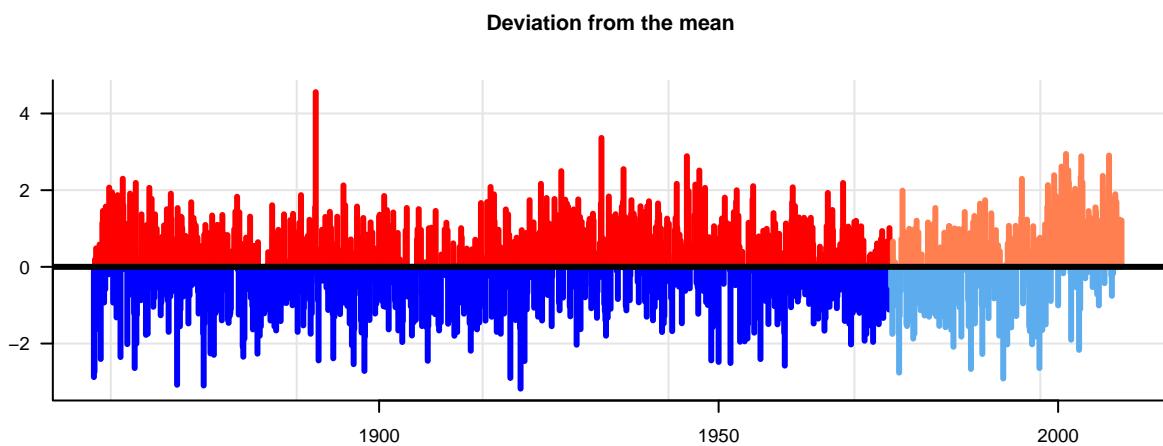
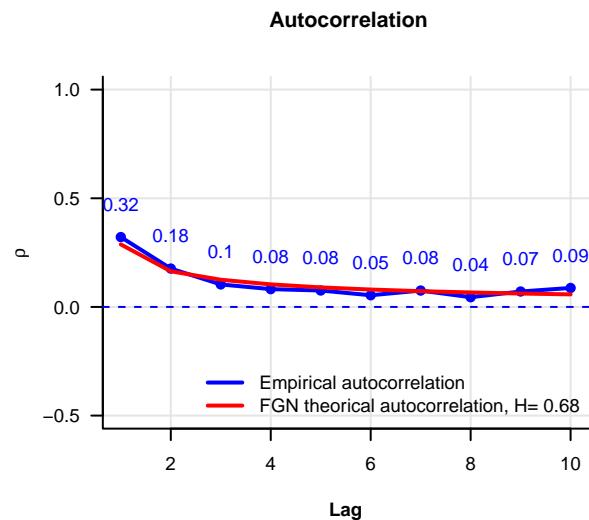
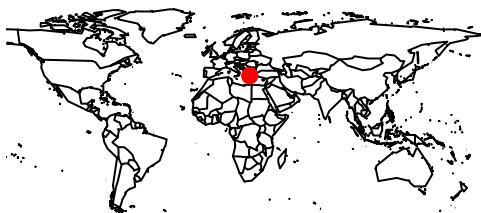
Germany, Hohenpeissenberg



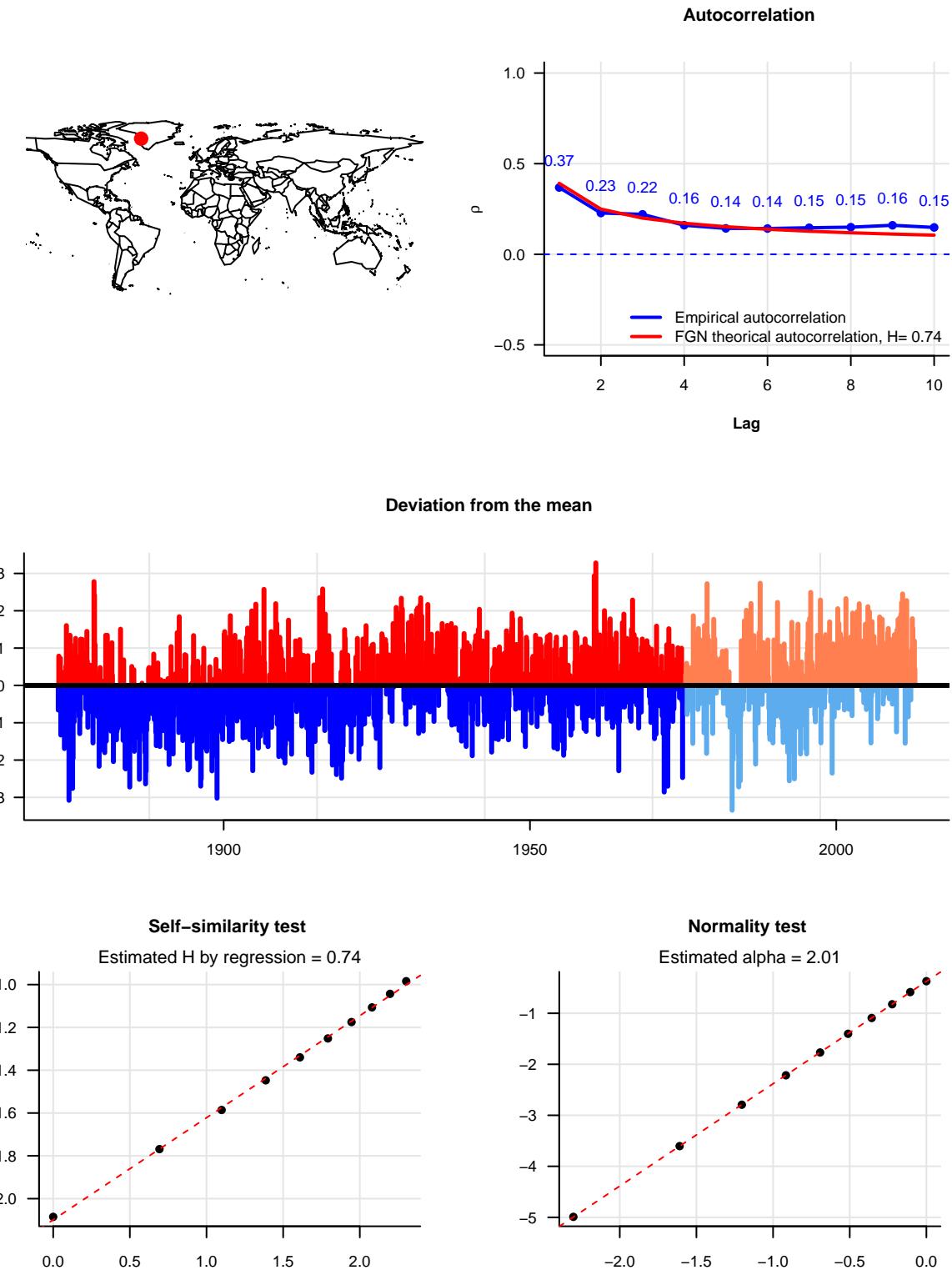
Germany, Karlsruhe



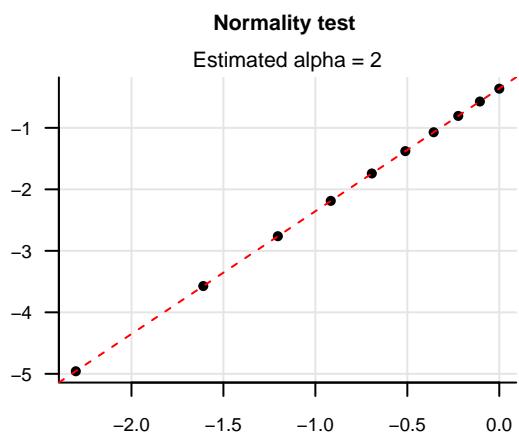
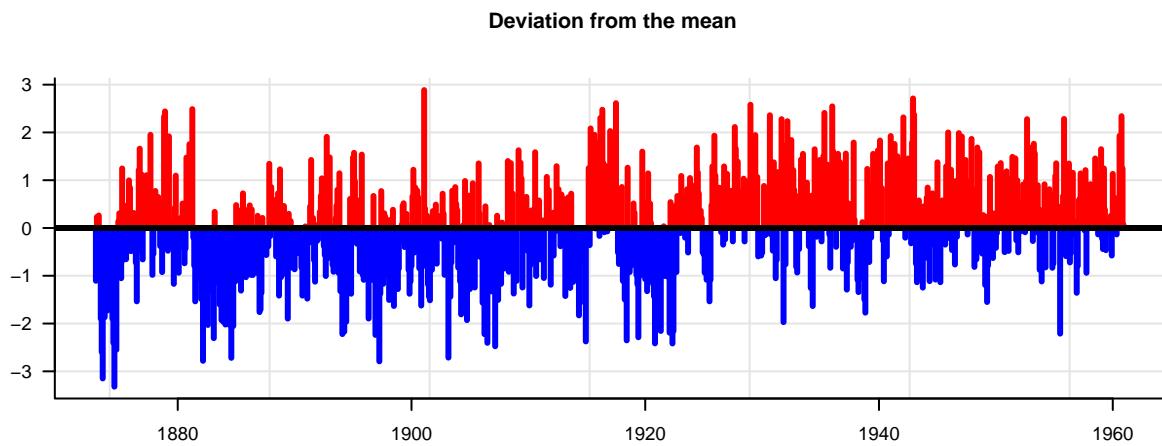
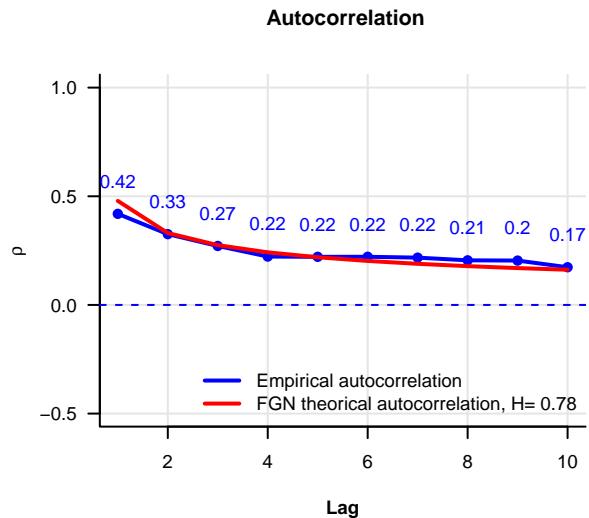
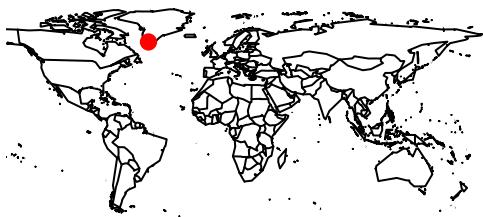
Greece, Athens



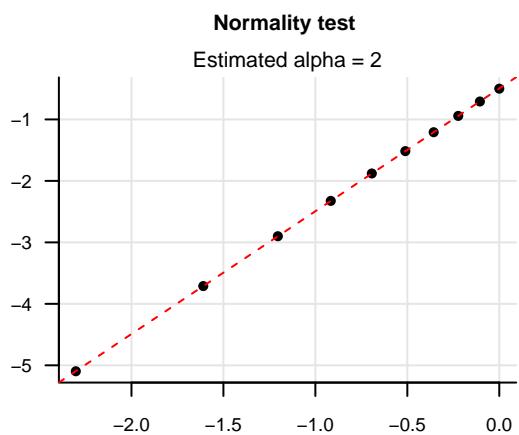
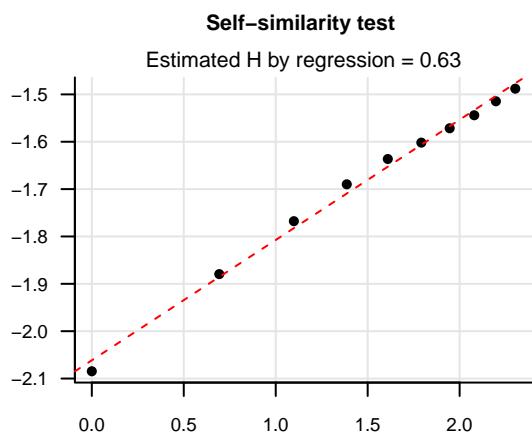
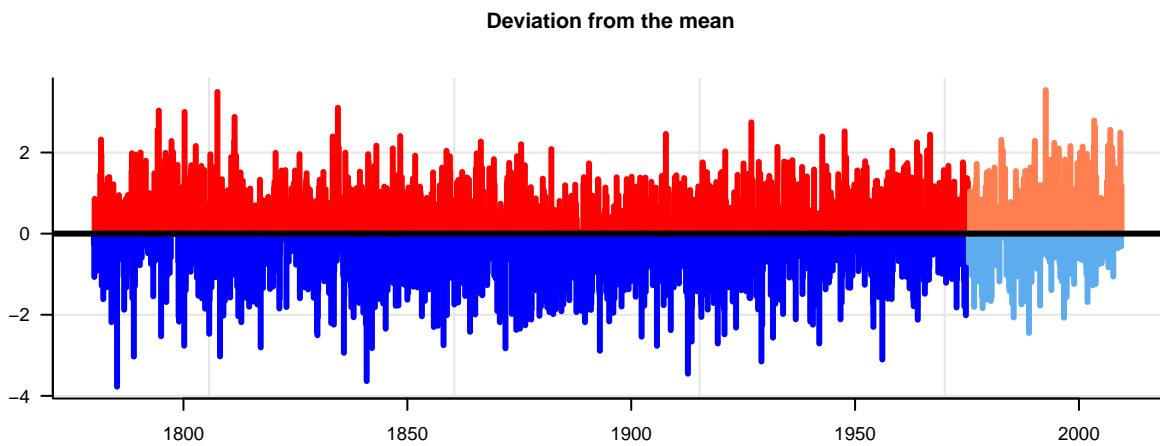
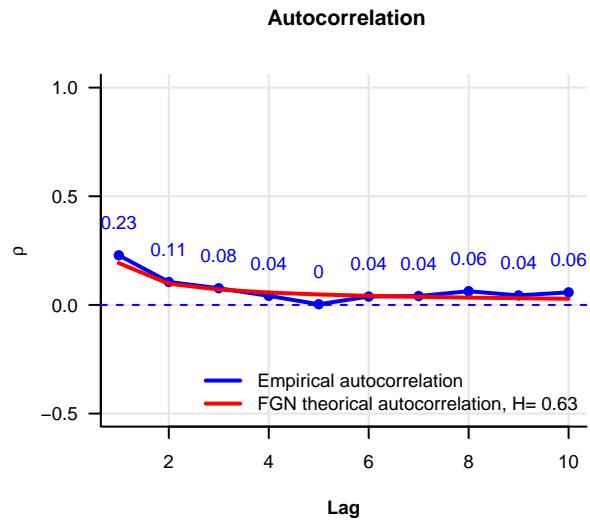
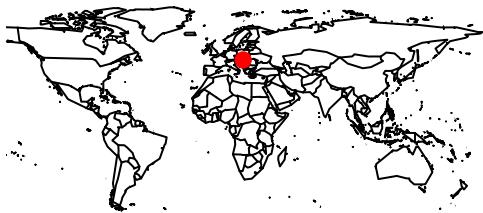
Greenland, Ilulissat



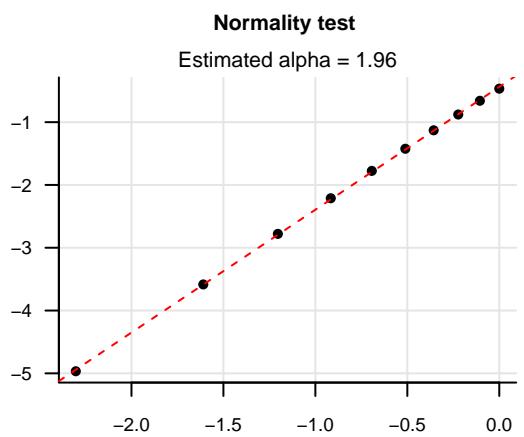
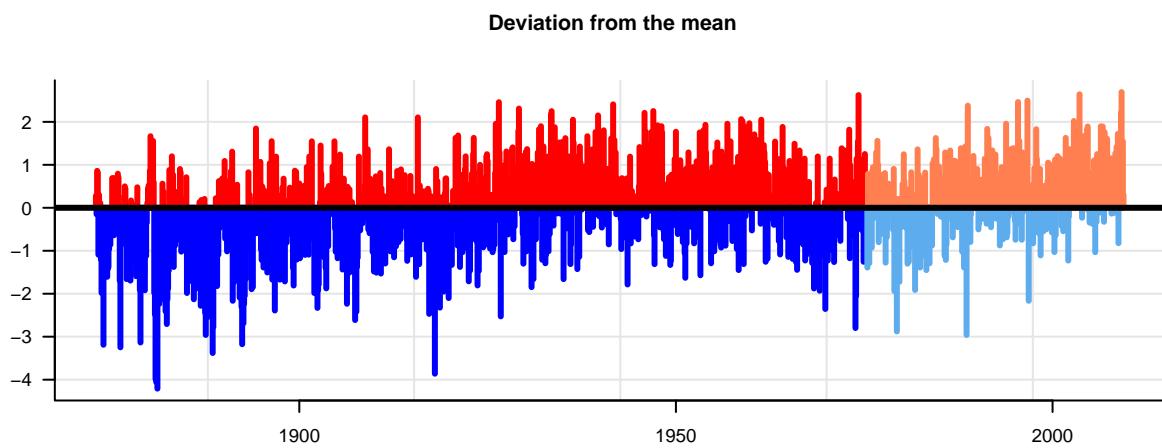
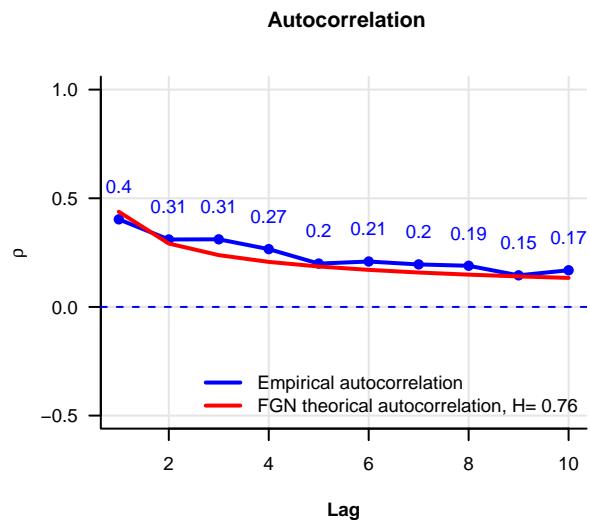
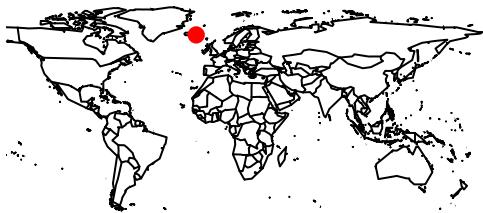
Greenland, Ivittuut



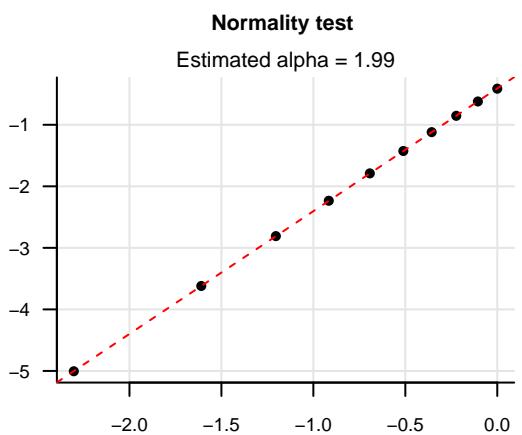
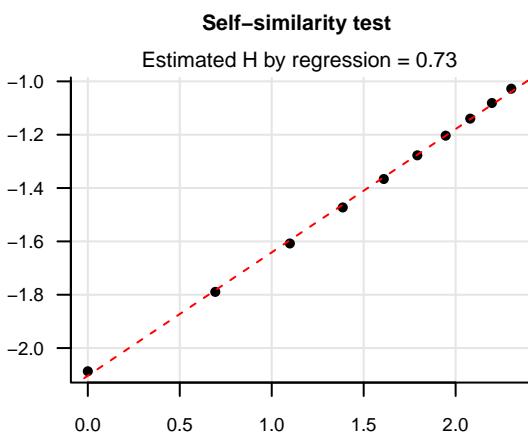
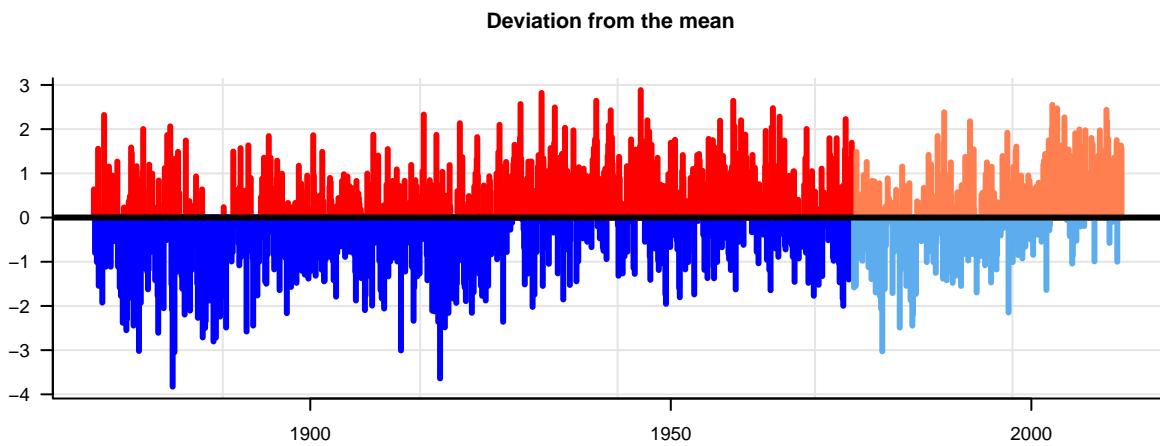
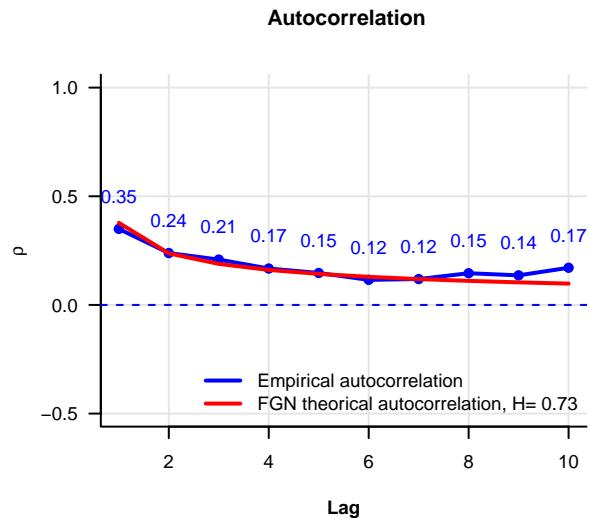
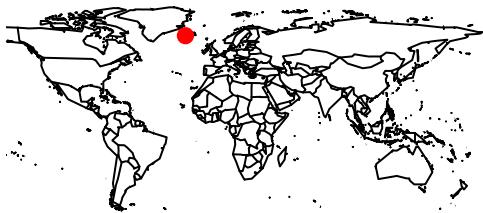
Hungary, Budapest



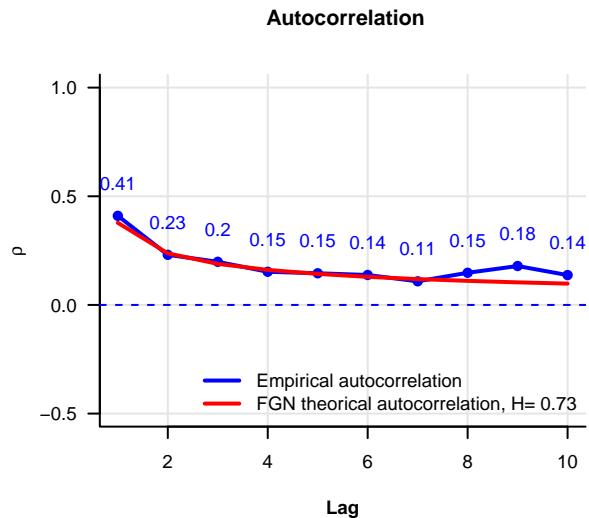
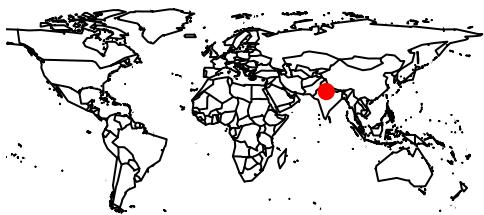
Iceland, Djupivogur



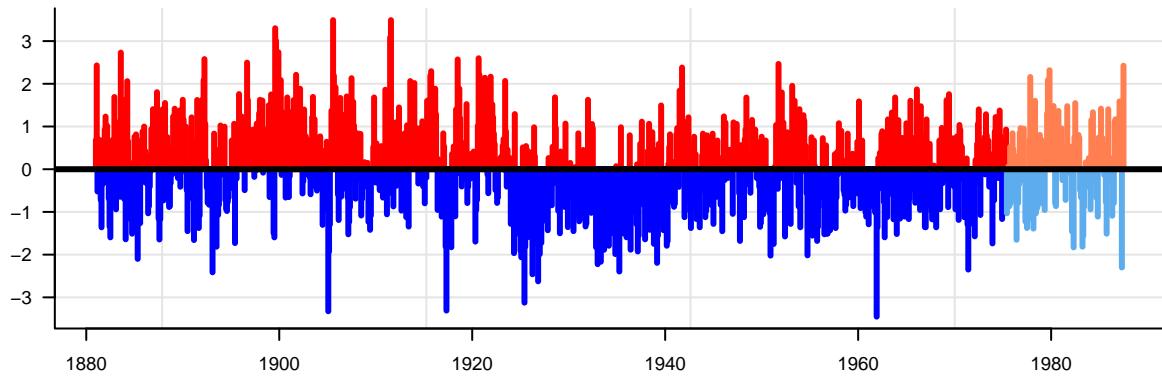
Iceland, Reykjavik



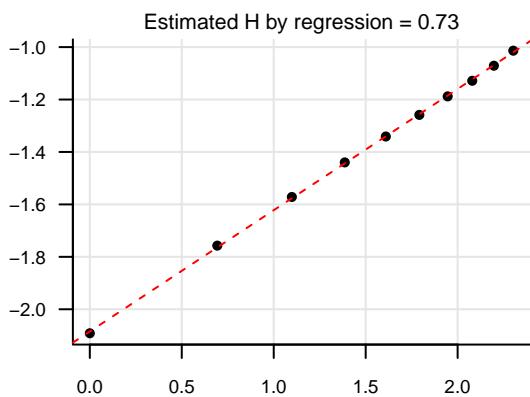
India, Agra



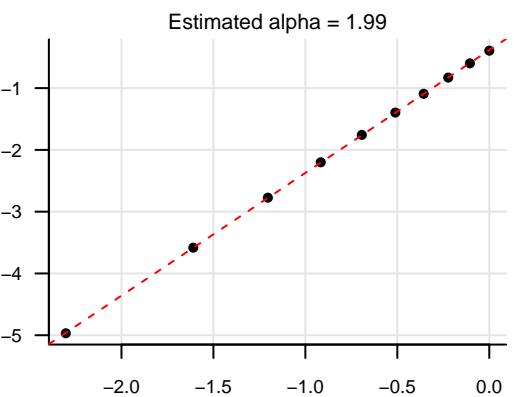
Deviation from the mean



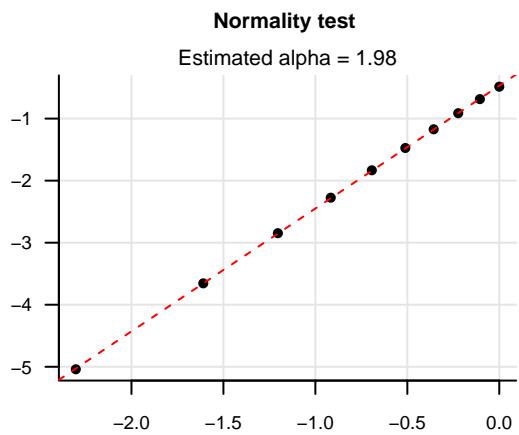
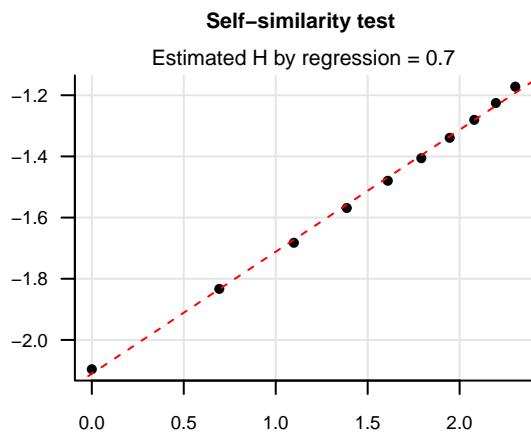
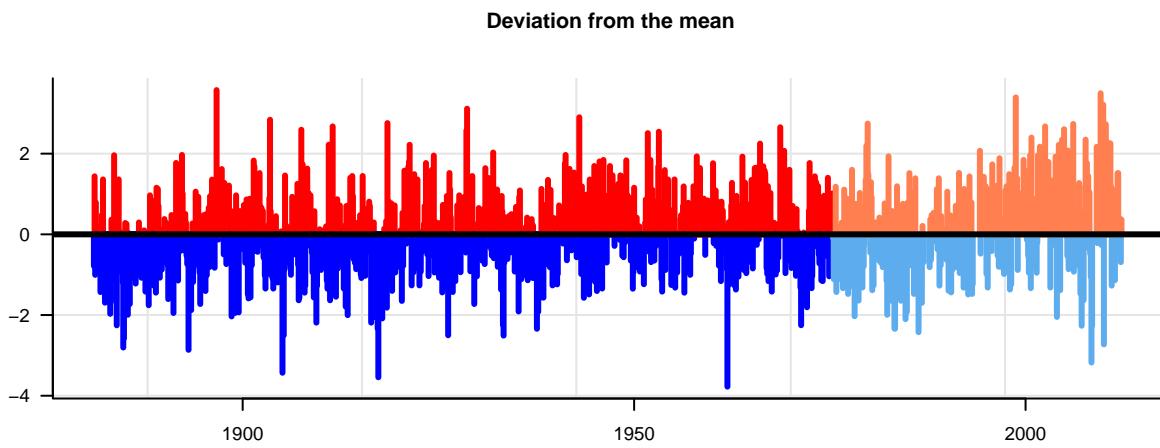
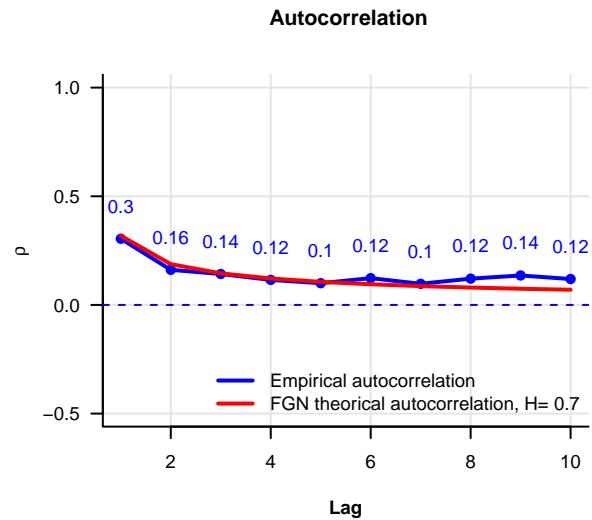
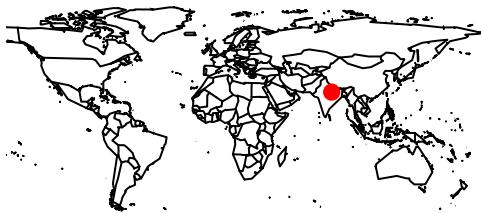
Self-similarity test



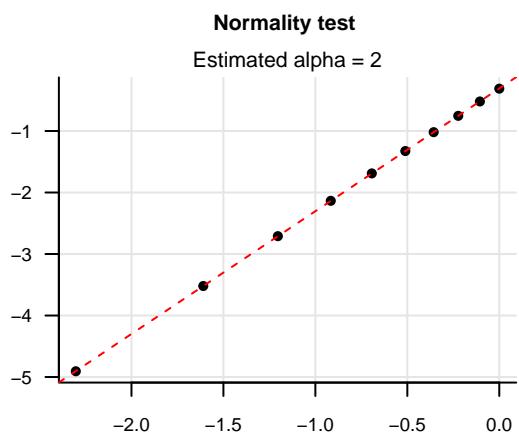
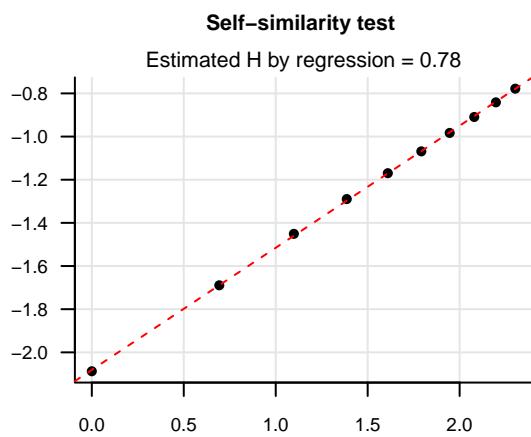
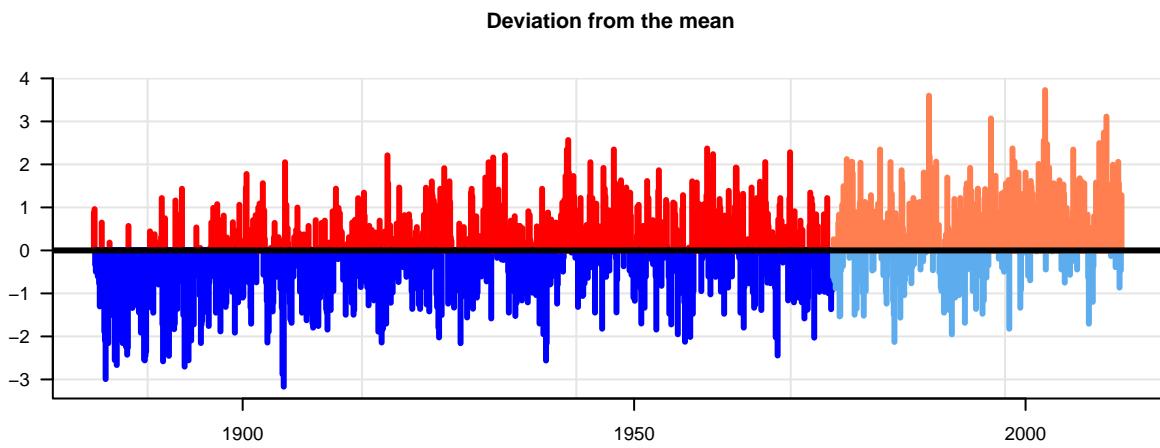
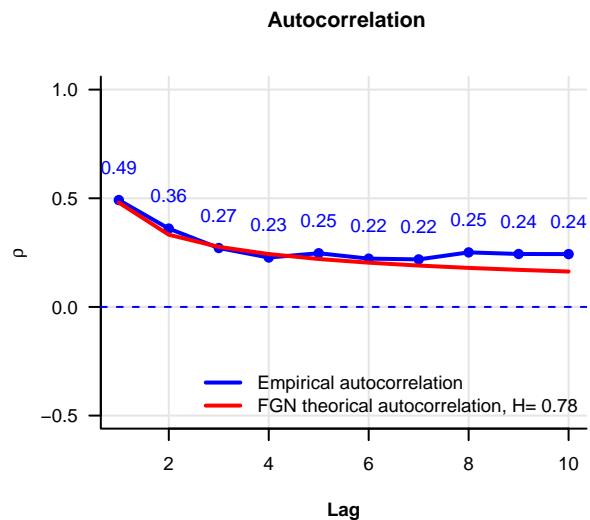
Normality test



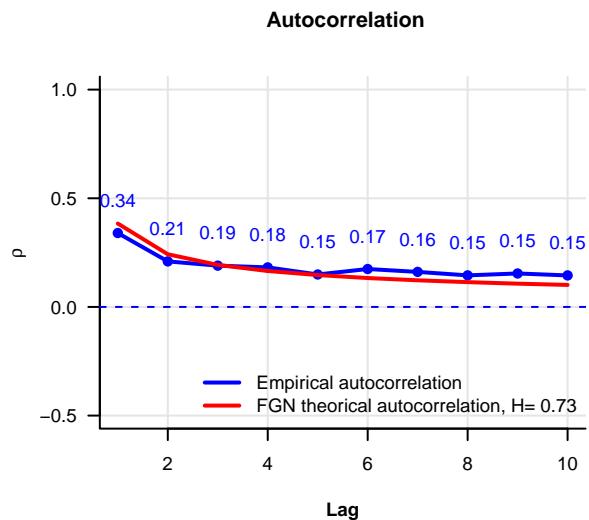
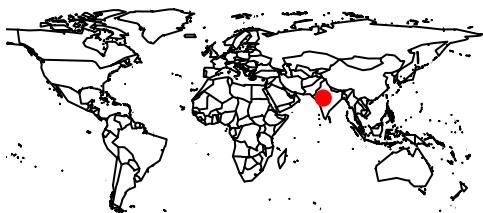
India, Allahabad



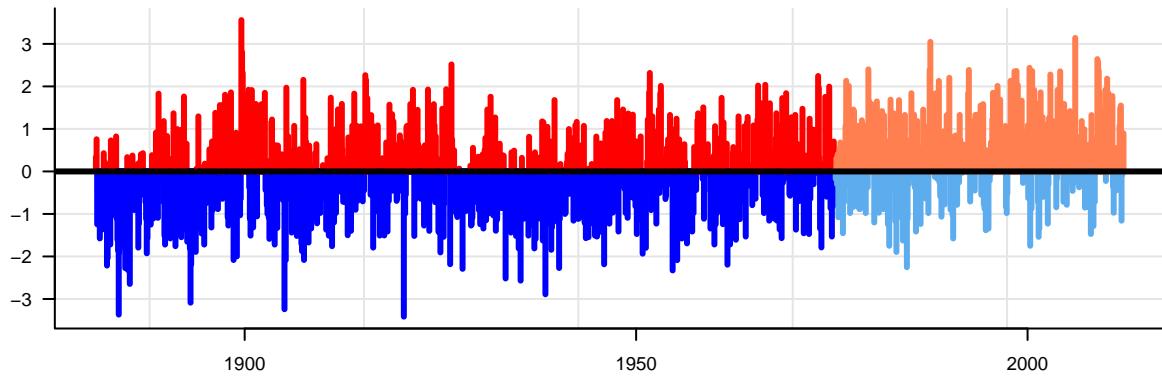
India, Bombay



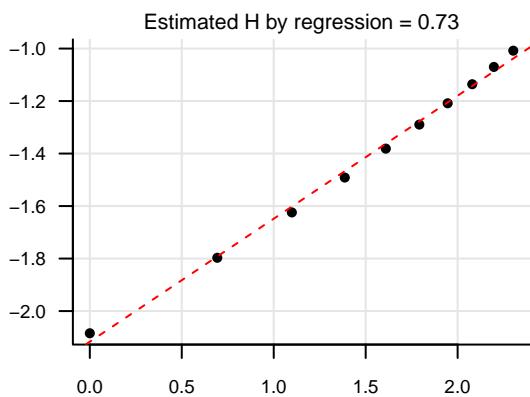
India, Indore



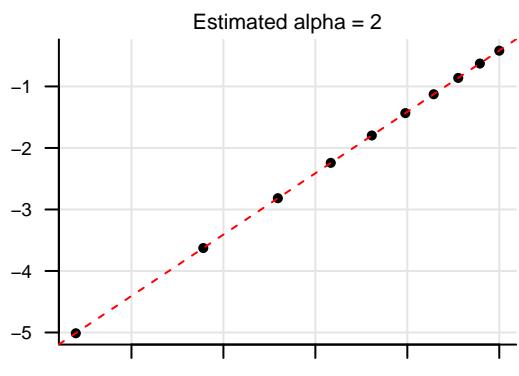
Deviation from the mean



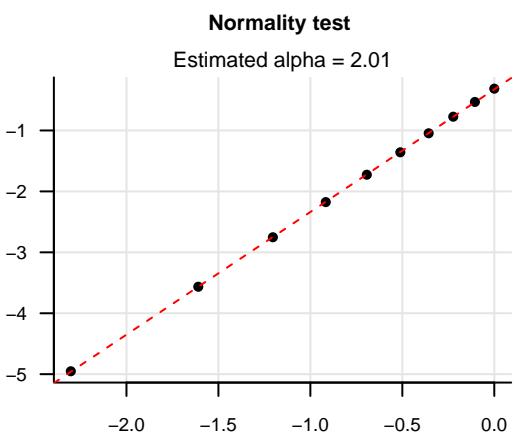
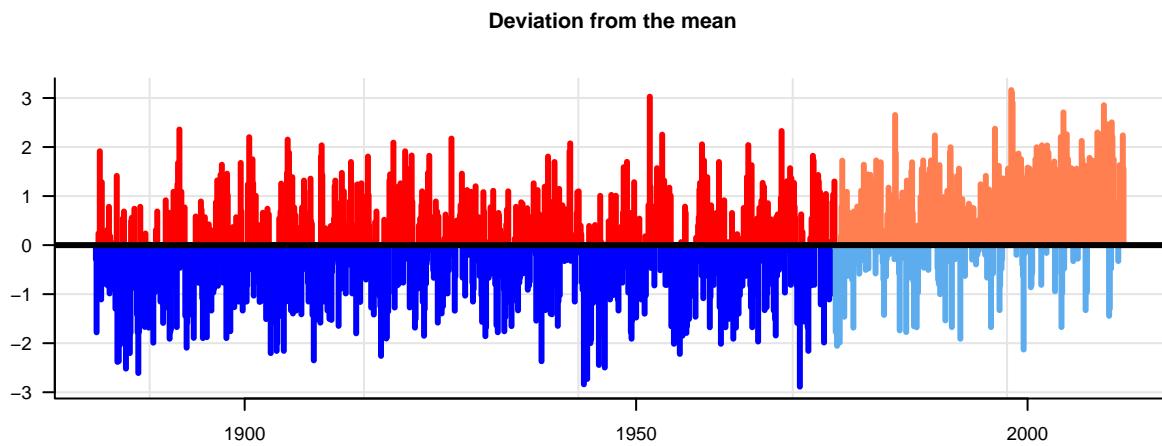
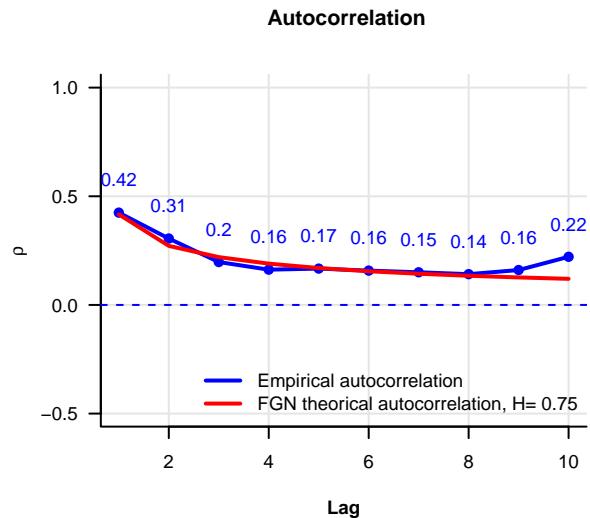
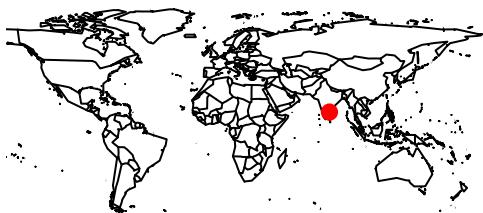
Self-similarity test



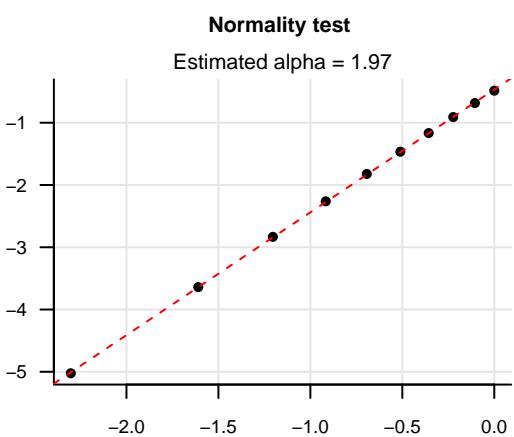
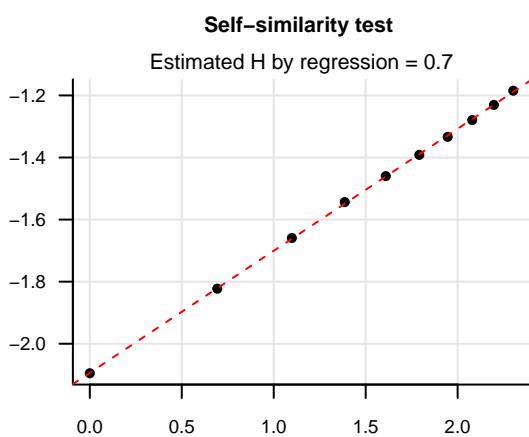
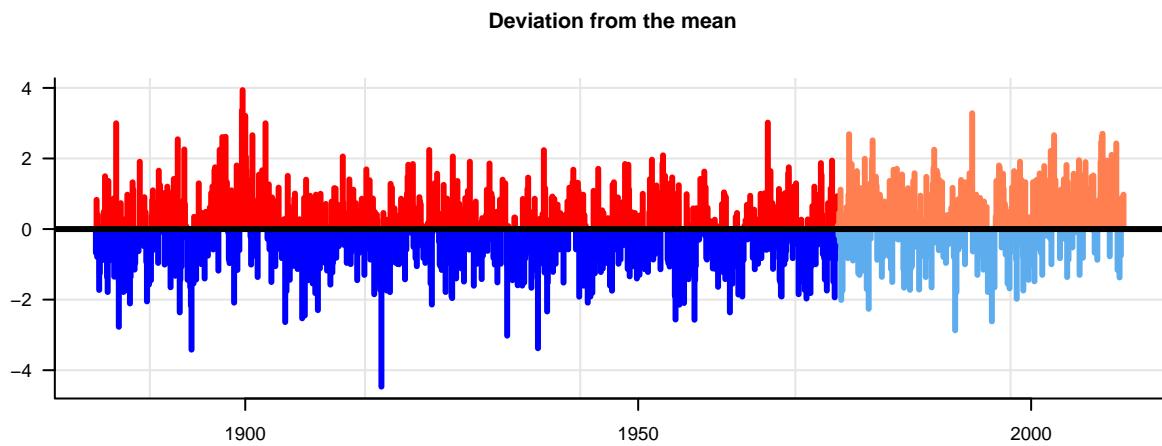
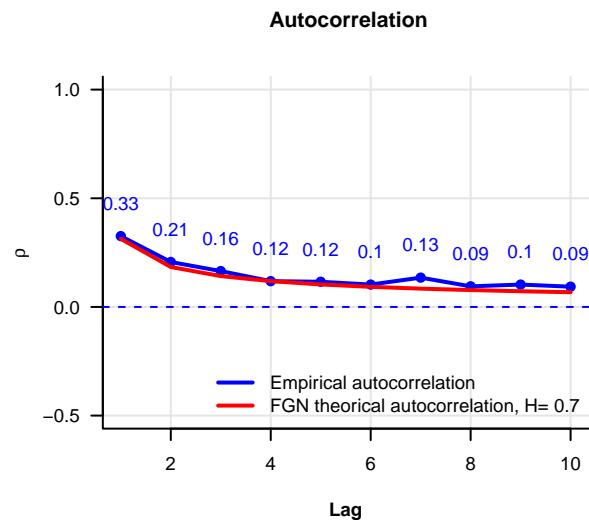
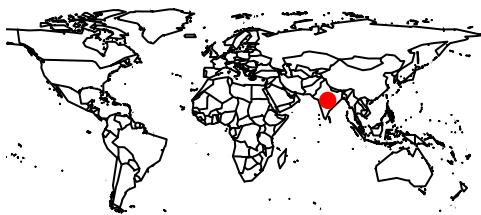
Normality test



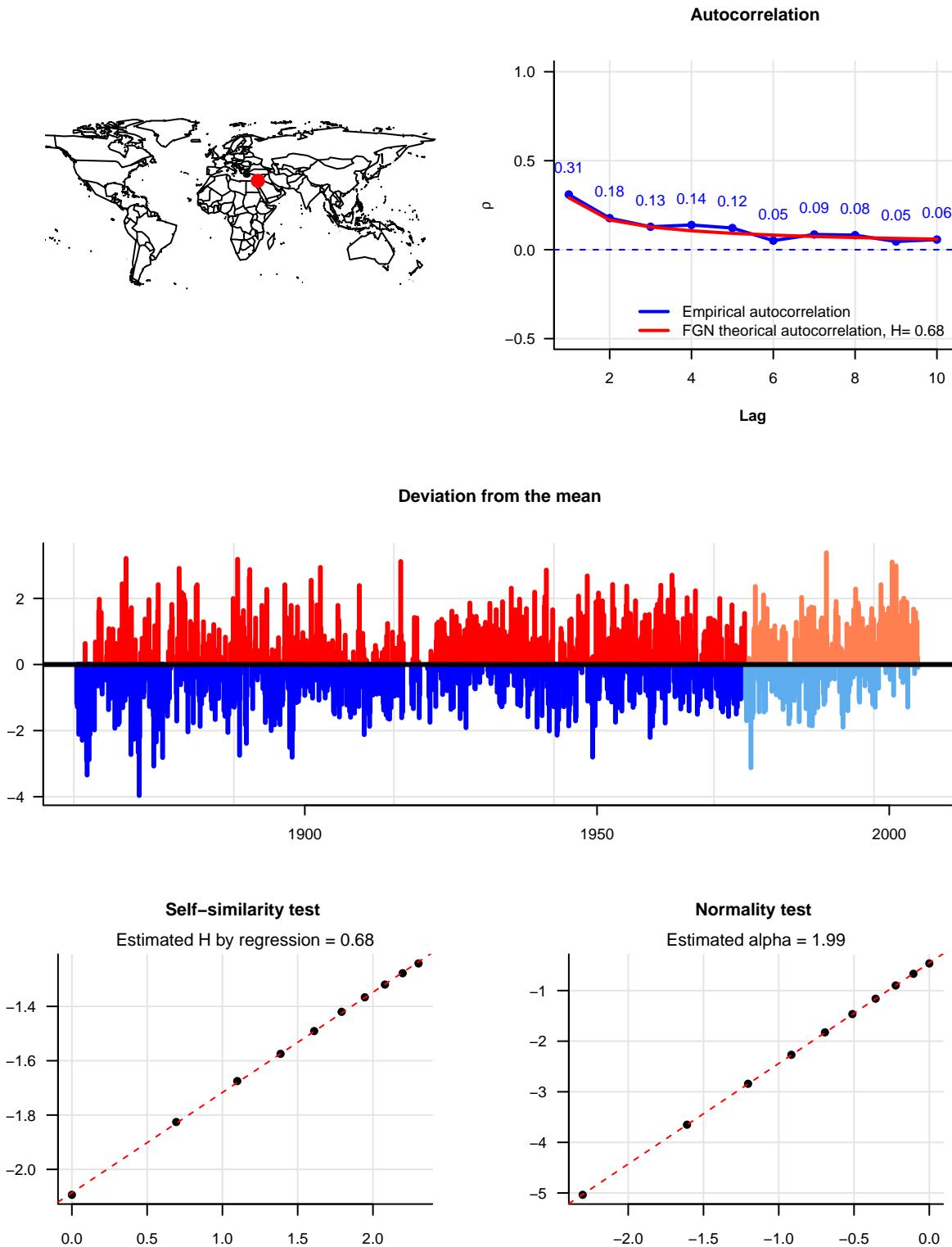
India, Madras



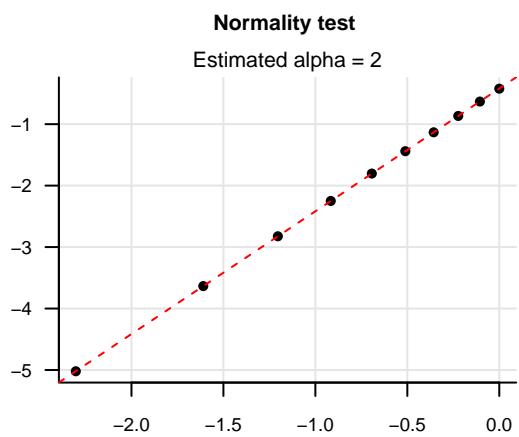
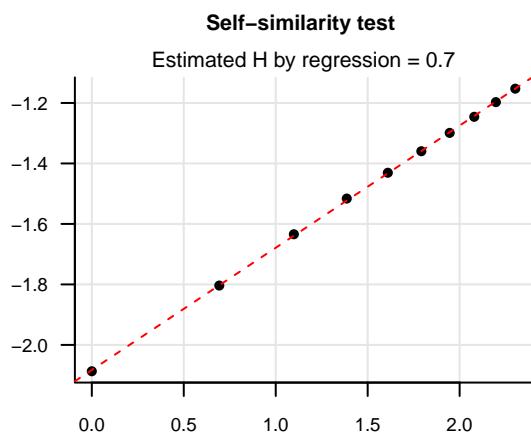
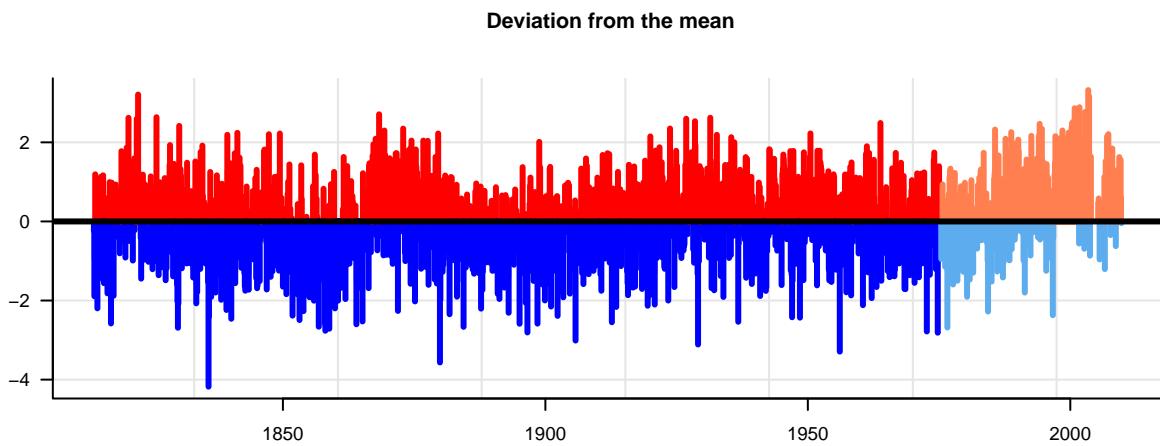
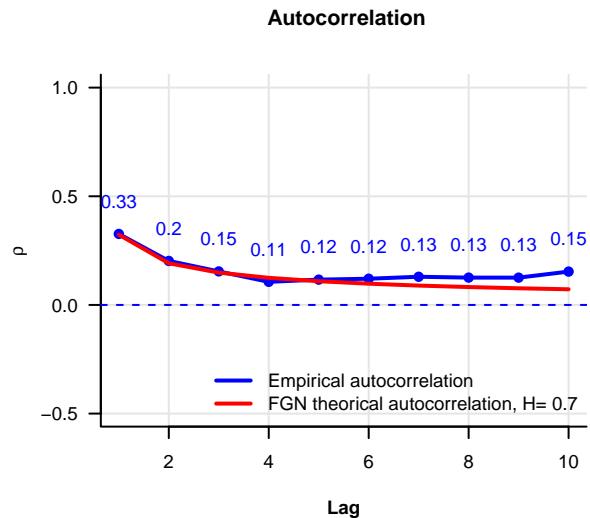
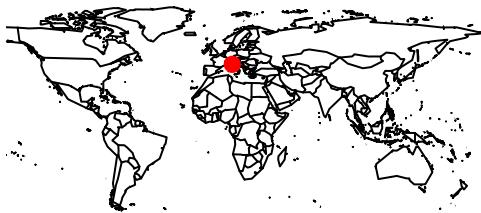
India, Nagpur



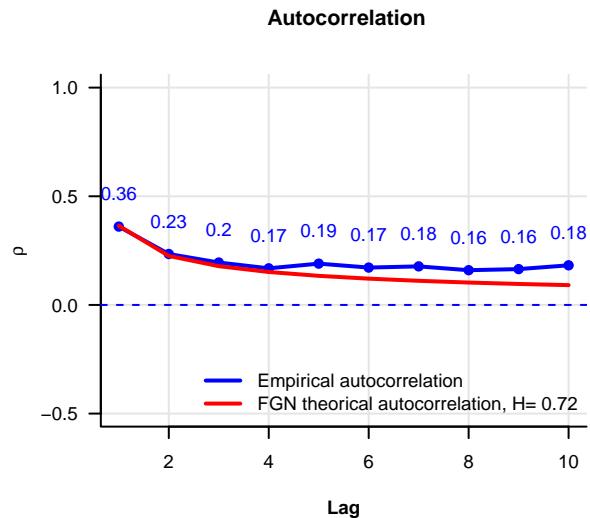
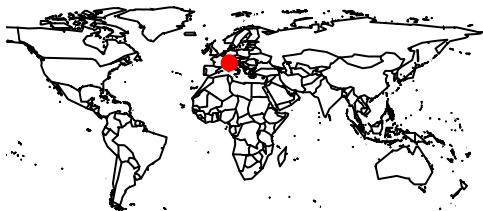
Israel, Jerusalem



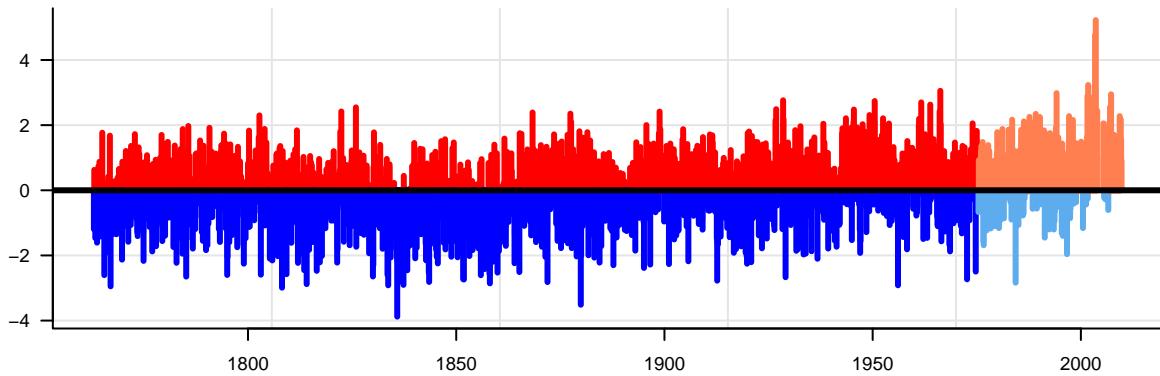
Italy, Bologna



Italy, Milan

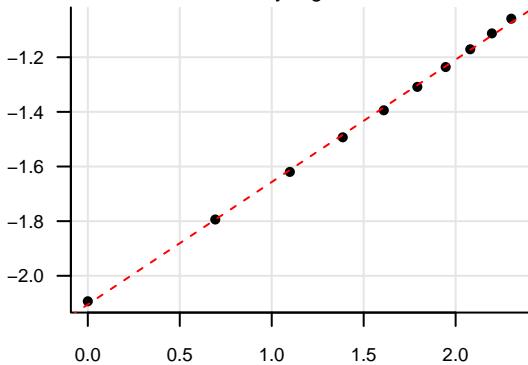


Deviation from the mean



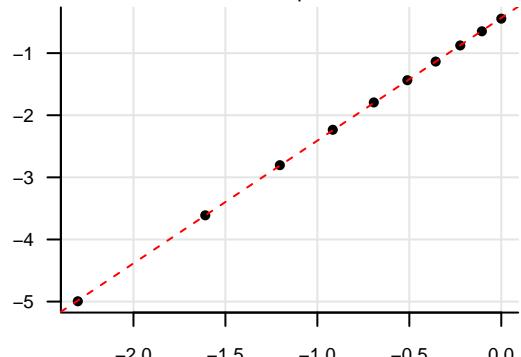
Self-similarity test

Estimated H by regression = 0.72

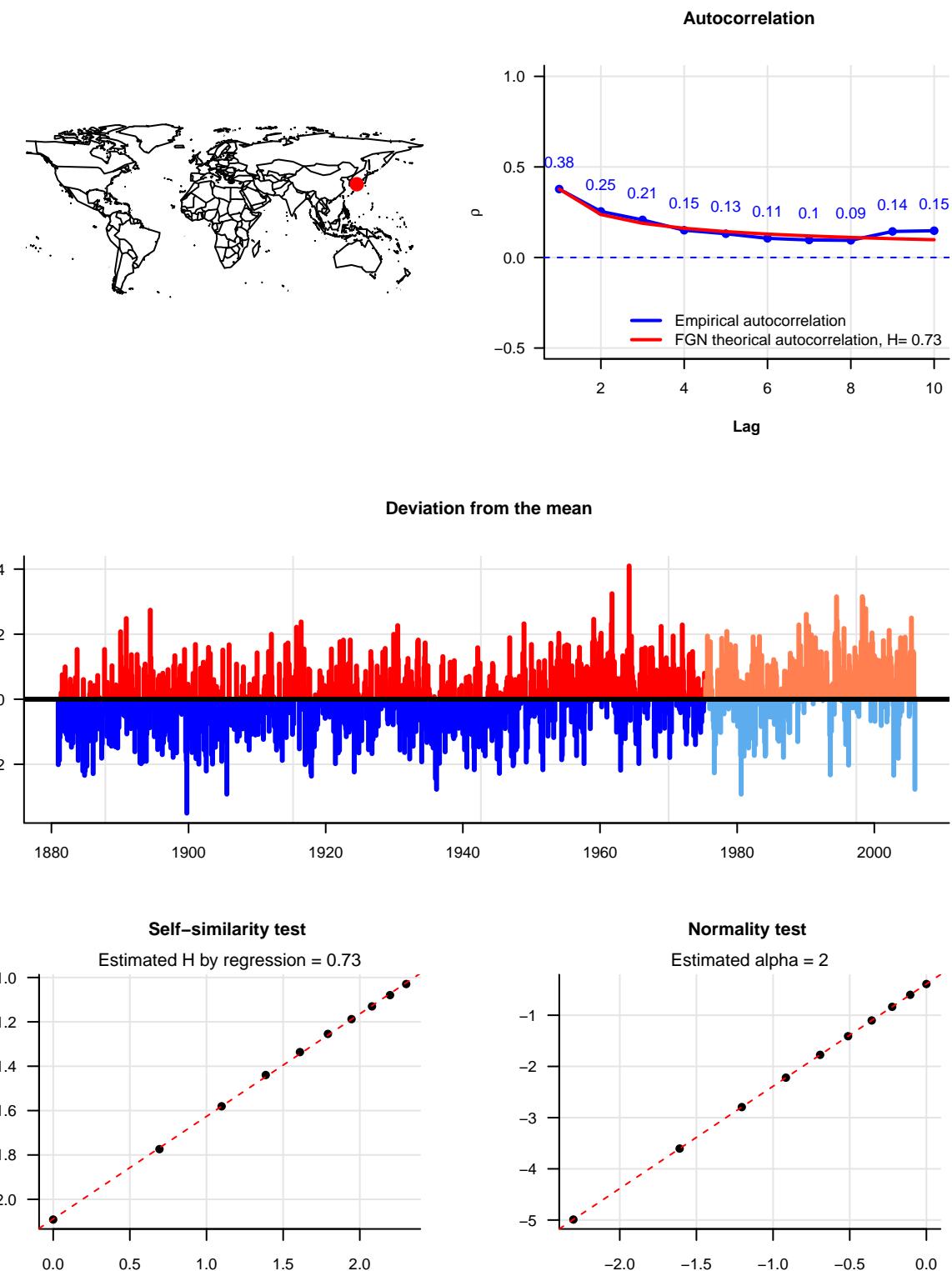


Normality test

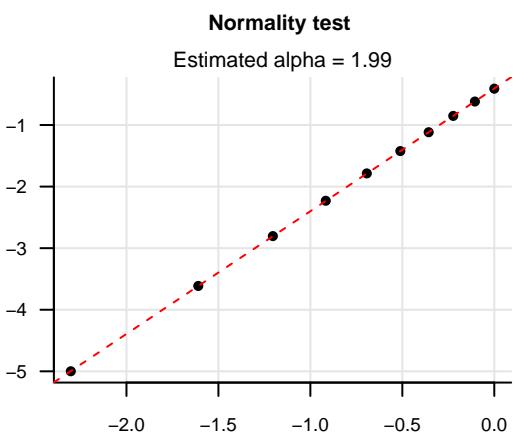
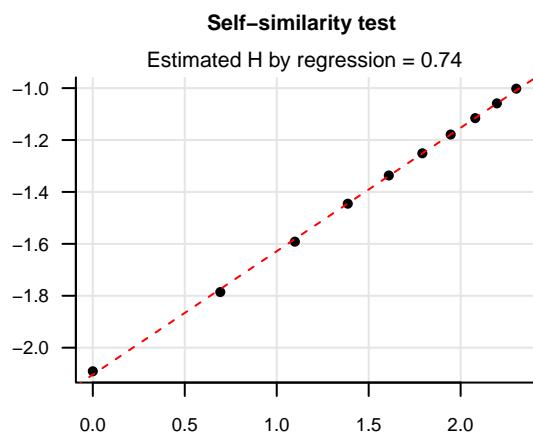
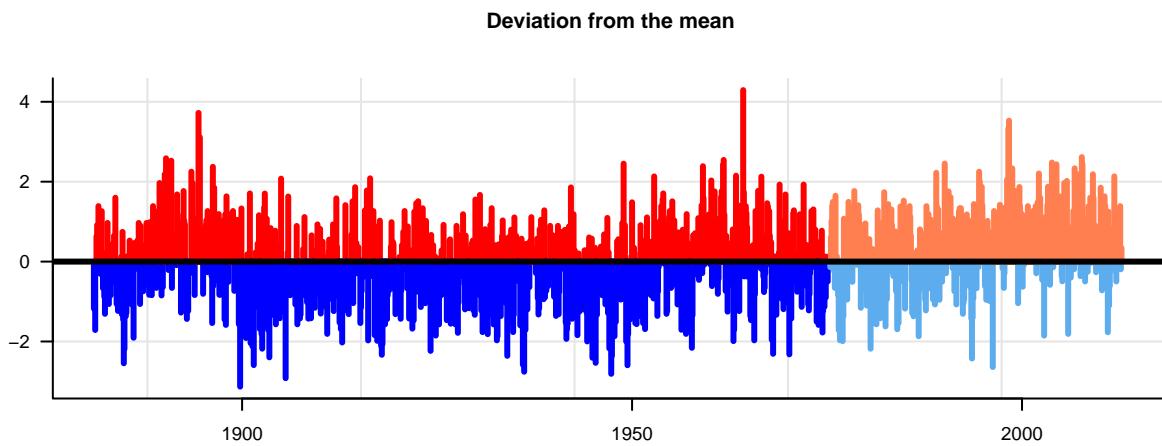
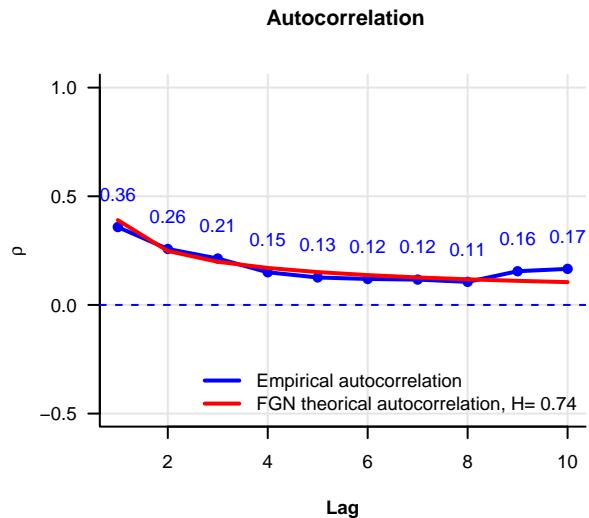
Estimated alpha = 1.98



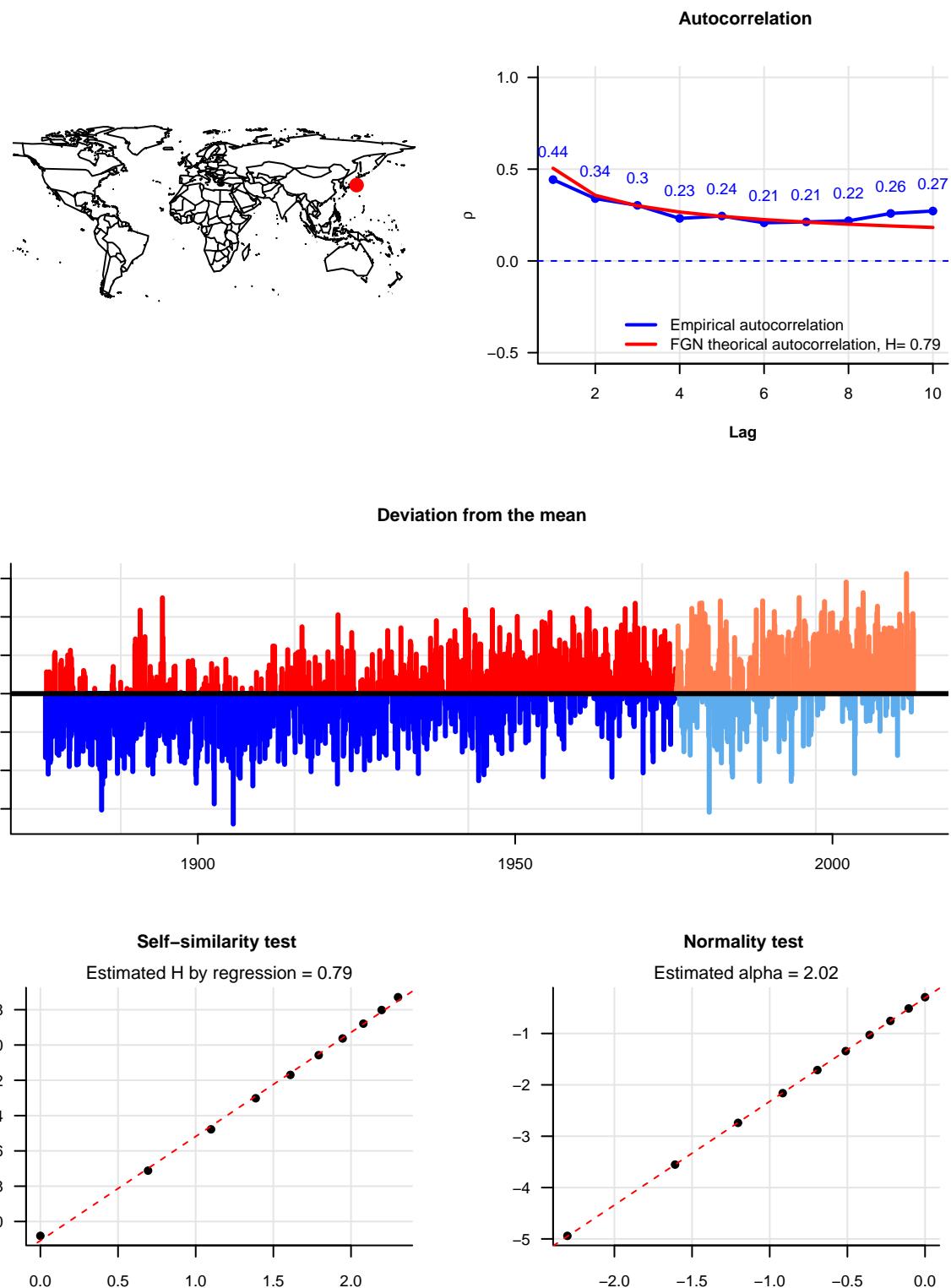
Japan, Hiroshima



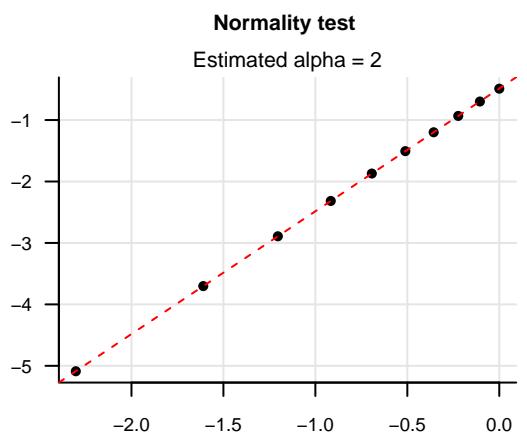
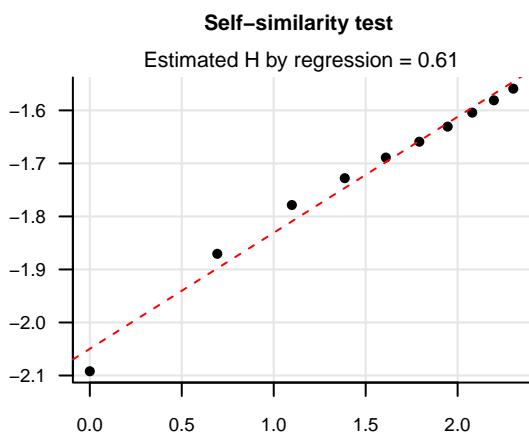
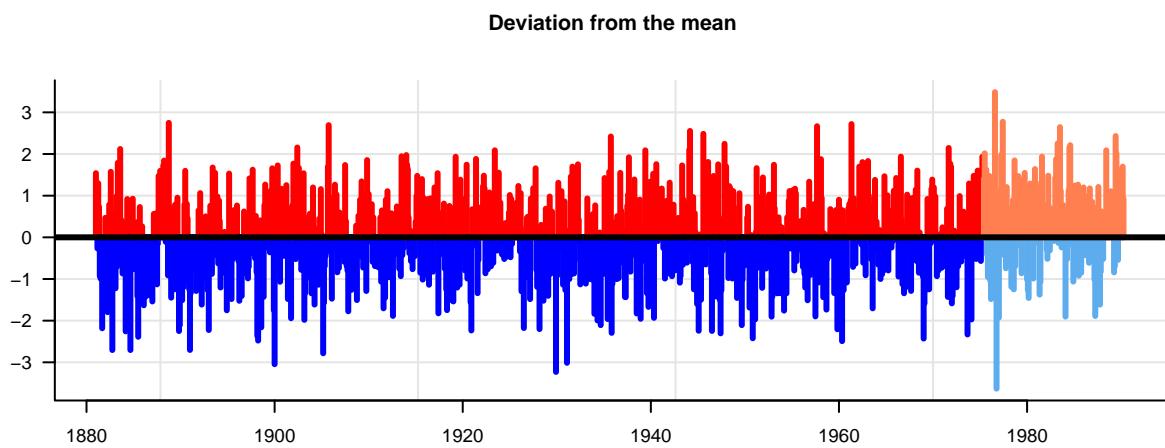
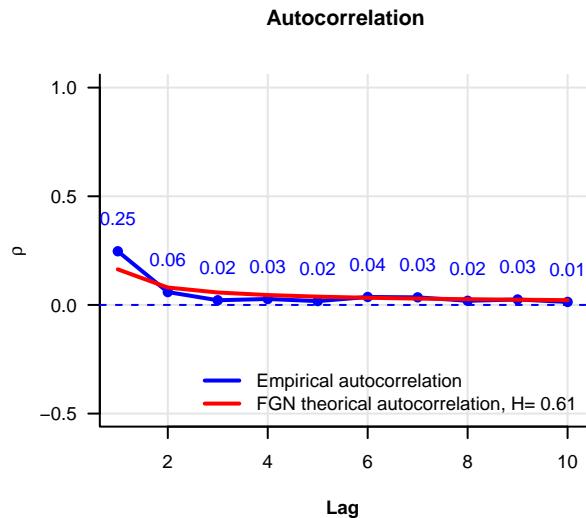
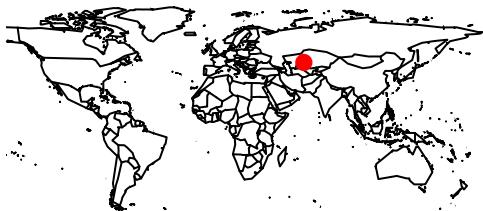
Japan, Nagasaki



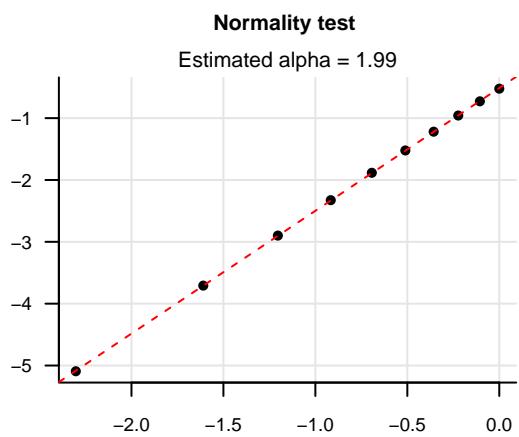
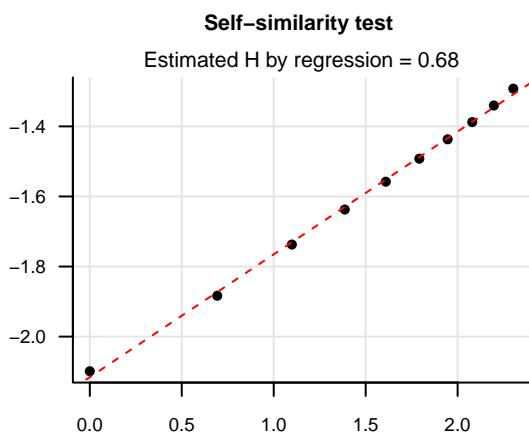
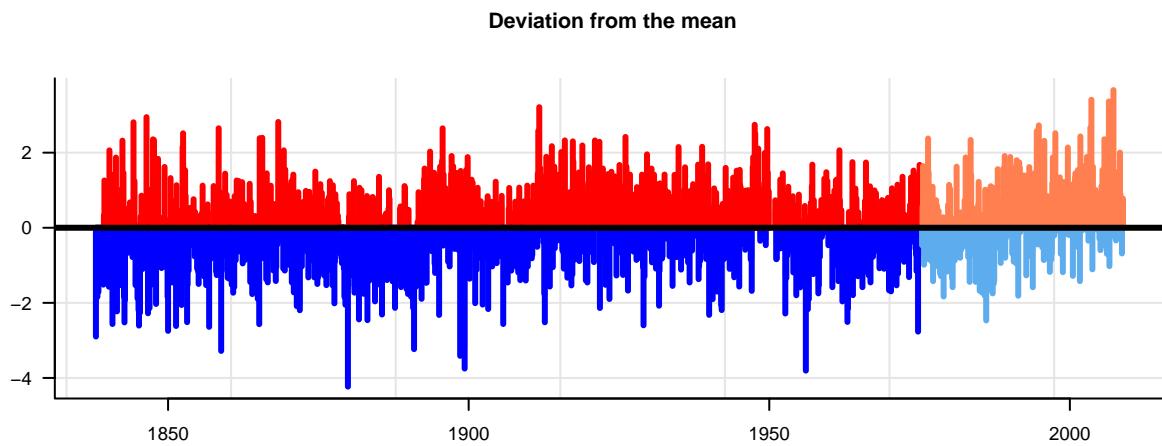
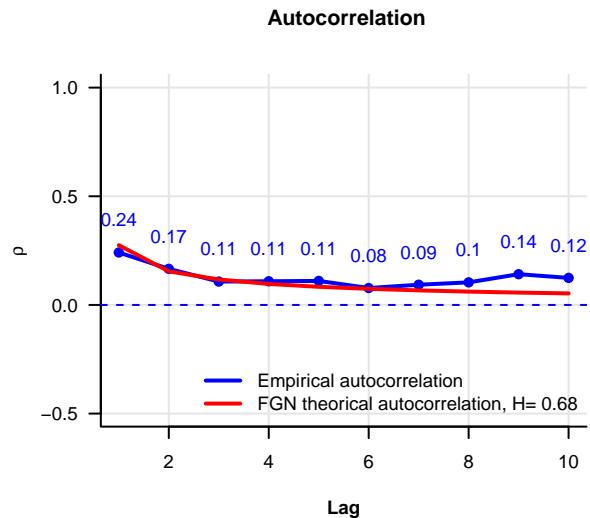
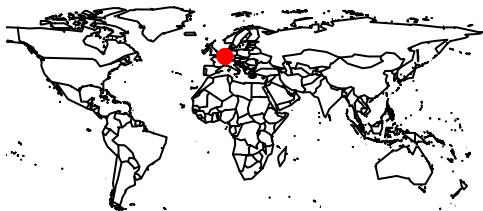
Japan, Tokyo



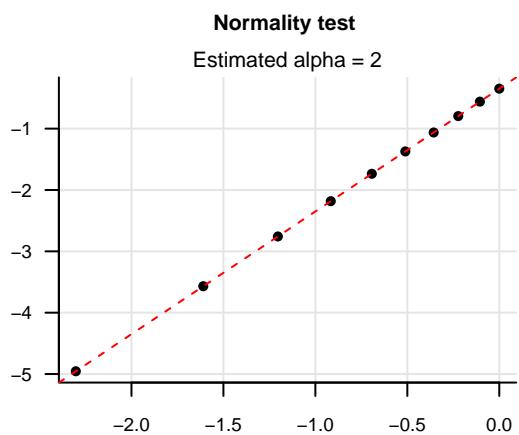
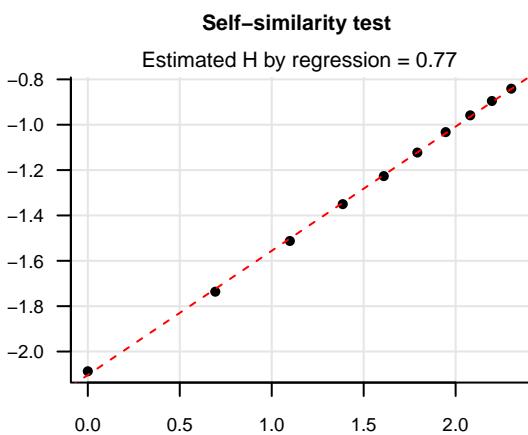
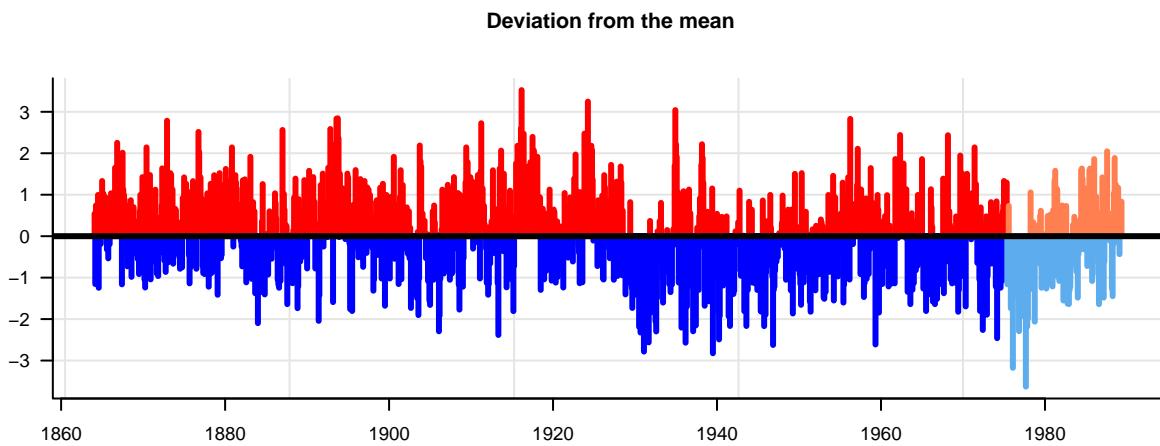
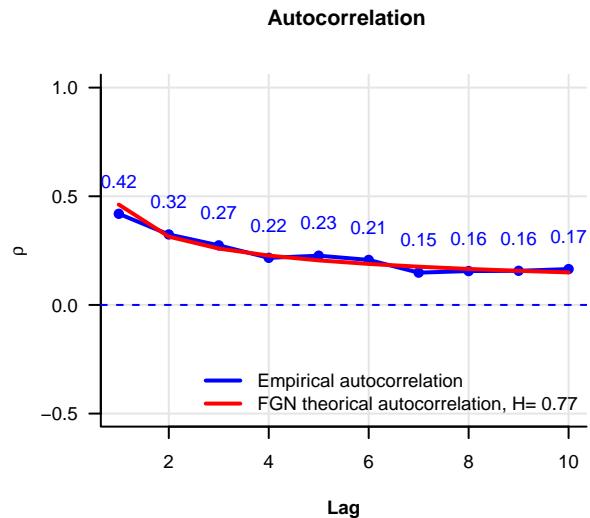
Kazakhstan, Kazalinsk



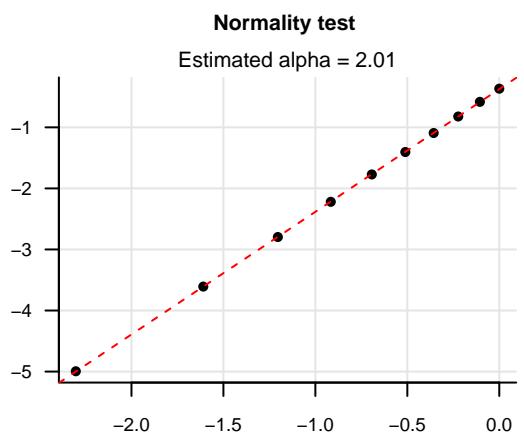
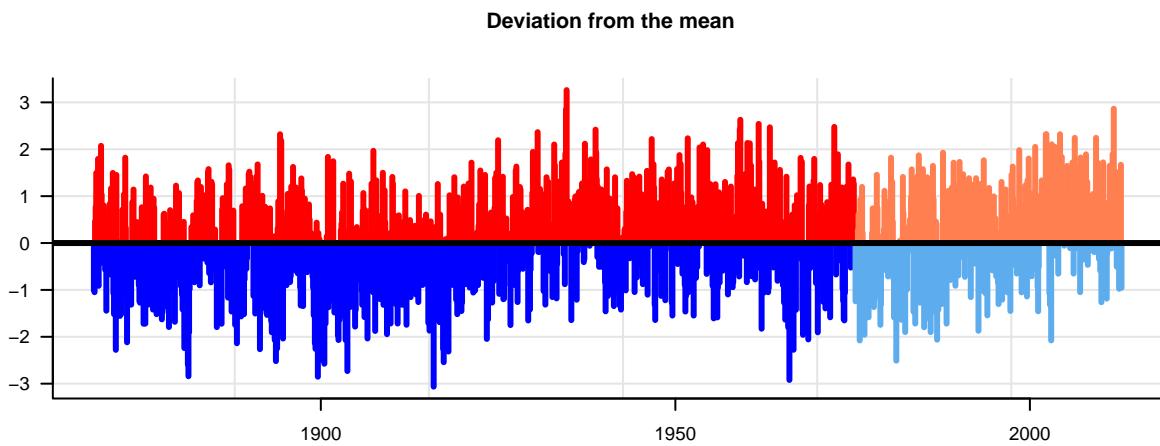
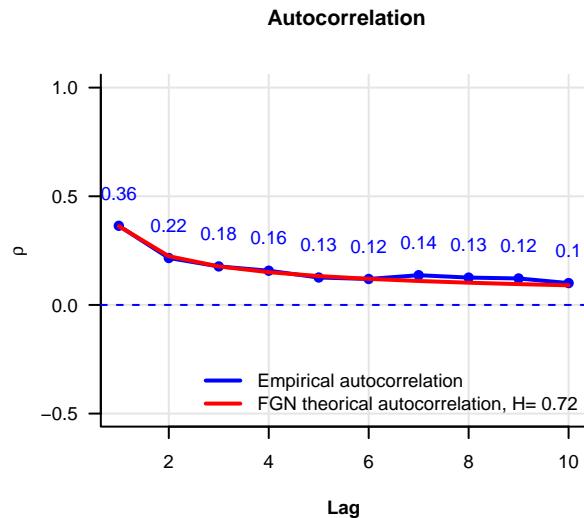
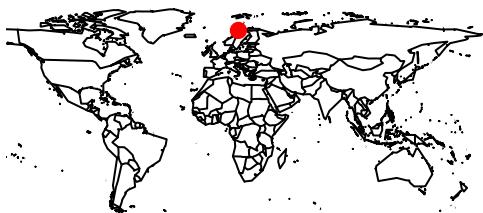
Luxembourg, Luxembourg



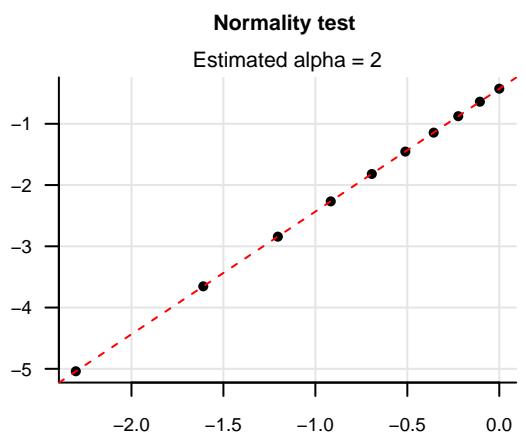
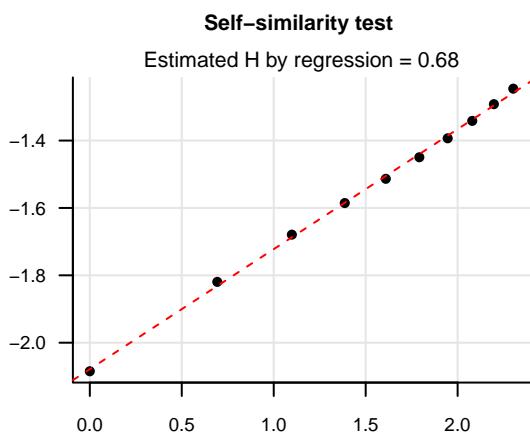
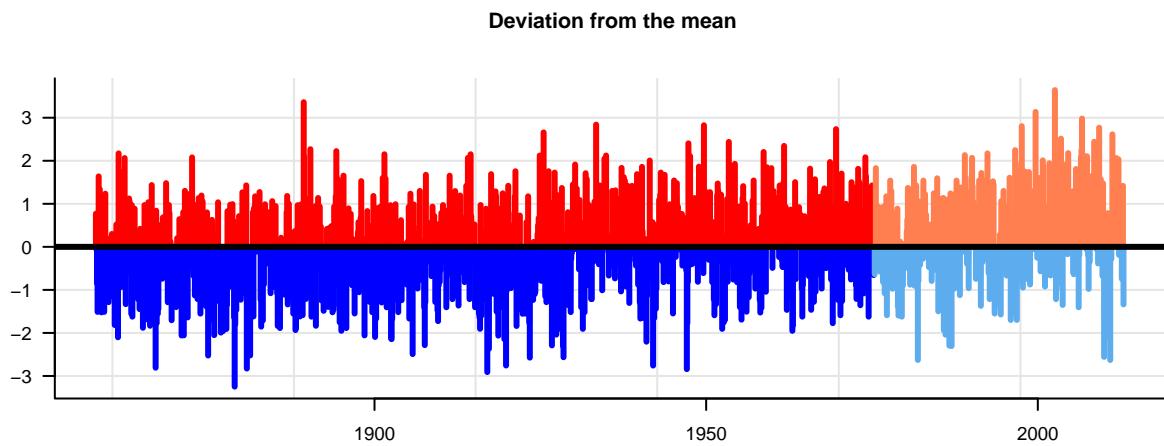
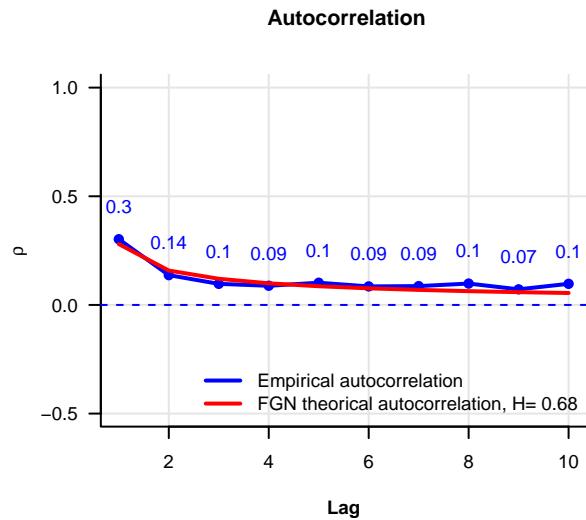
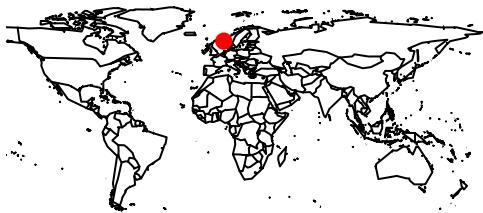
New Zealand, Wellington



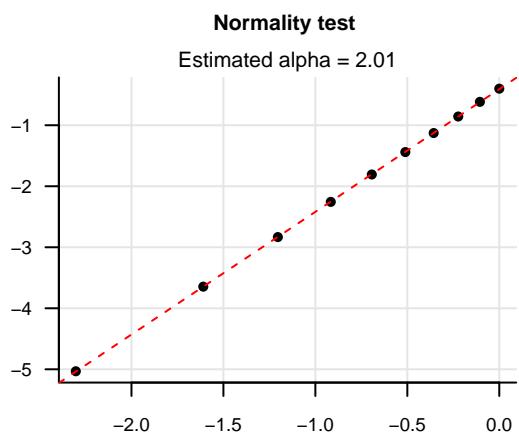
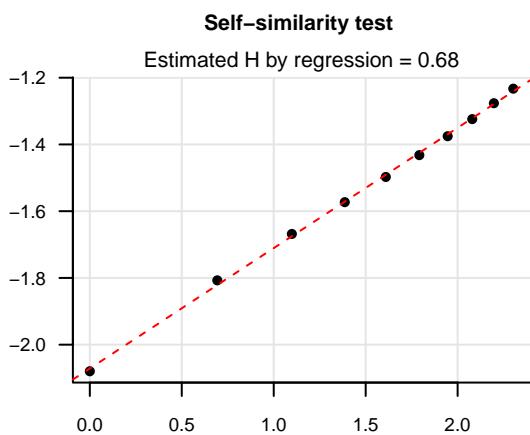
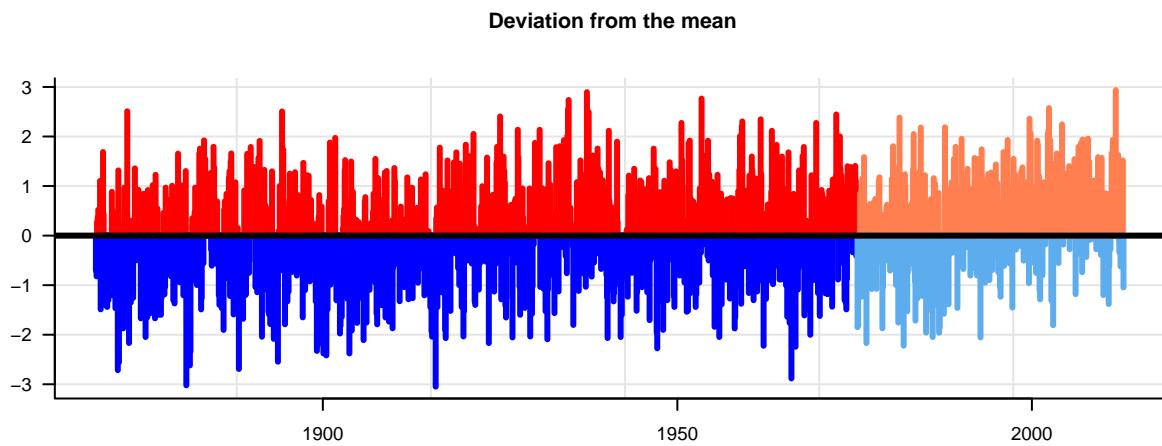
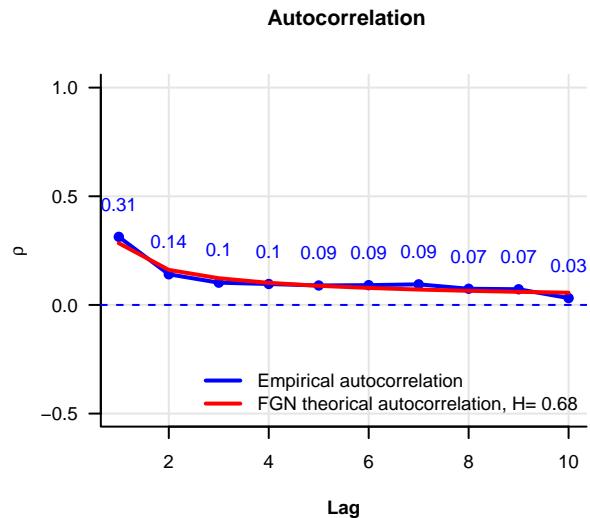
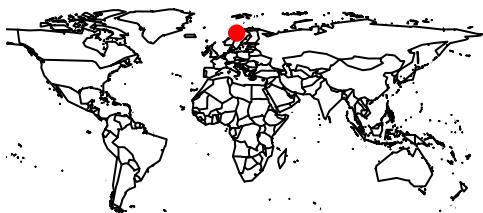
Norway, Andoya



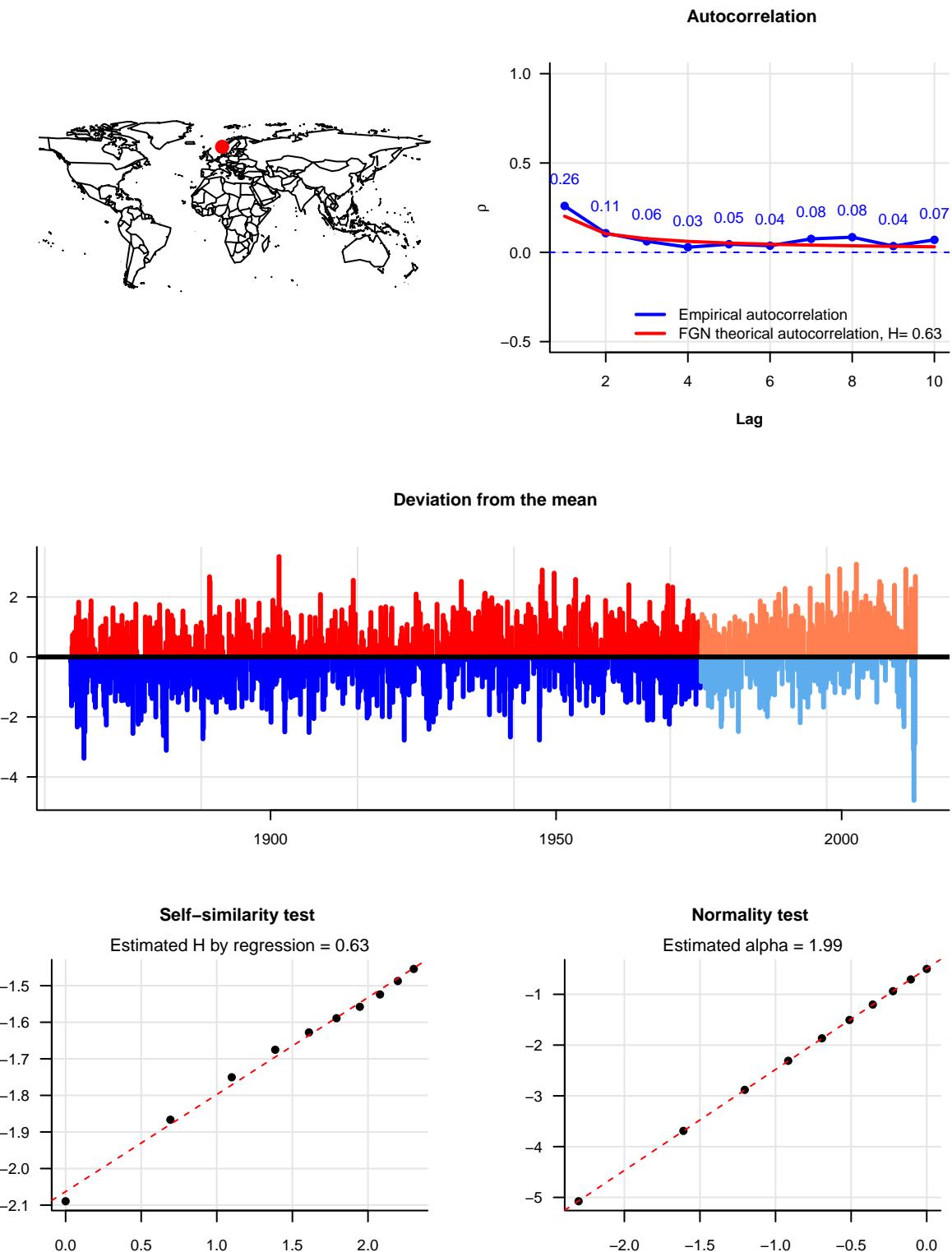
Norway, Bergen



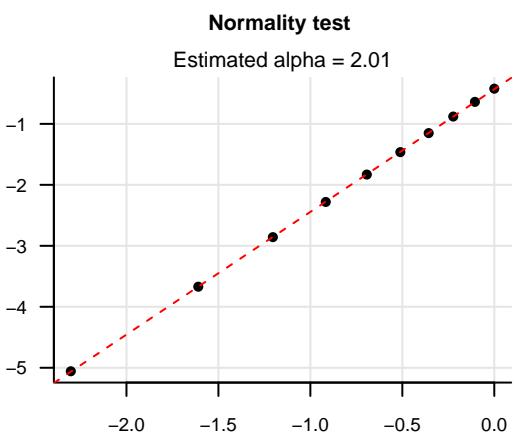
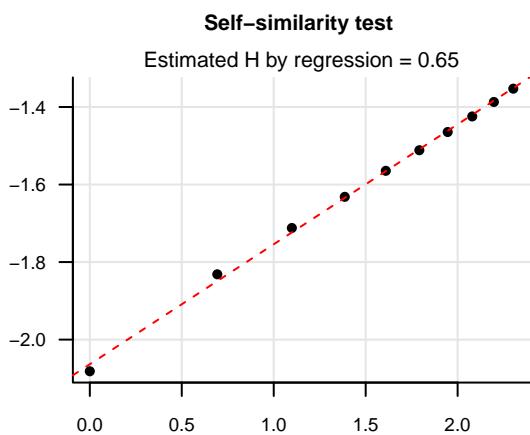
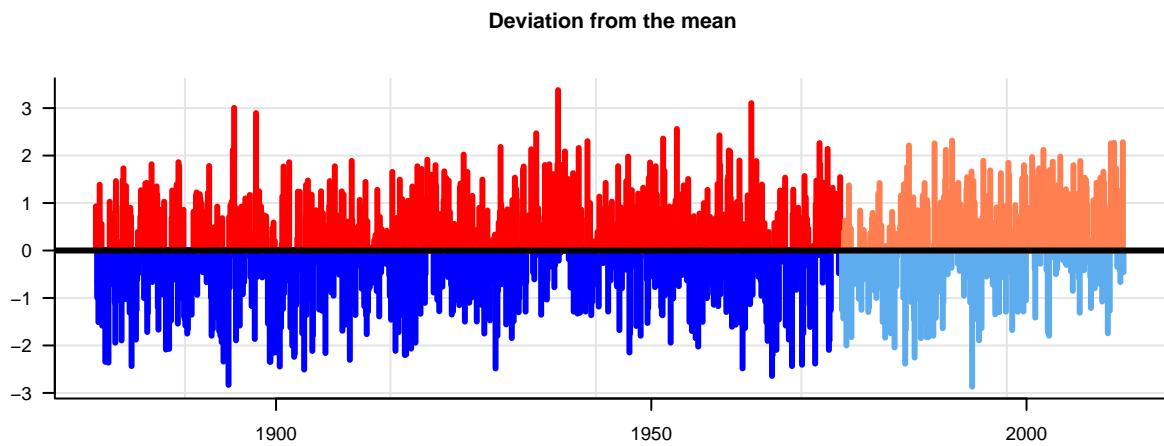
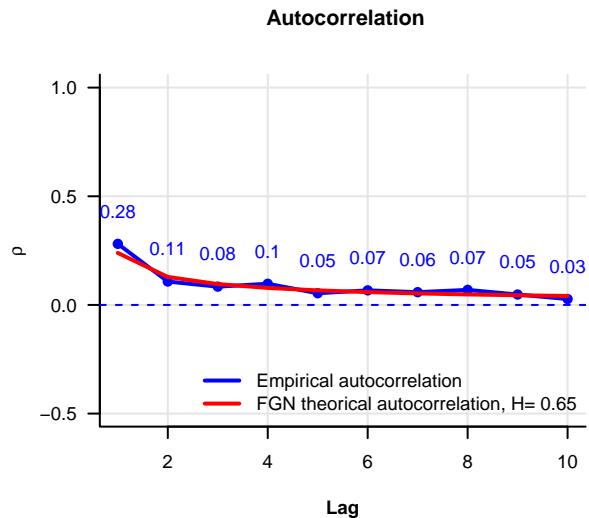
Norway, Bodo



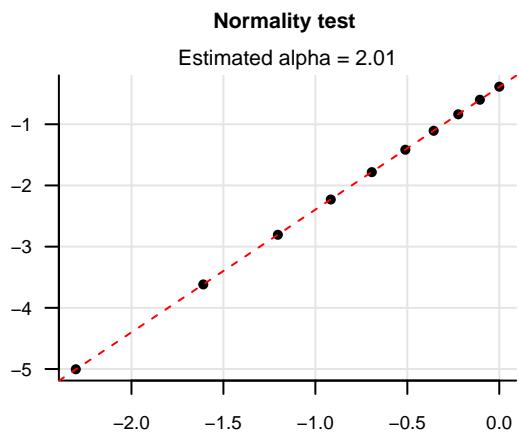
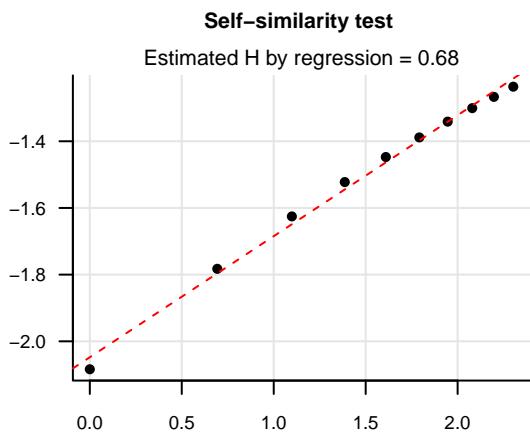
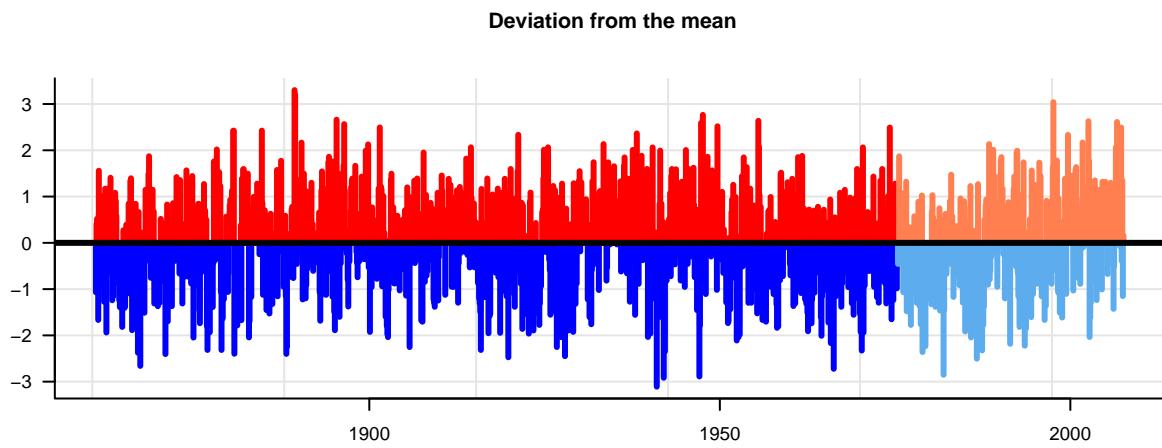
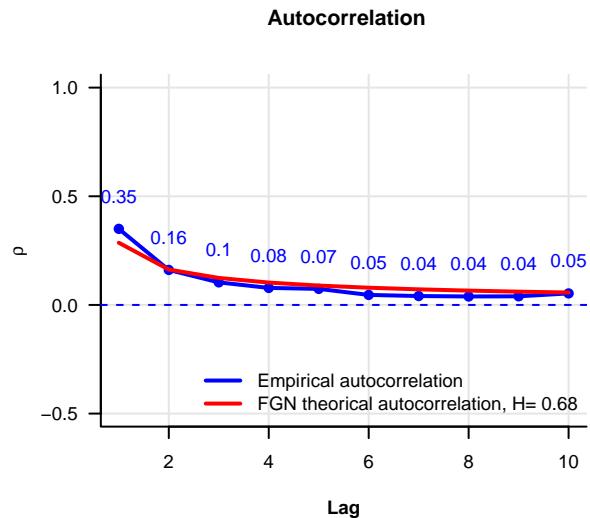
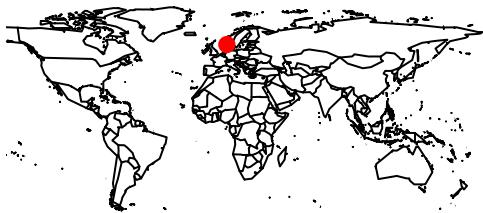
Norway, Dombas



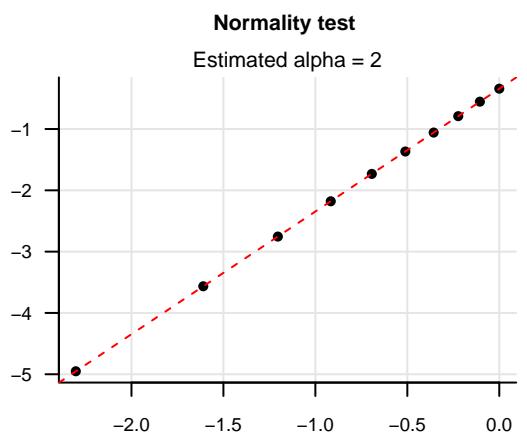
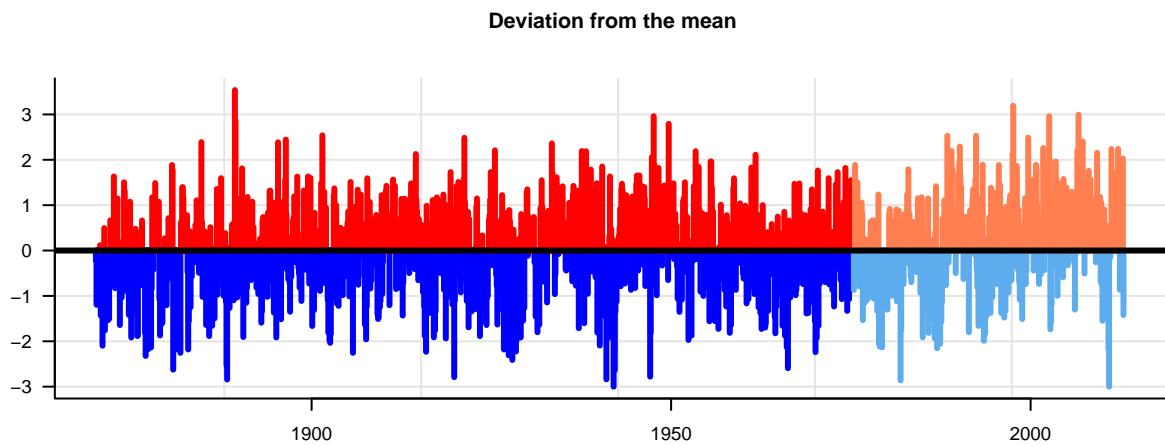
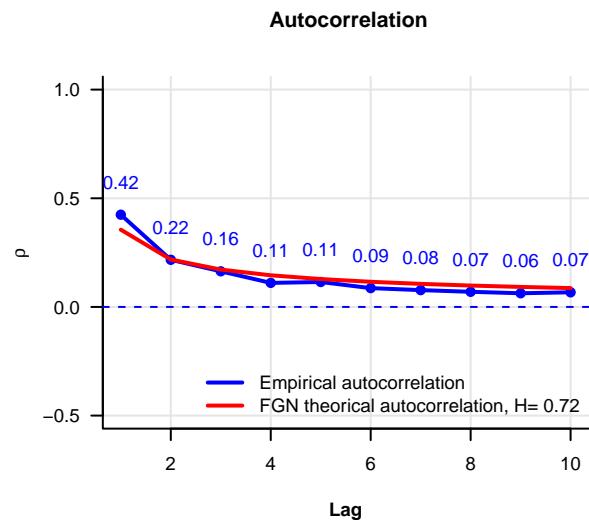
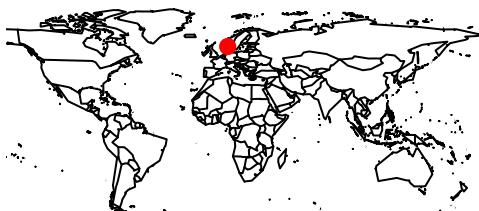
Norway, Karasjok



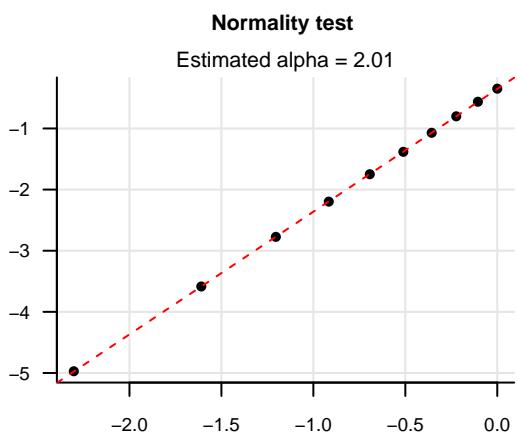
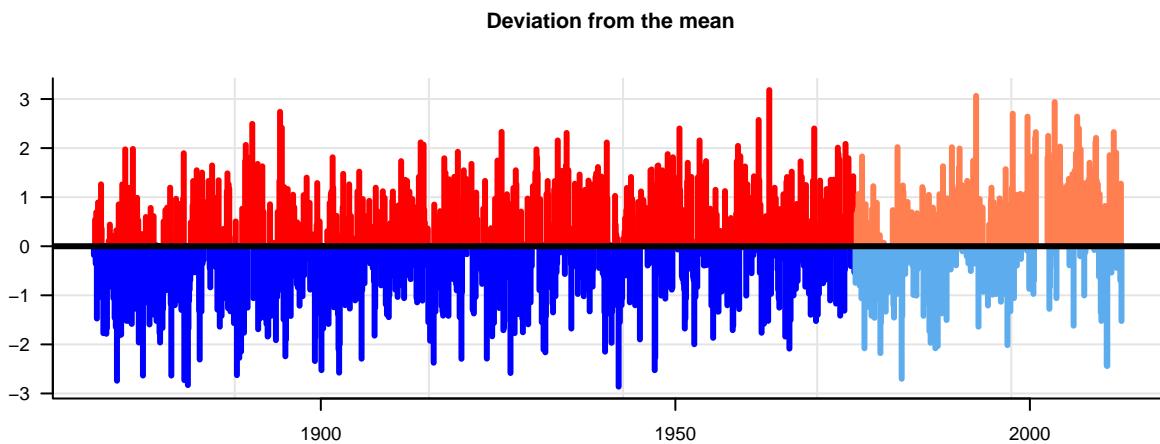
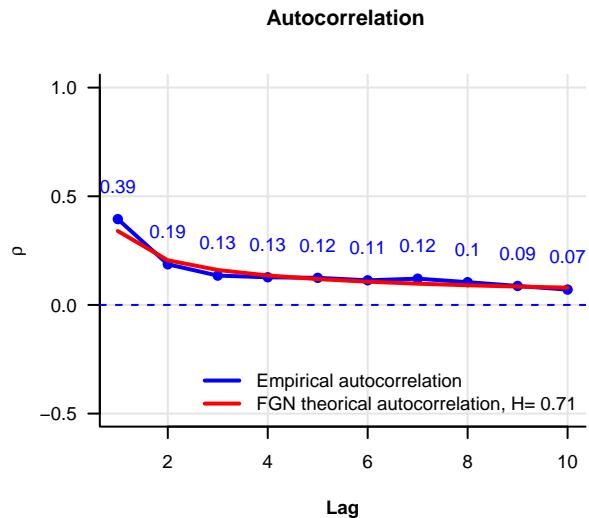
Norway, Mandal



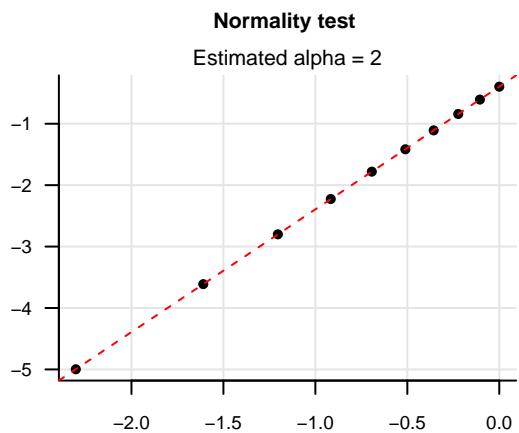
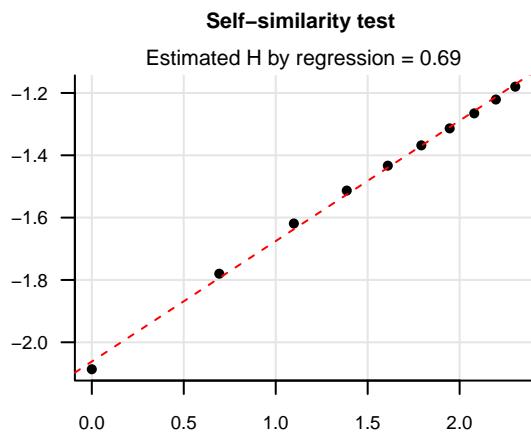
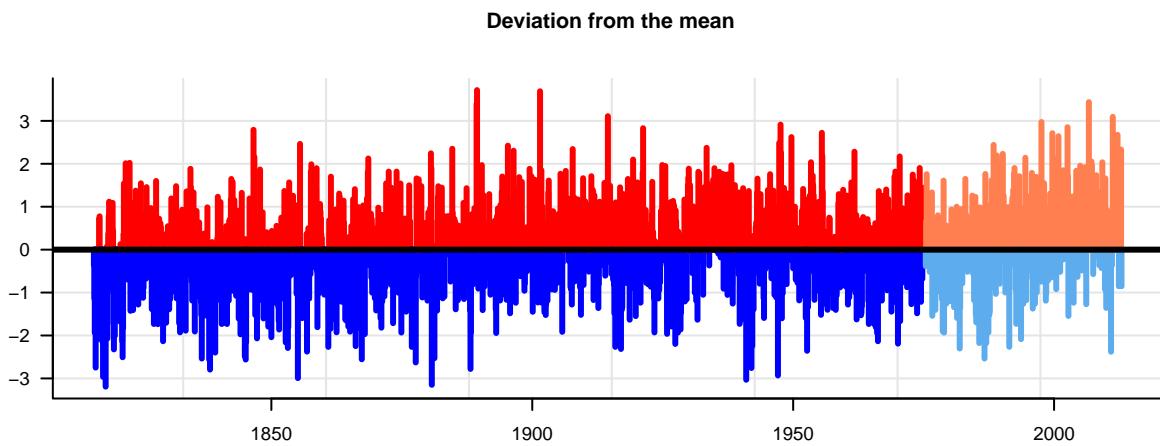
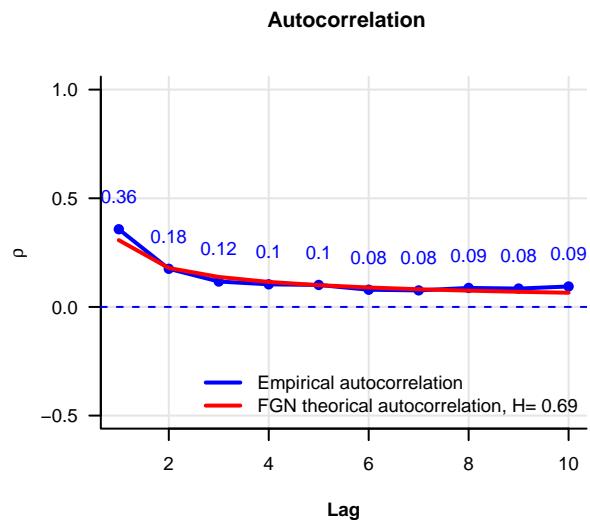
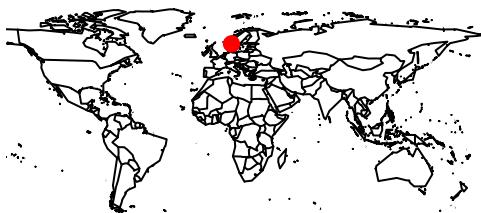
Norway, Oksoy Lighthouse



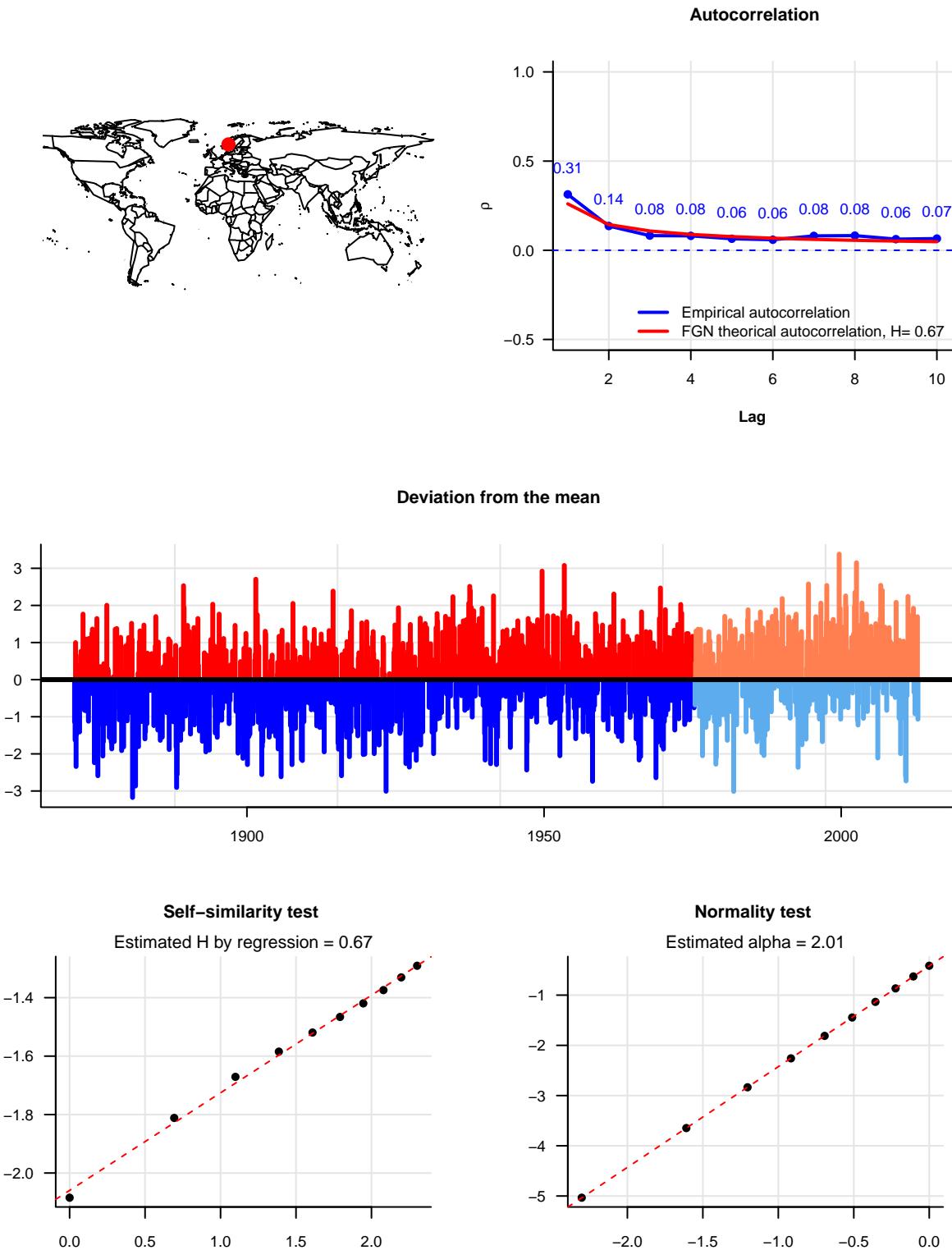
Norway, Ona



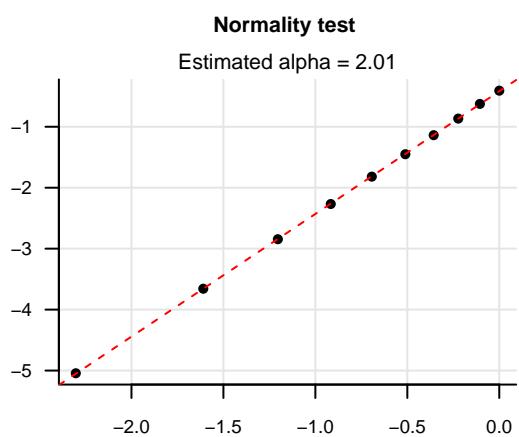
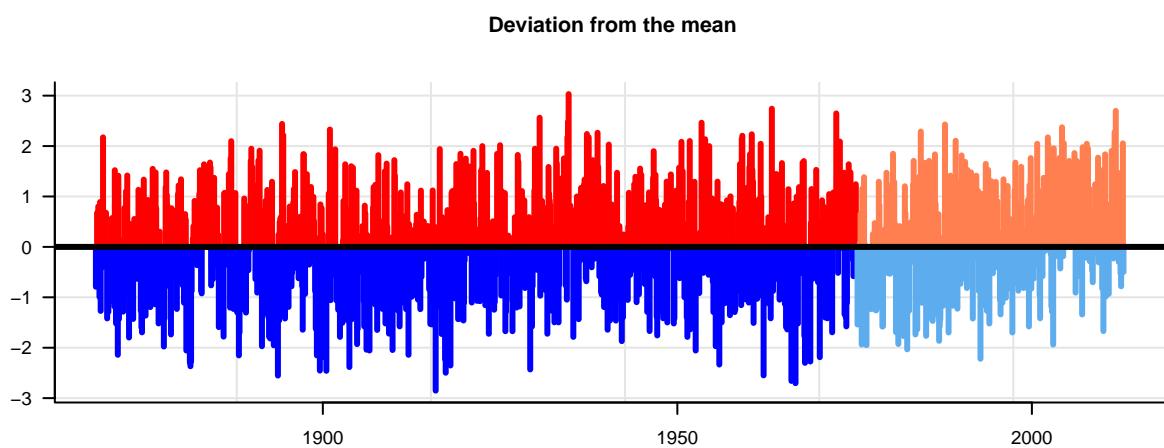
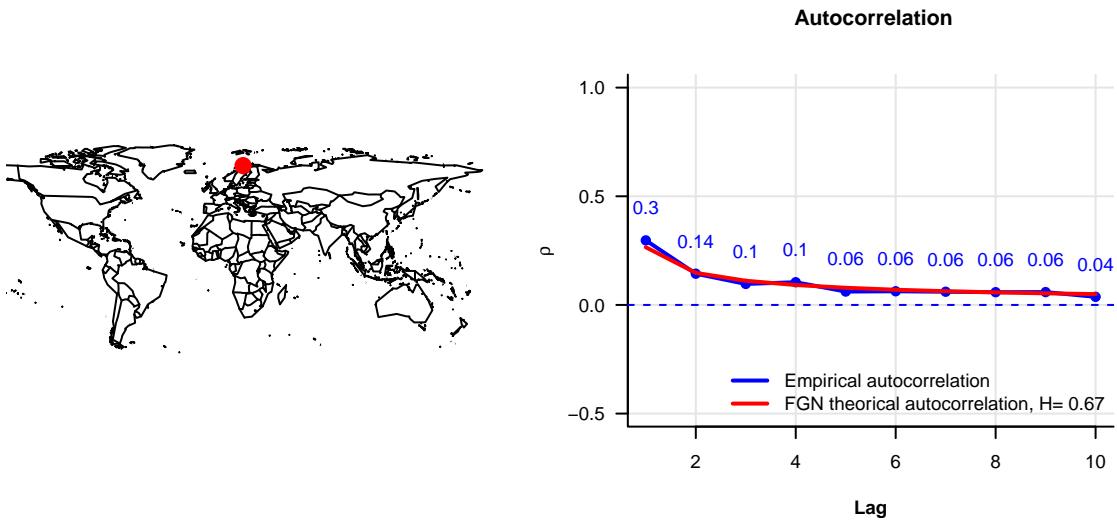
Norway, Oslo



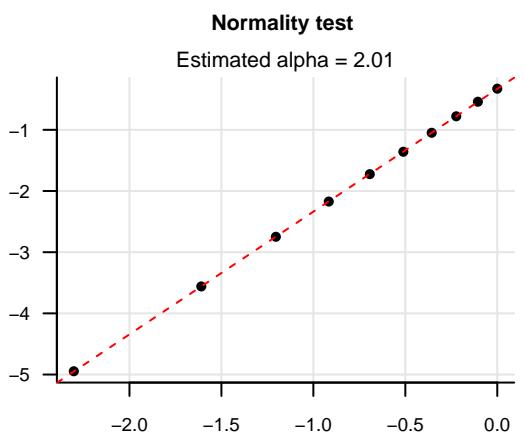
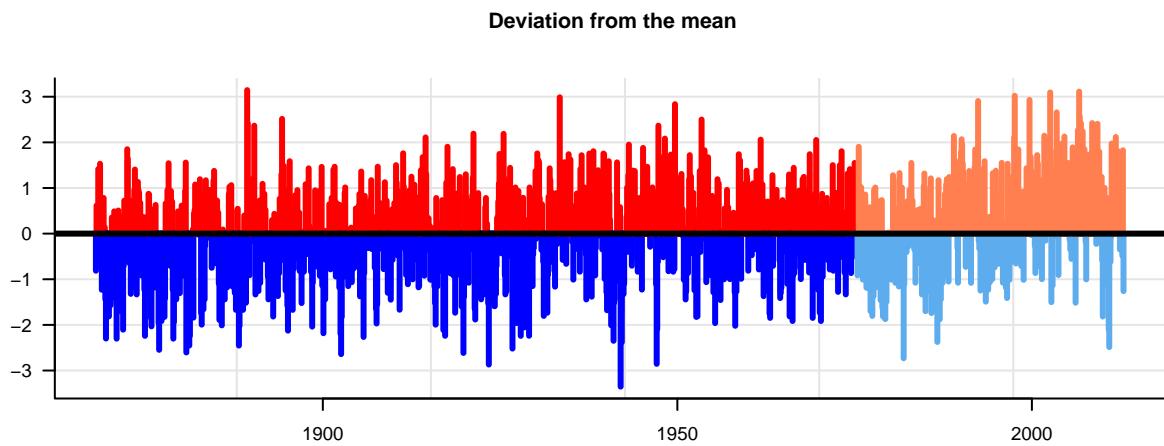
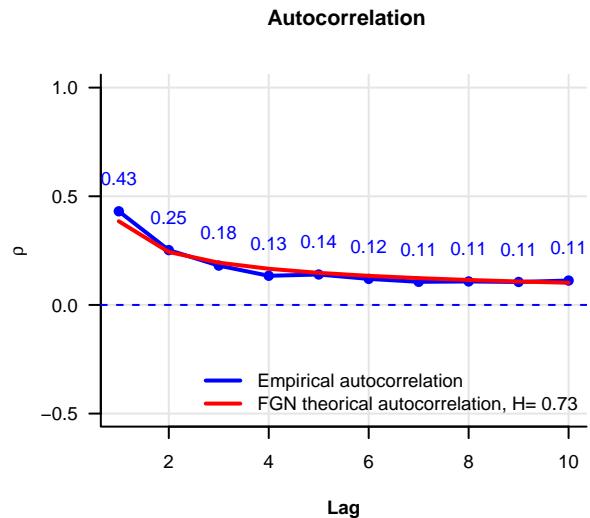
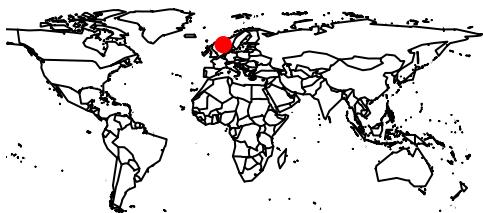
Norway, Roros



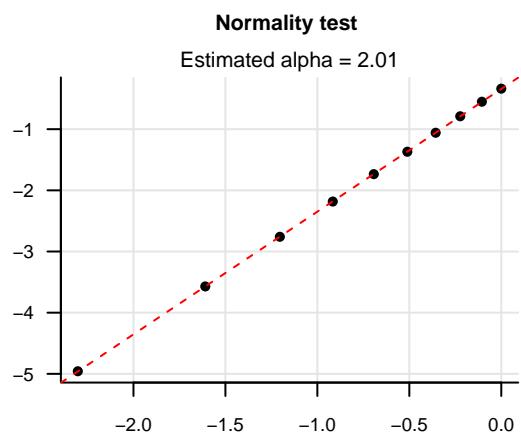
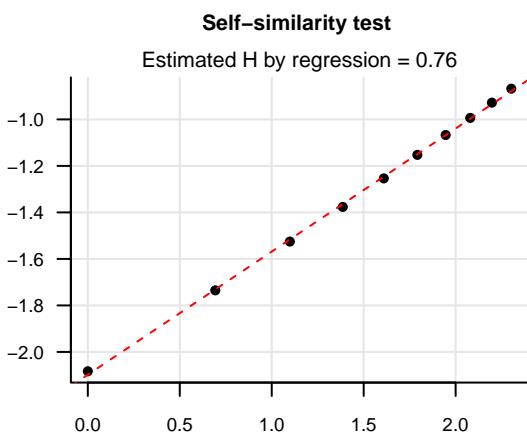
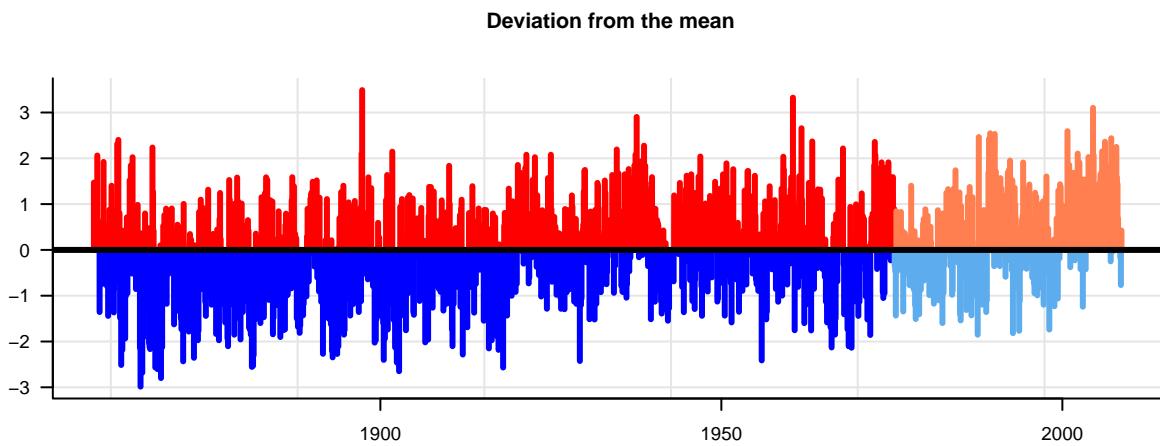
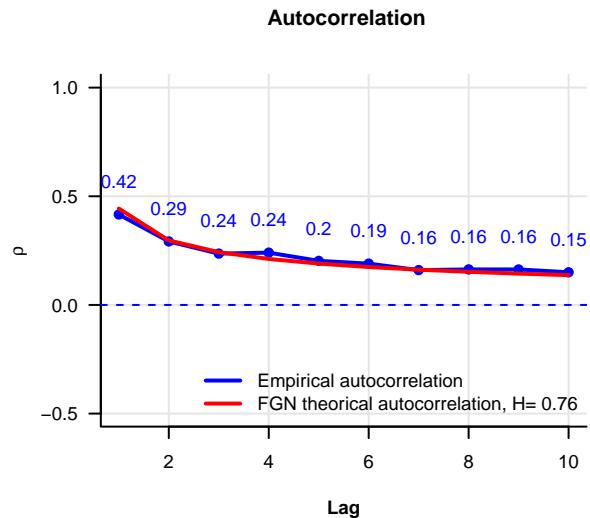
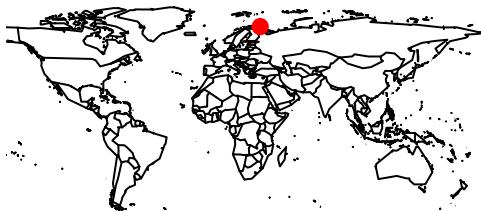
Norway, Tromso



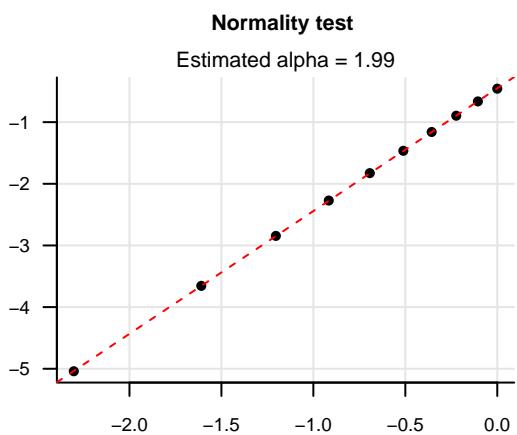
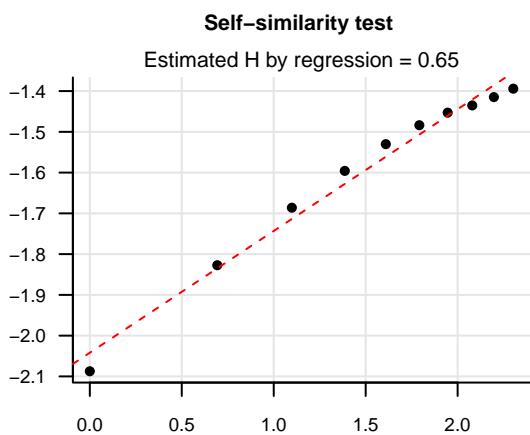
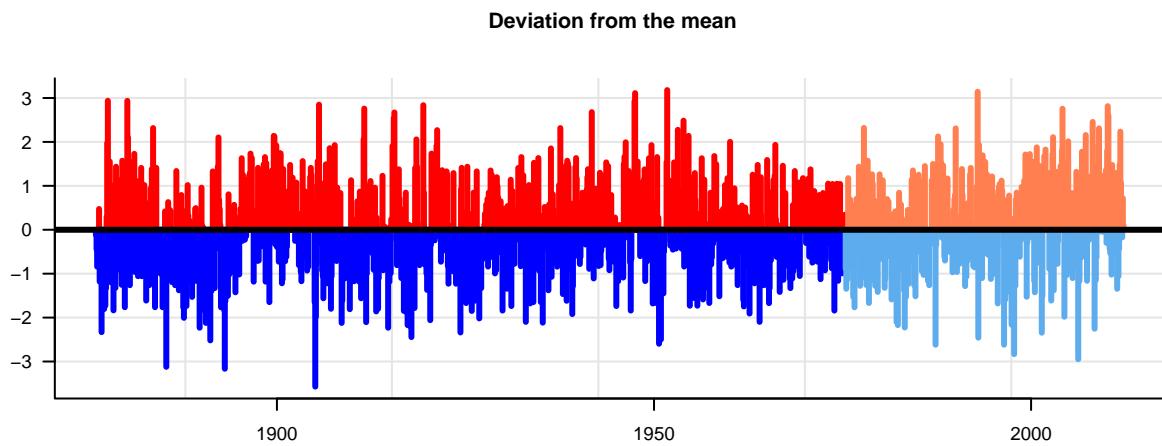
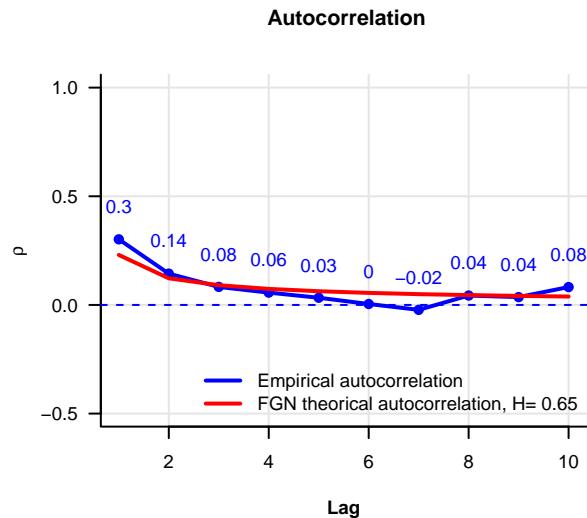
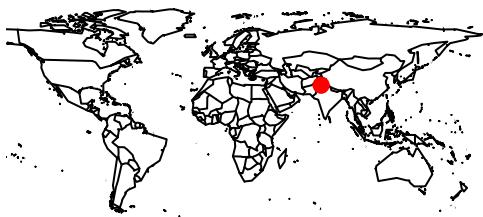
Norway, Utsira



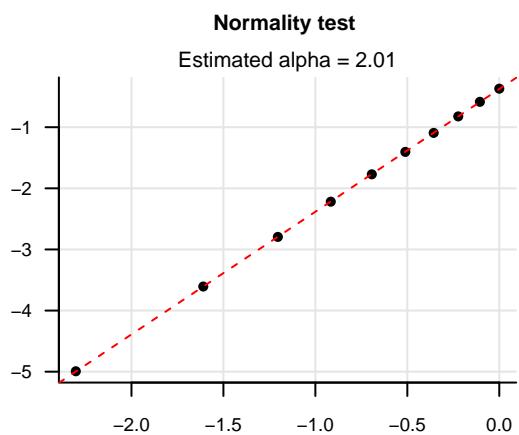
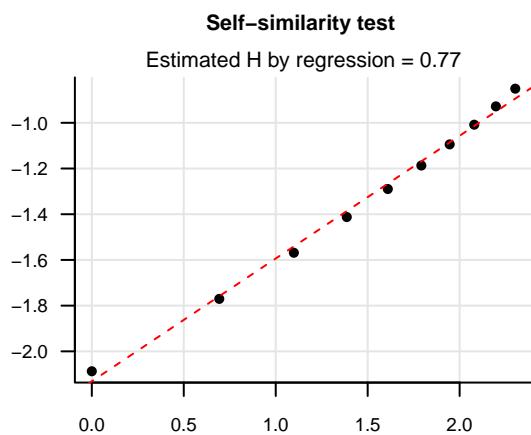
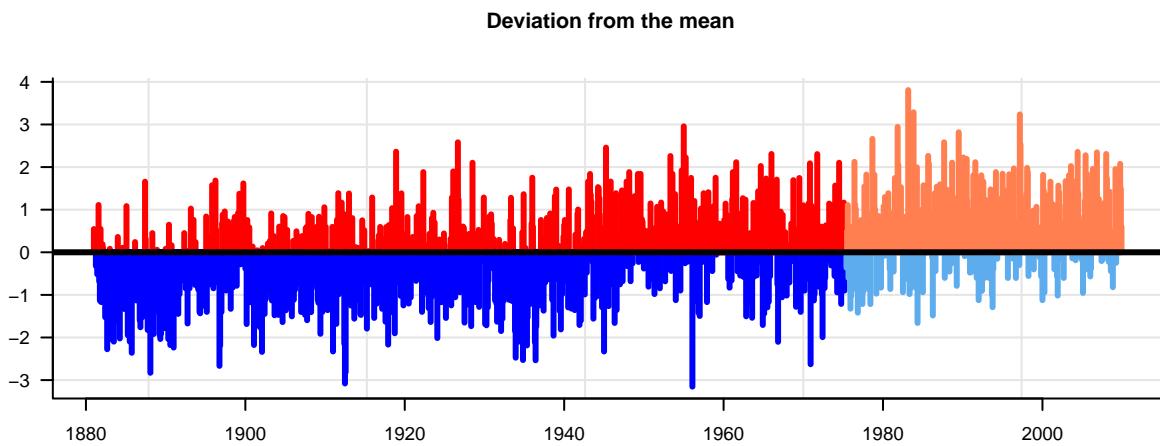
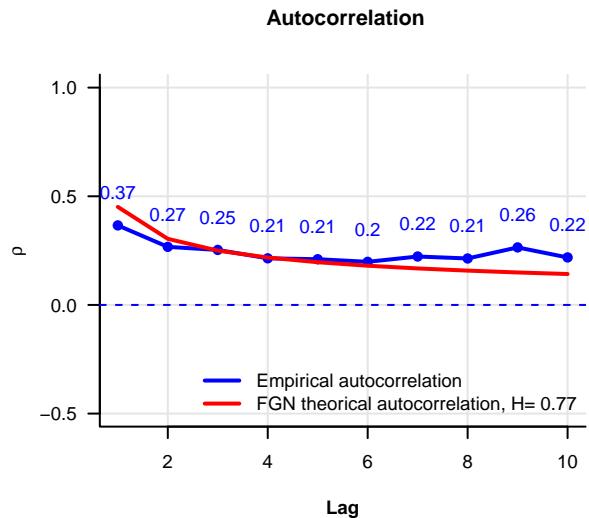
Norway, Vardo



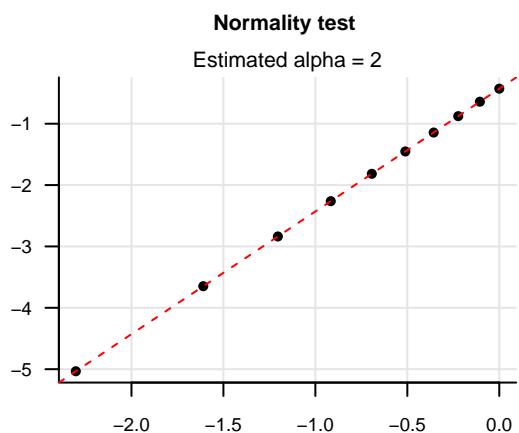
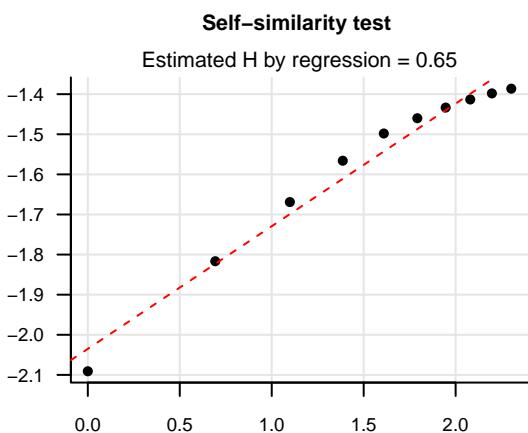
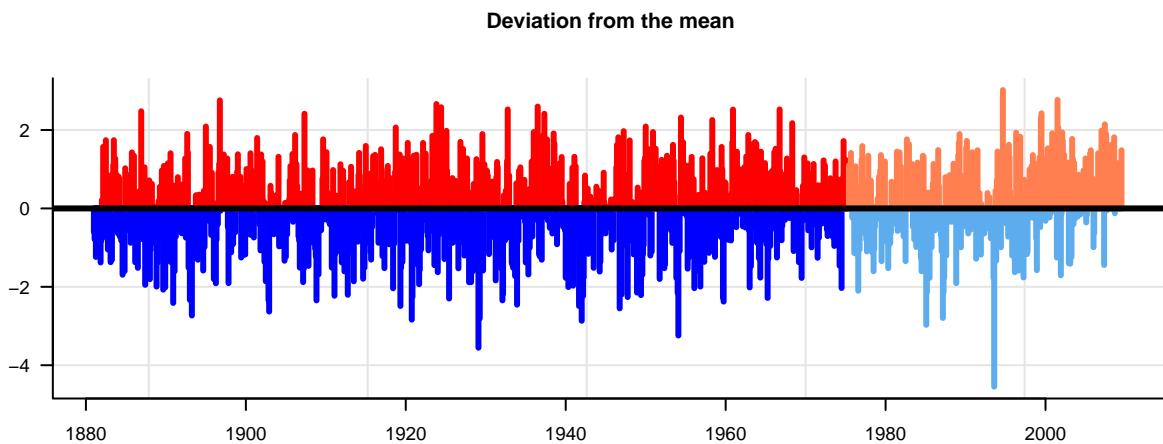
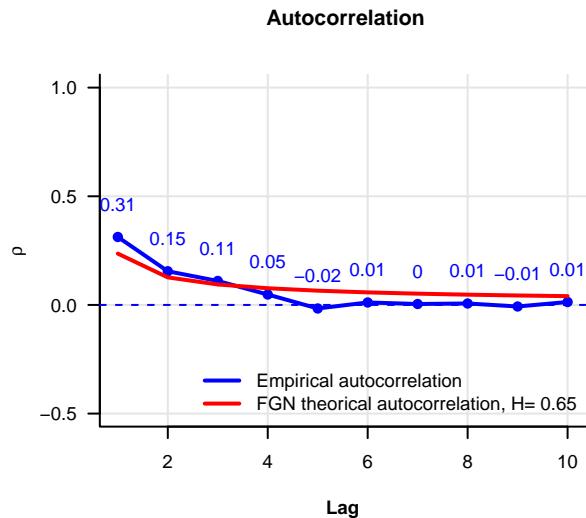
Pakistan, Lahore



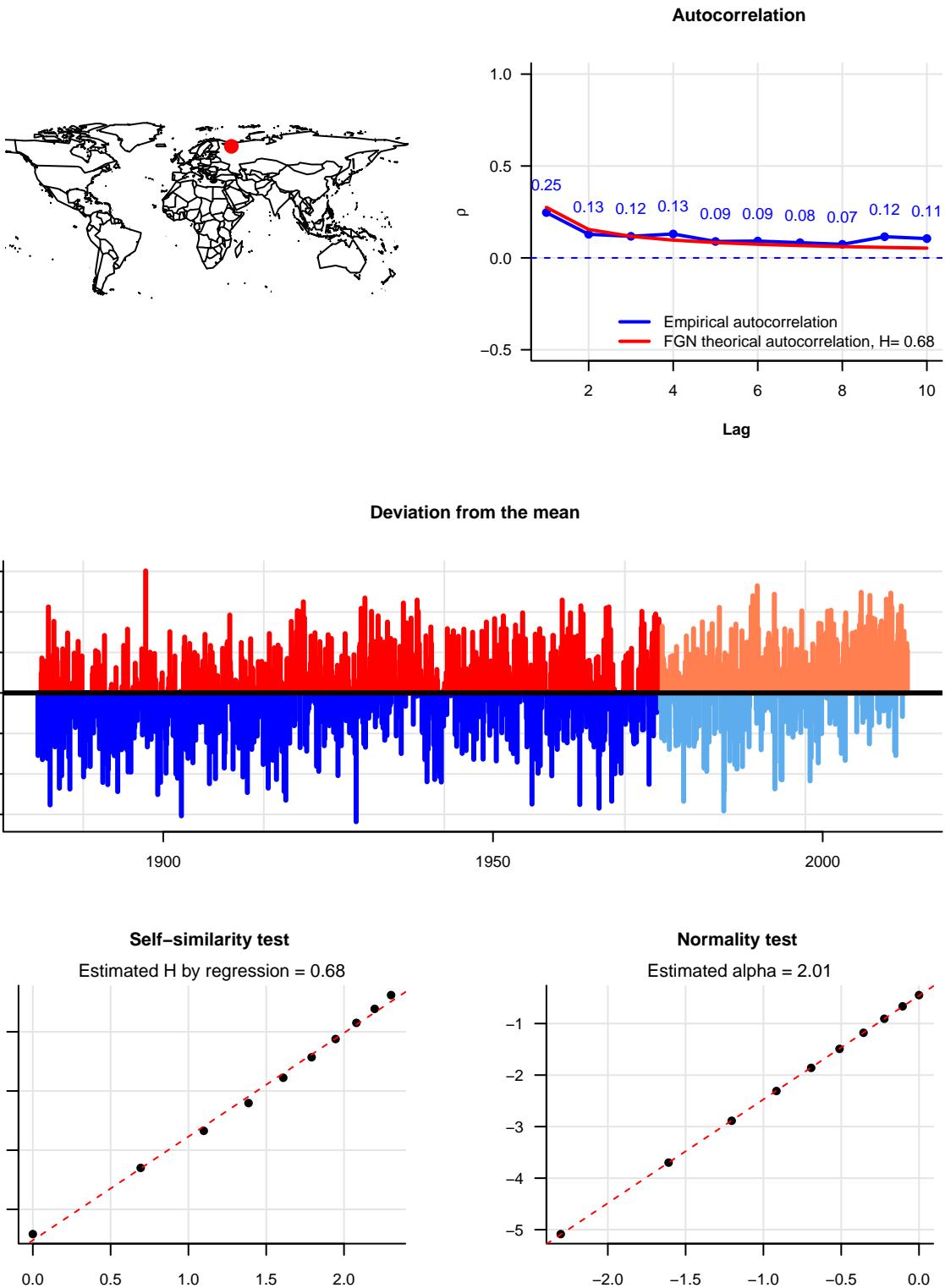
Portugal, Lisbon



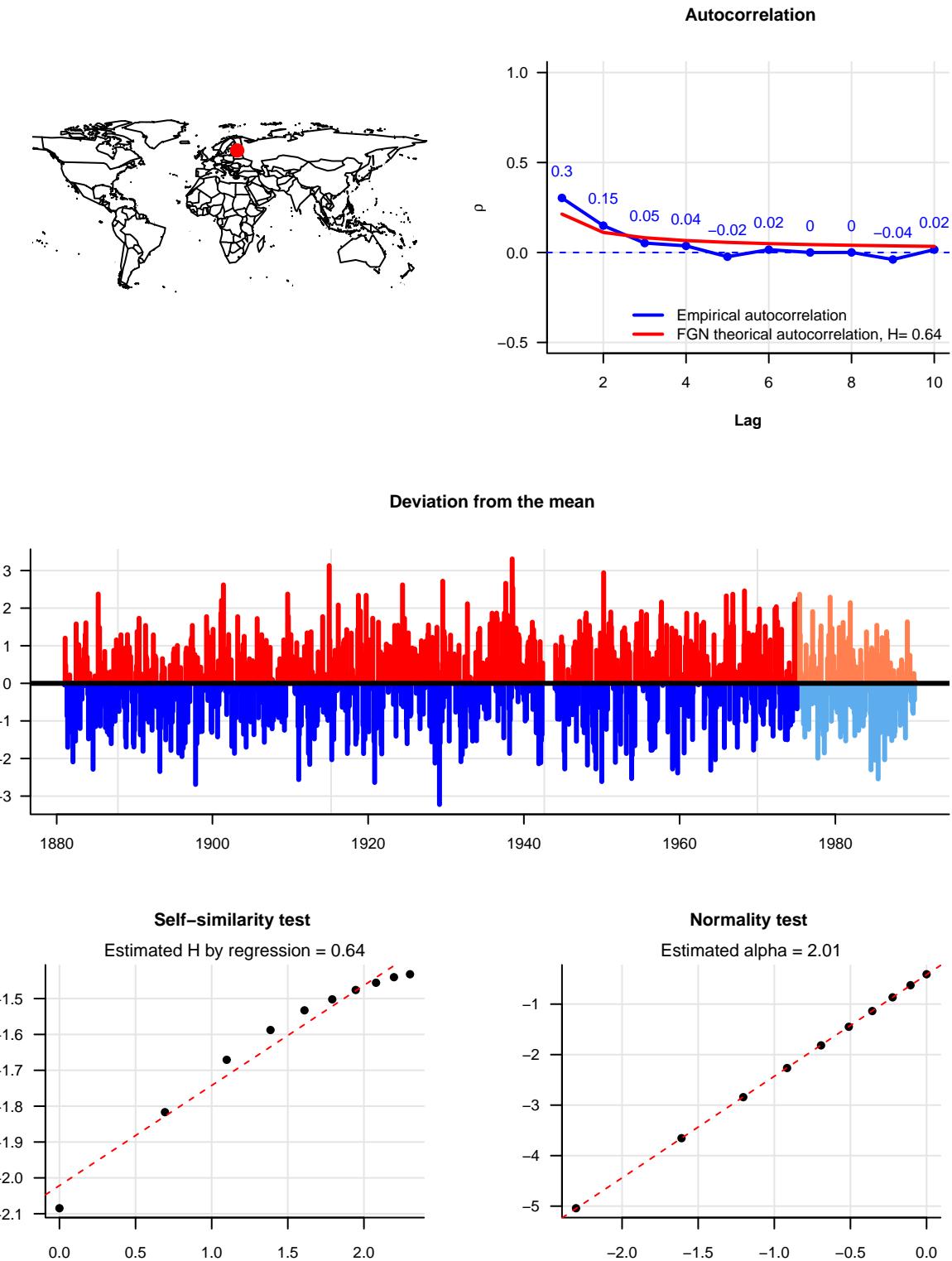
Romania, Sulina



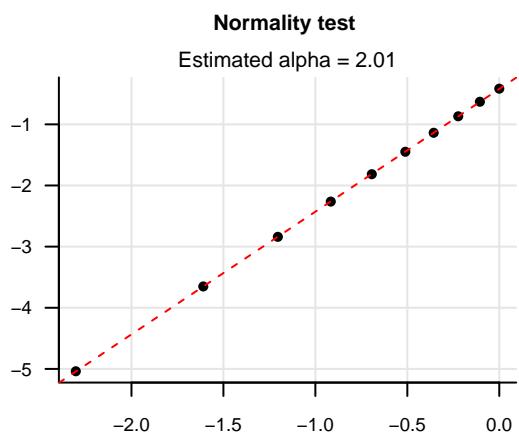
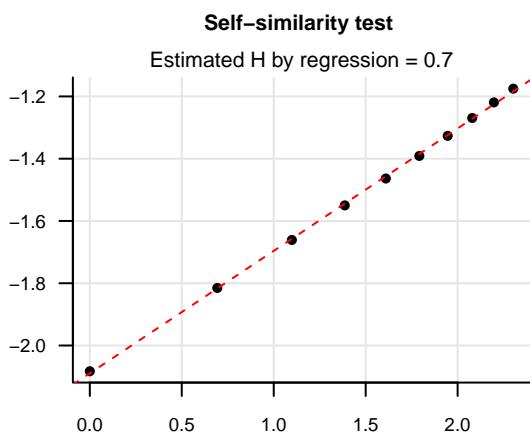
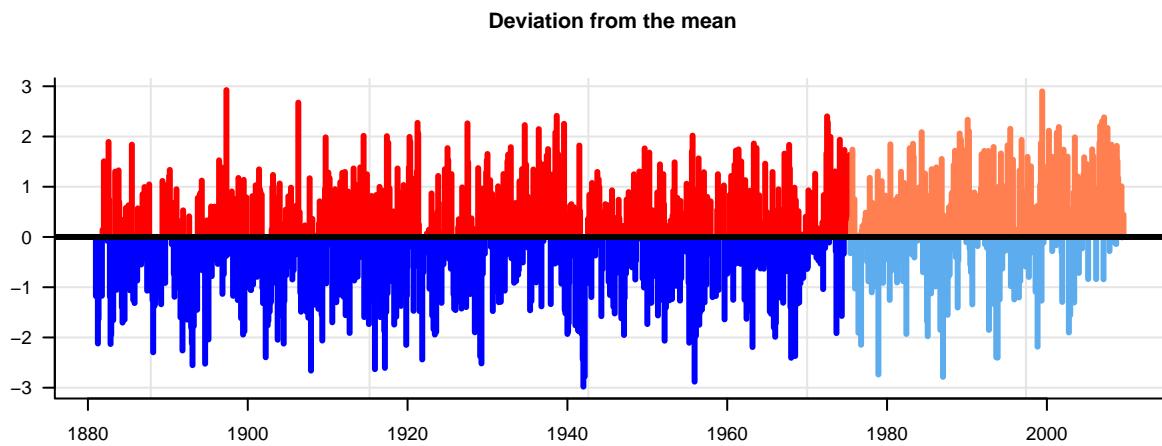
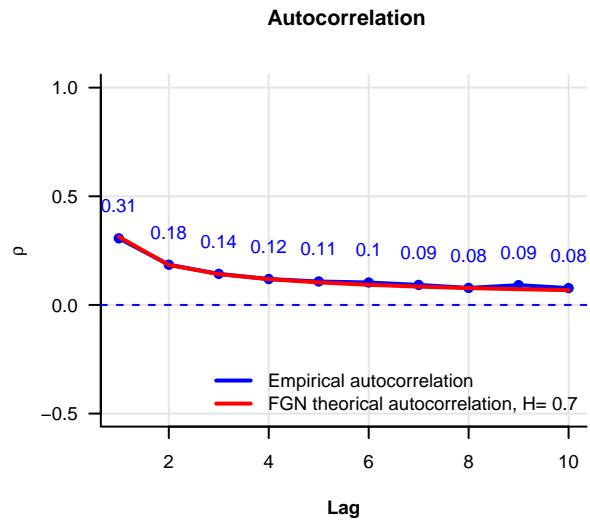
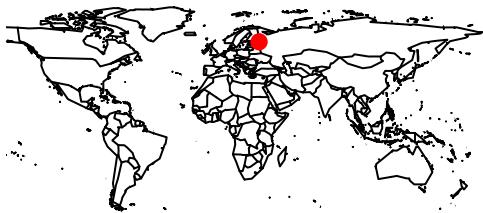
Russia, Archangelsk



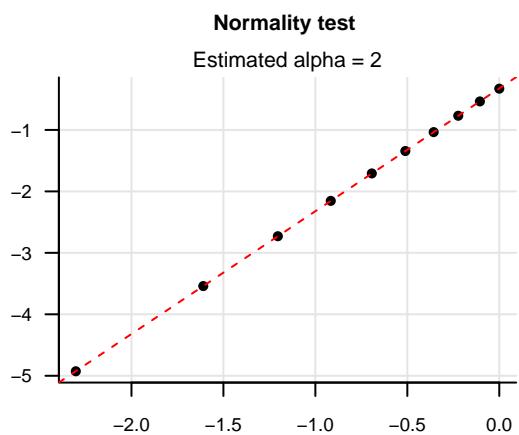
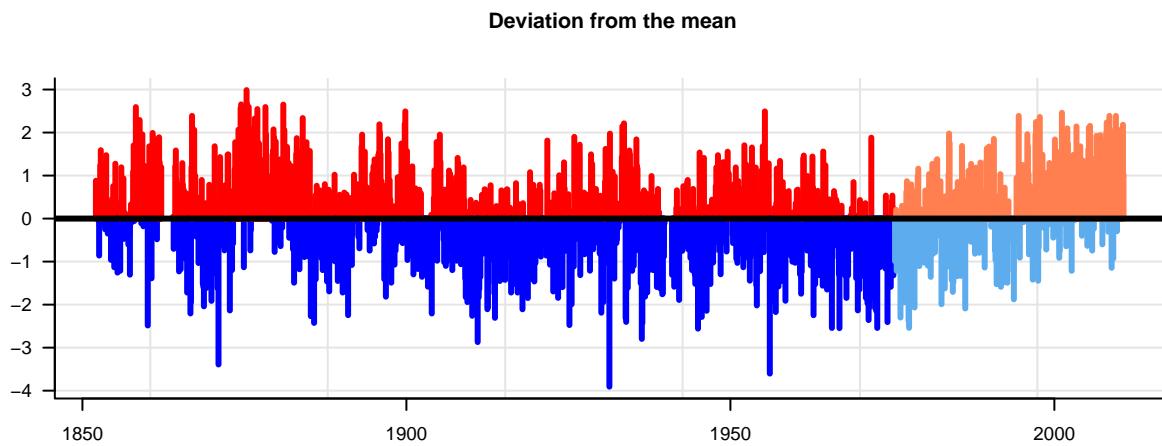
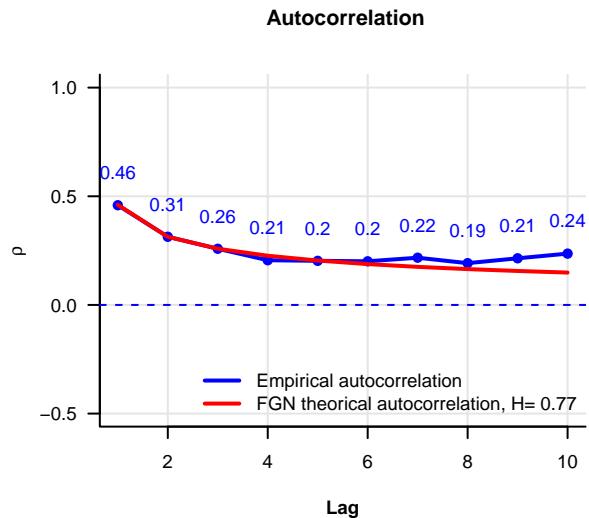
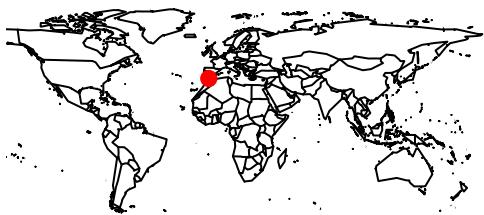
Russia, Sort



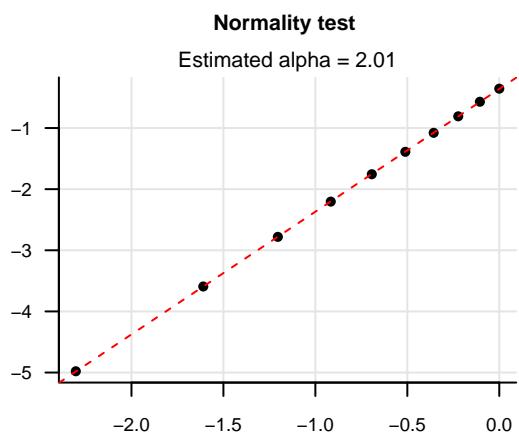
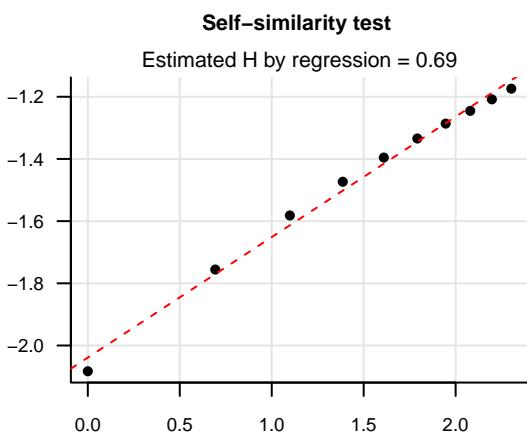
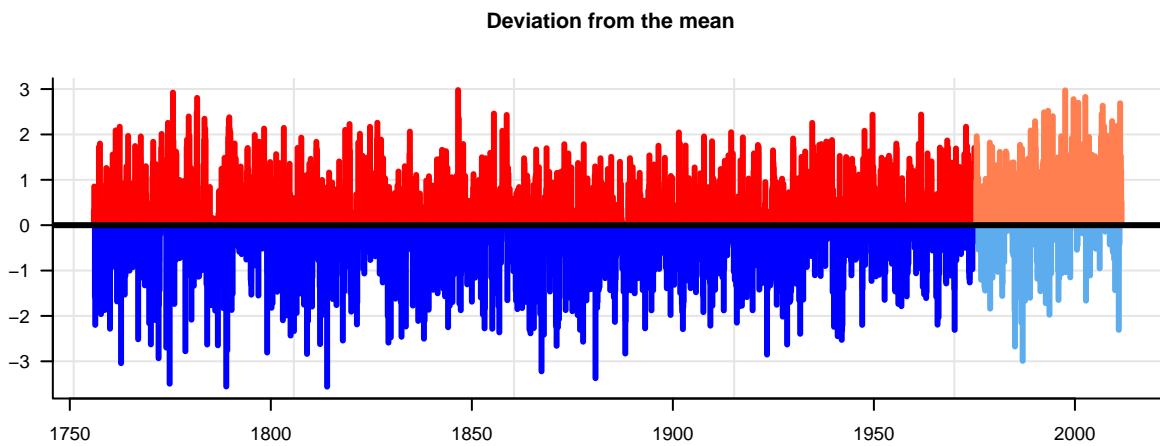
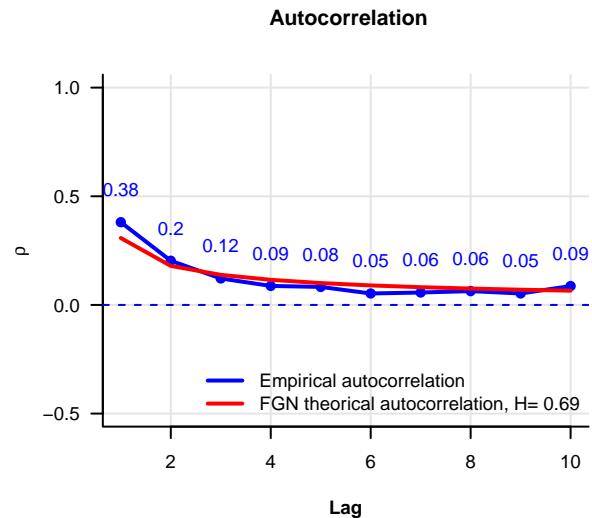
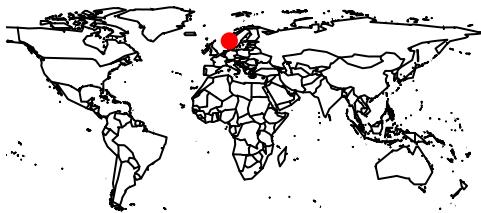
Russia, St Petersburg



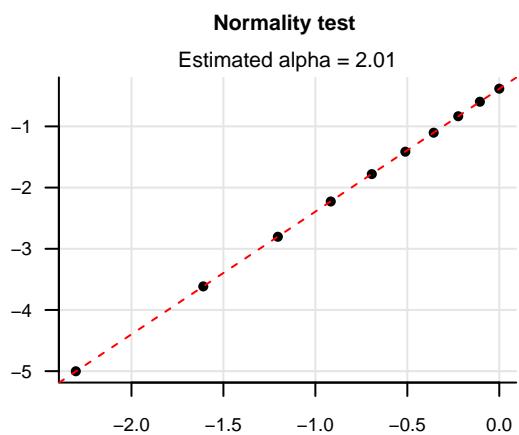
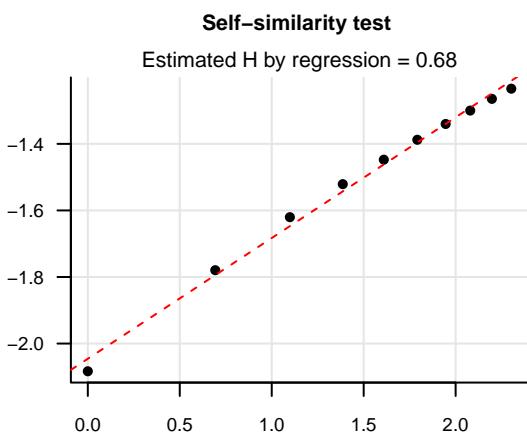
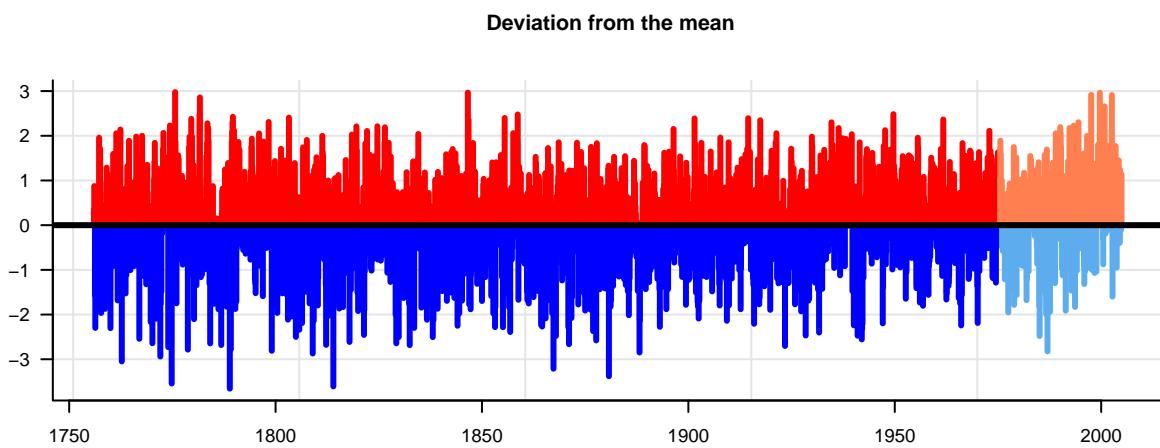
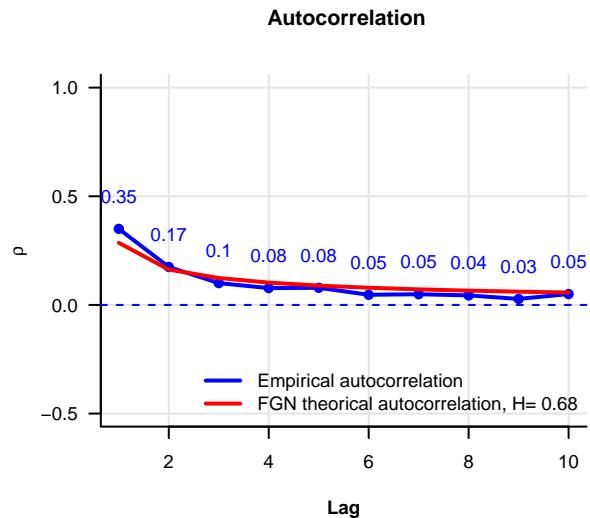
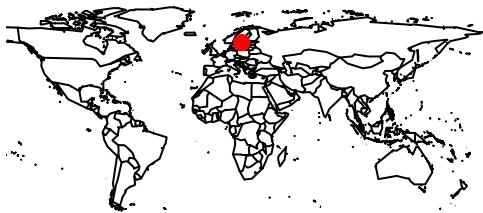
Spain, Gibraltar



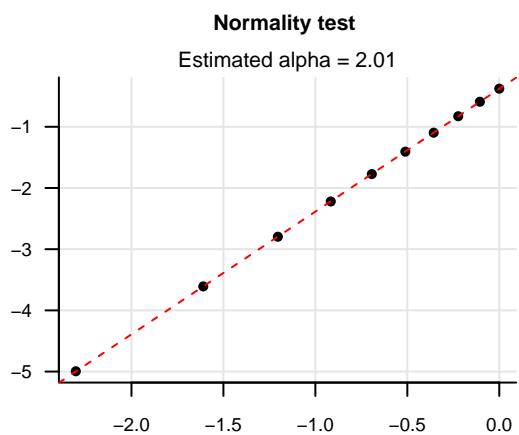
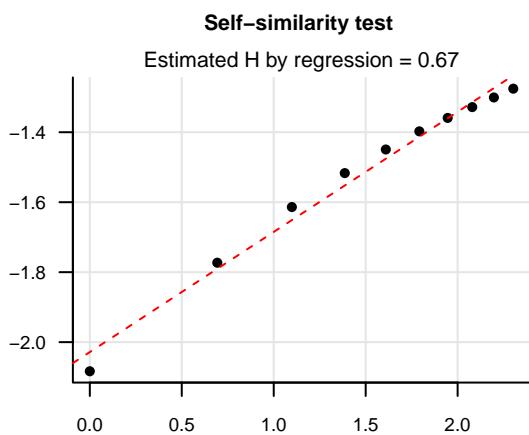
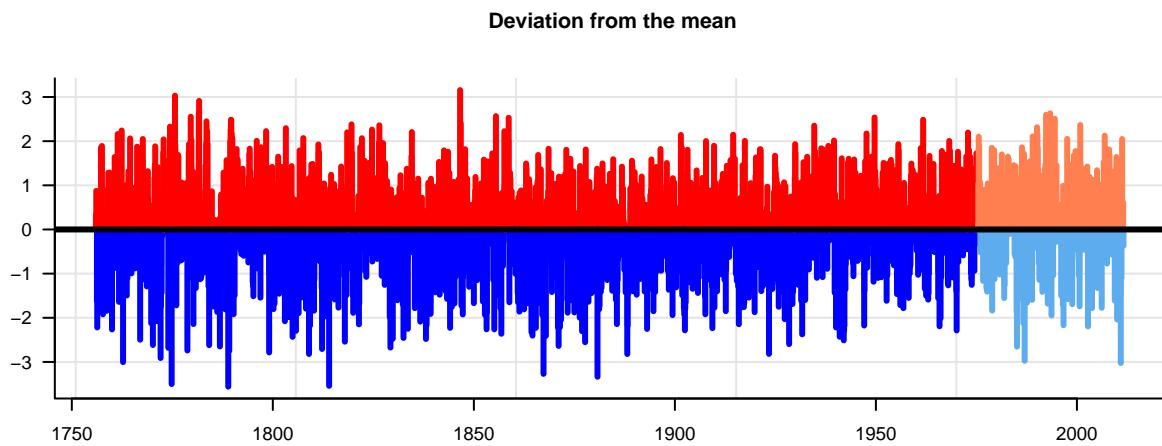
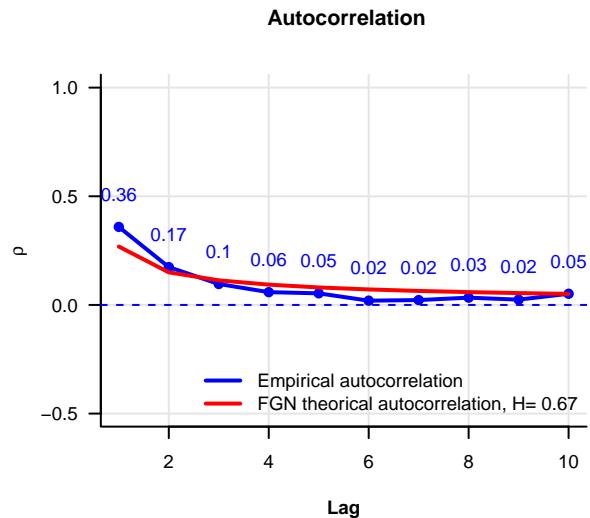
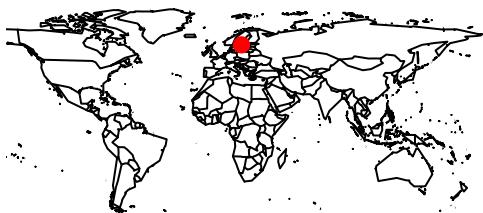
Sweden, Bromma



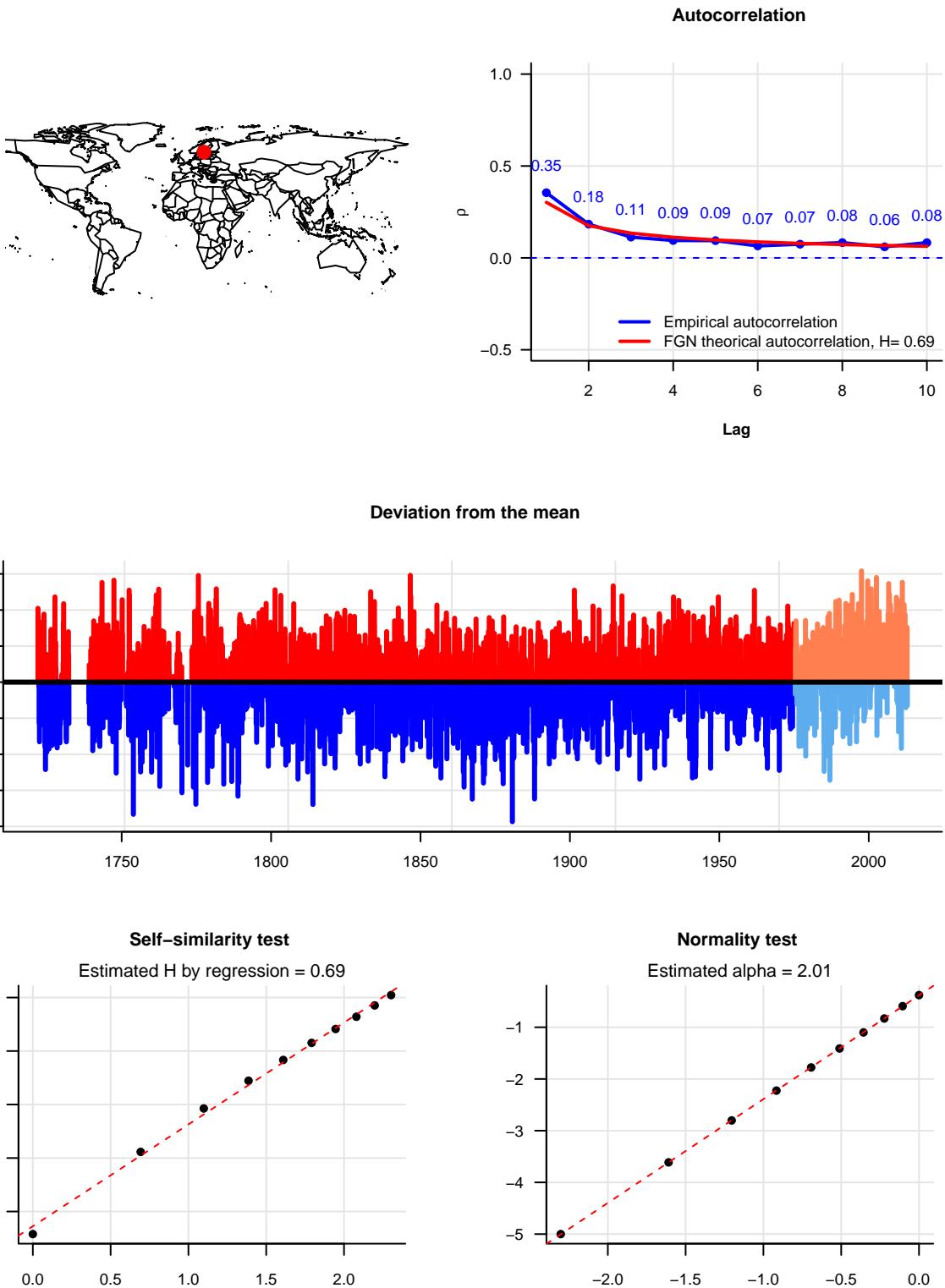
Sweden, Stockholm



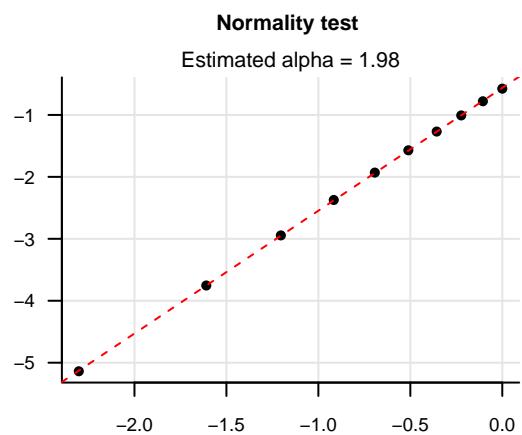
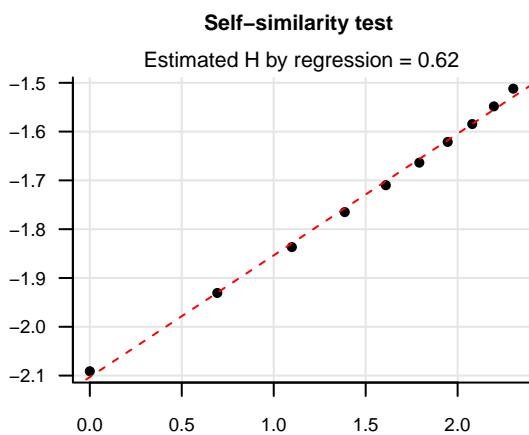
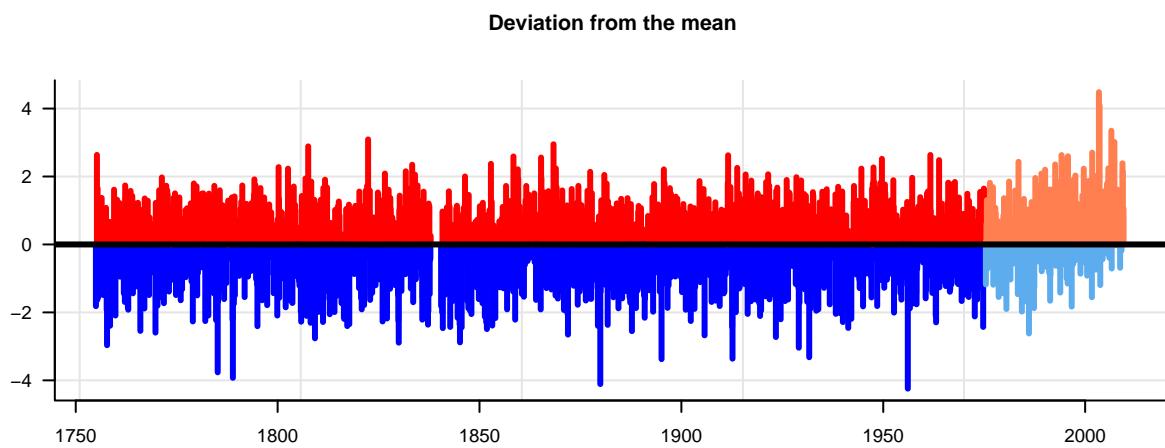
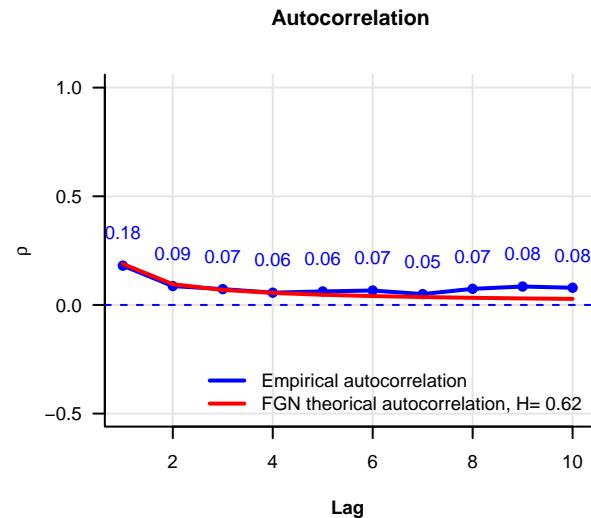
Sweden, Tullinge



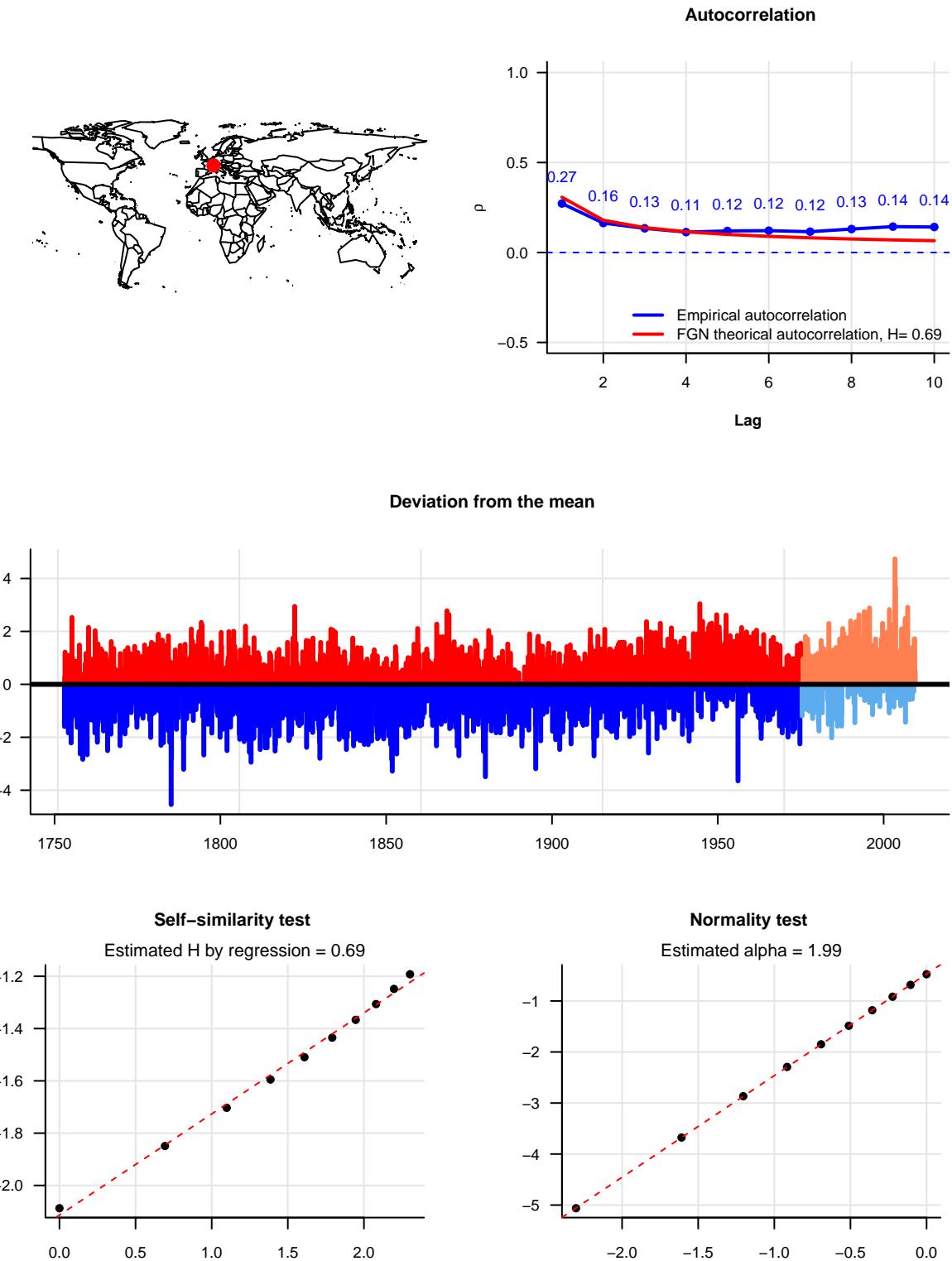
Sweden, Uppsala



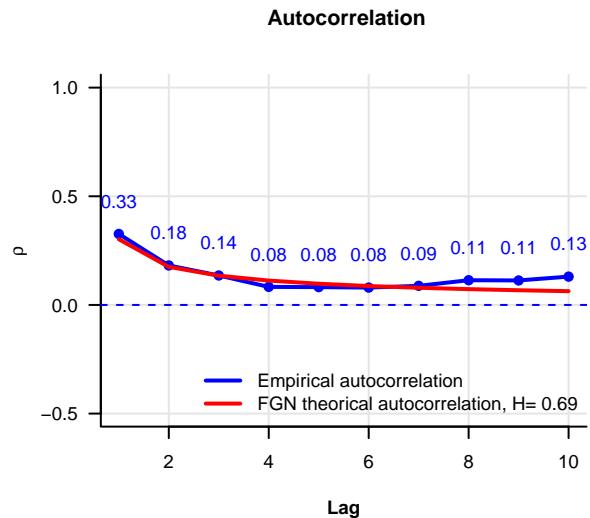
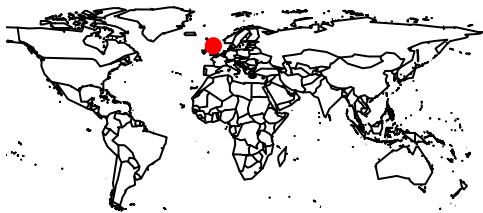
Switzerland, Basel



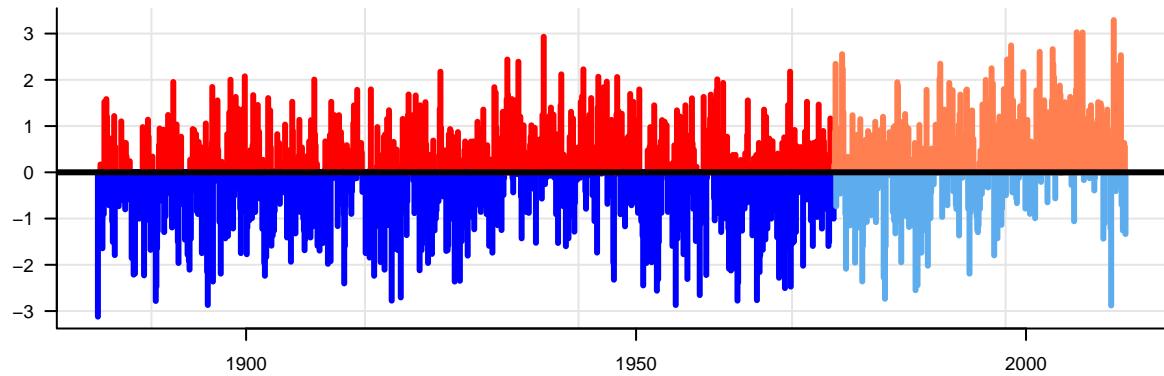
Switzerland, Geneva



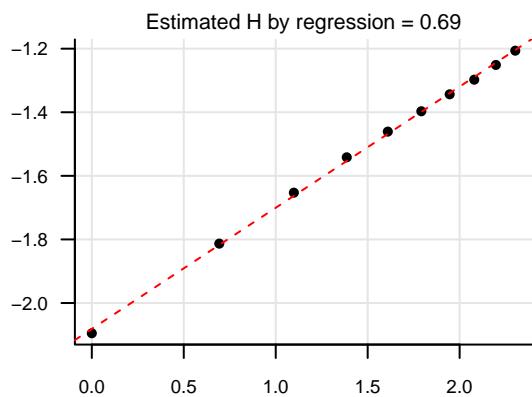
UK, Aberdeen



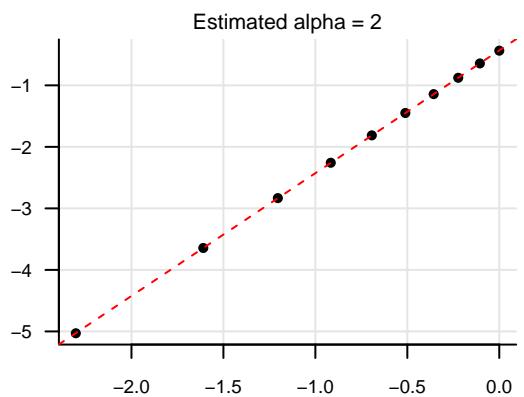
Deviation from the mean



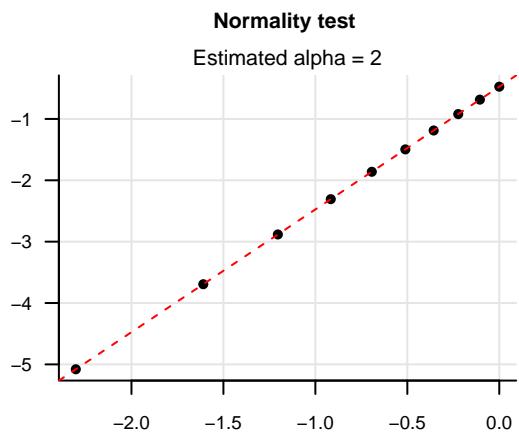
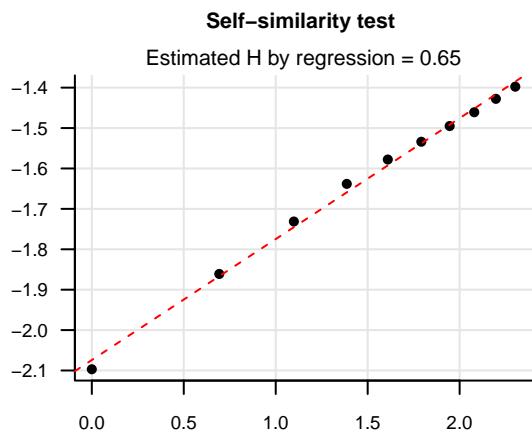
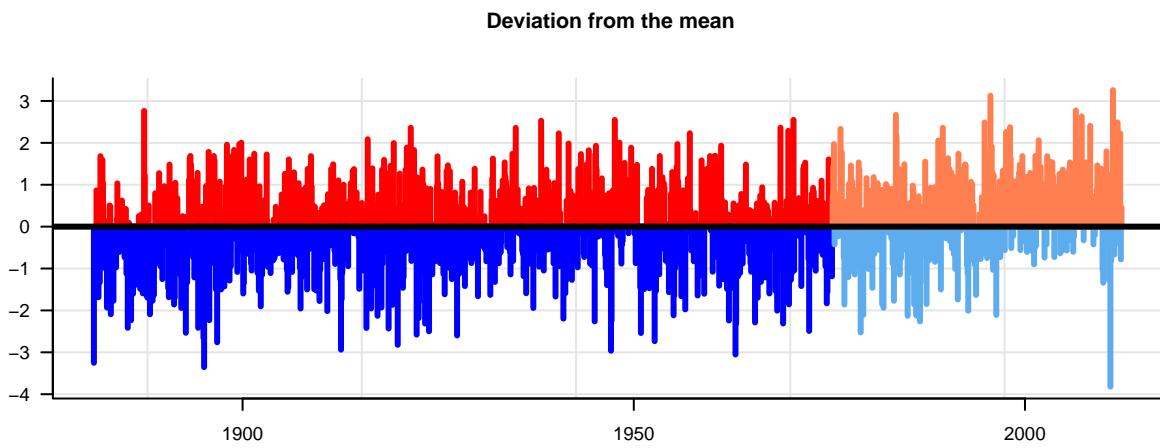
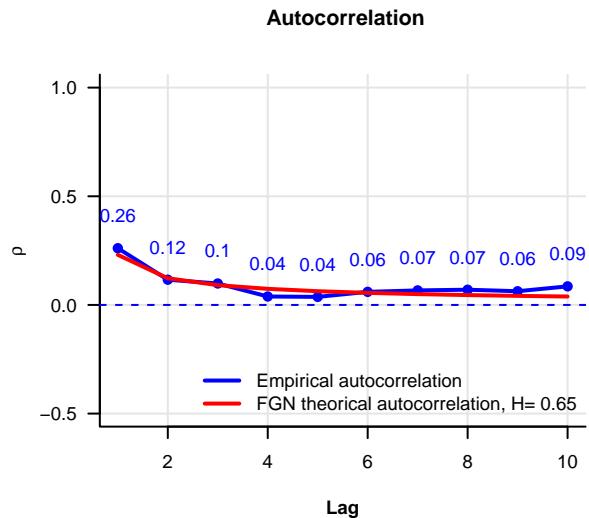
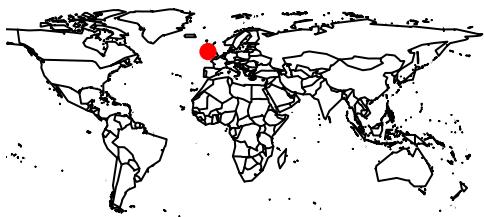
Self-similarity test



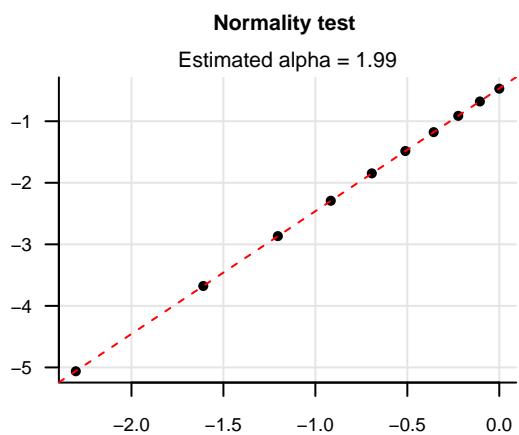
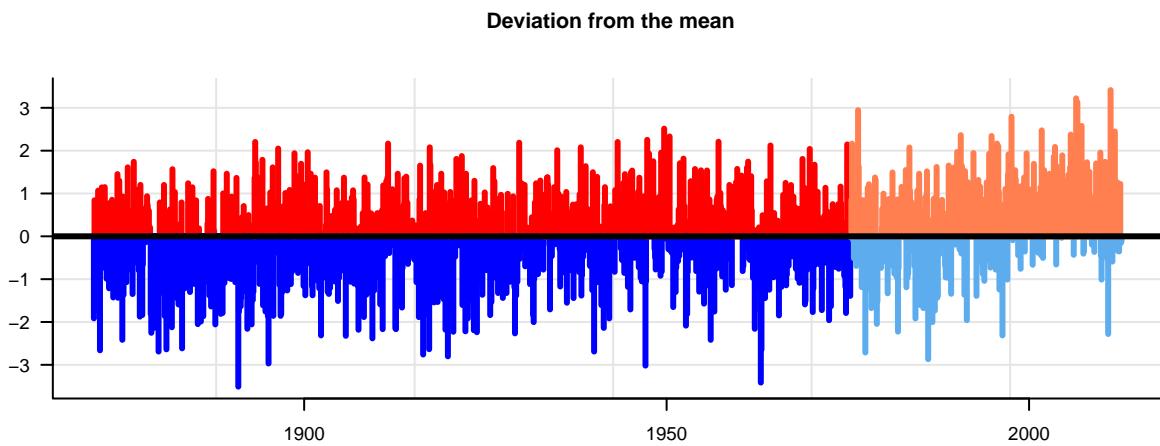
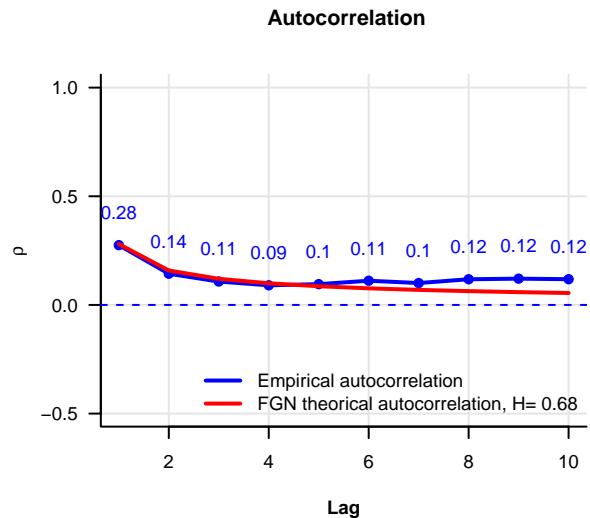
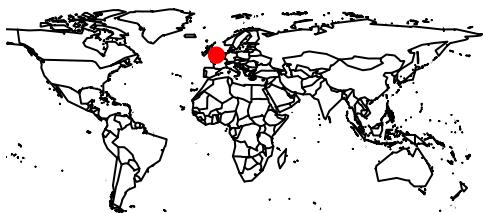
Normality test



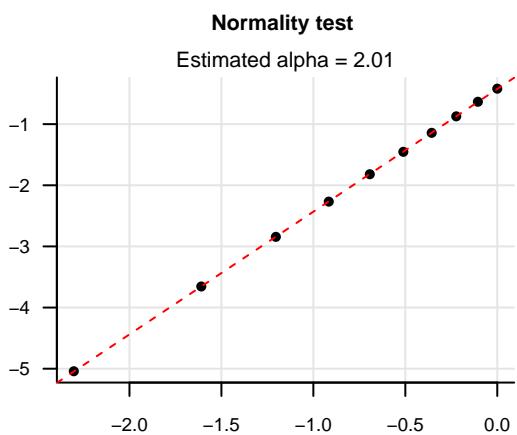
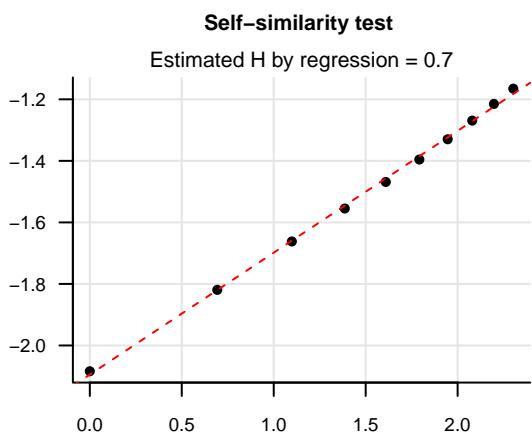
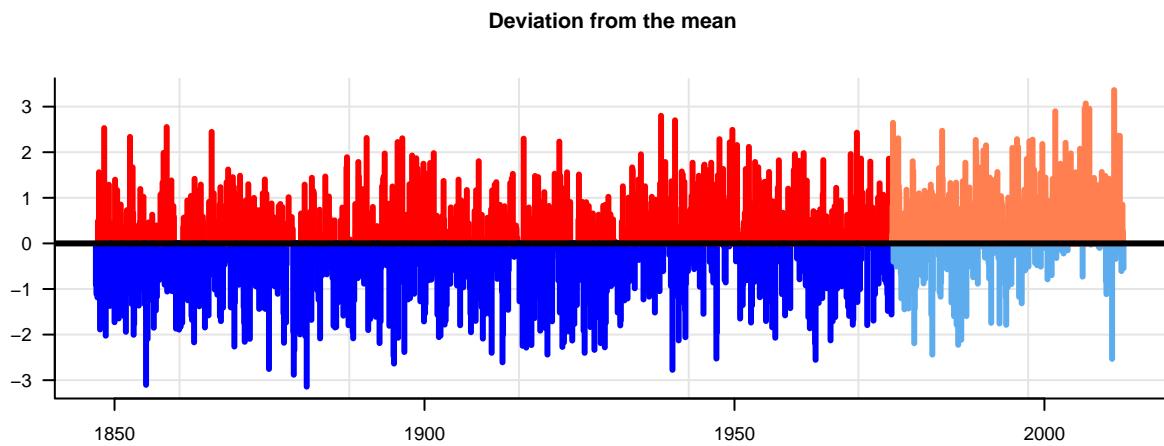
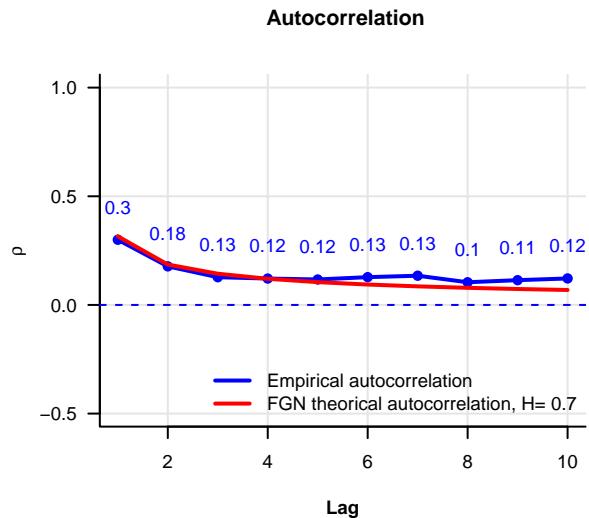
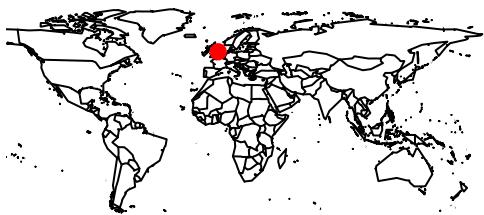
UK, Belfast



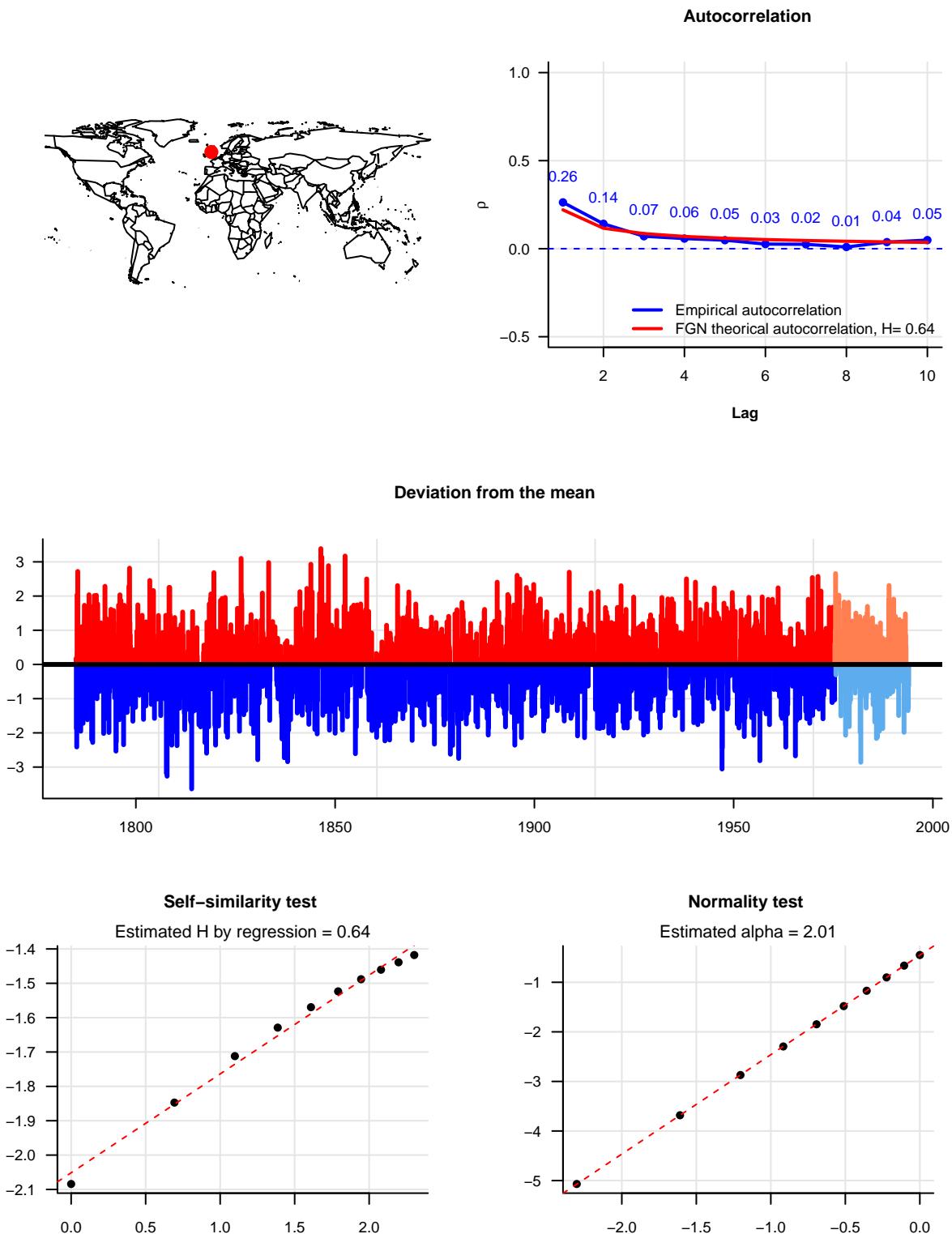
UK, Cambridge



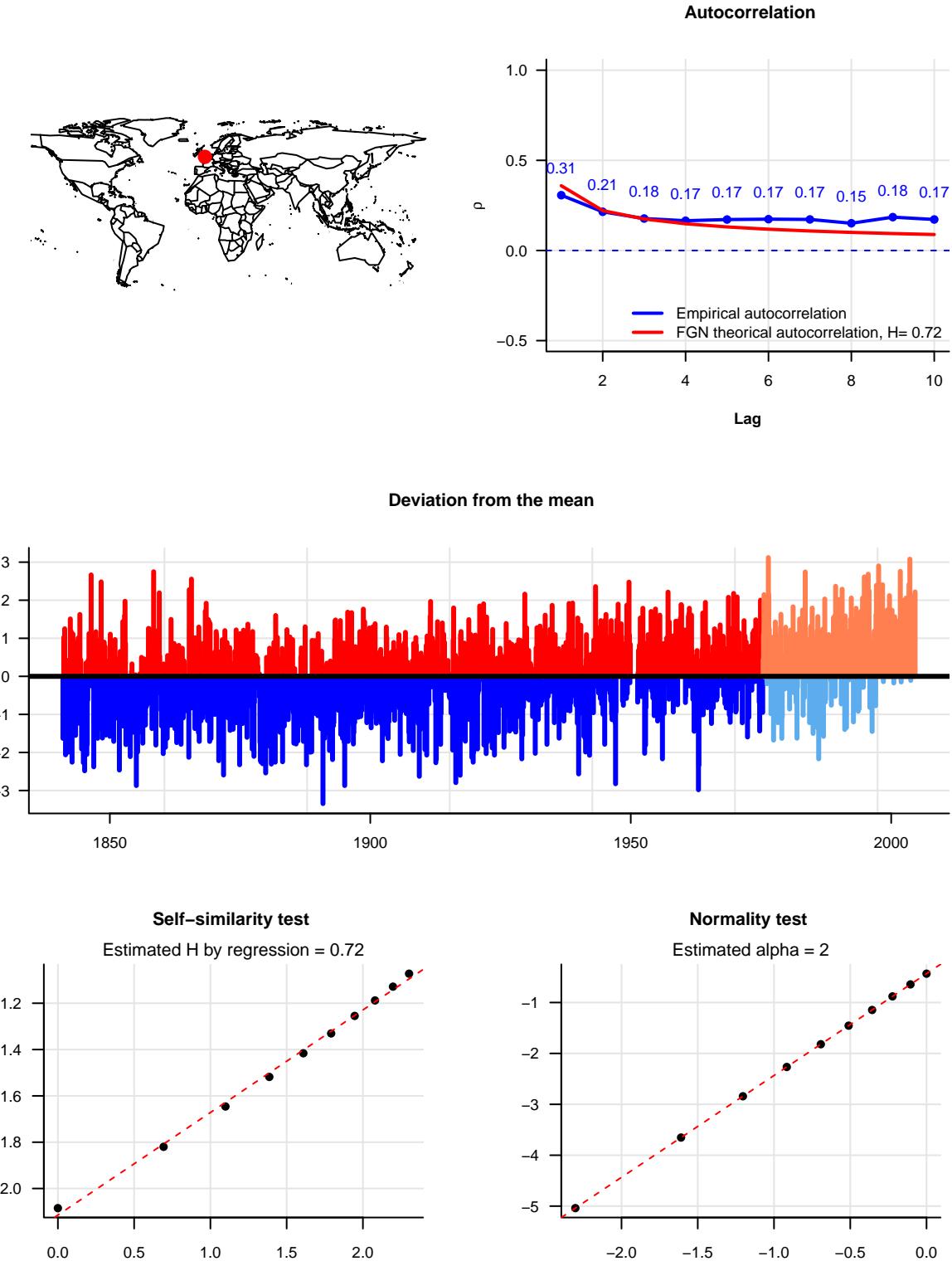
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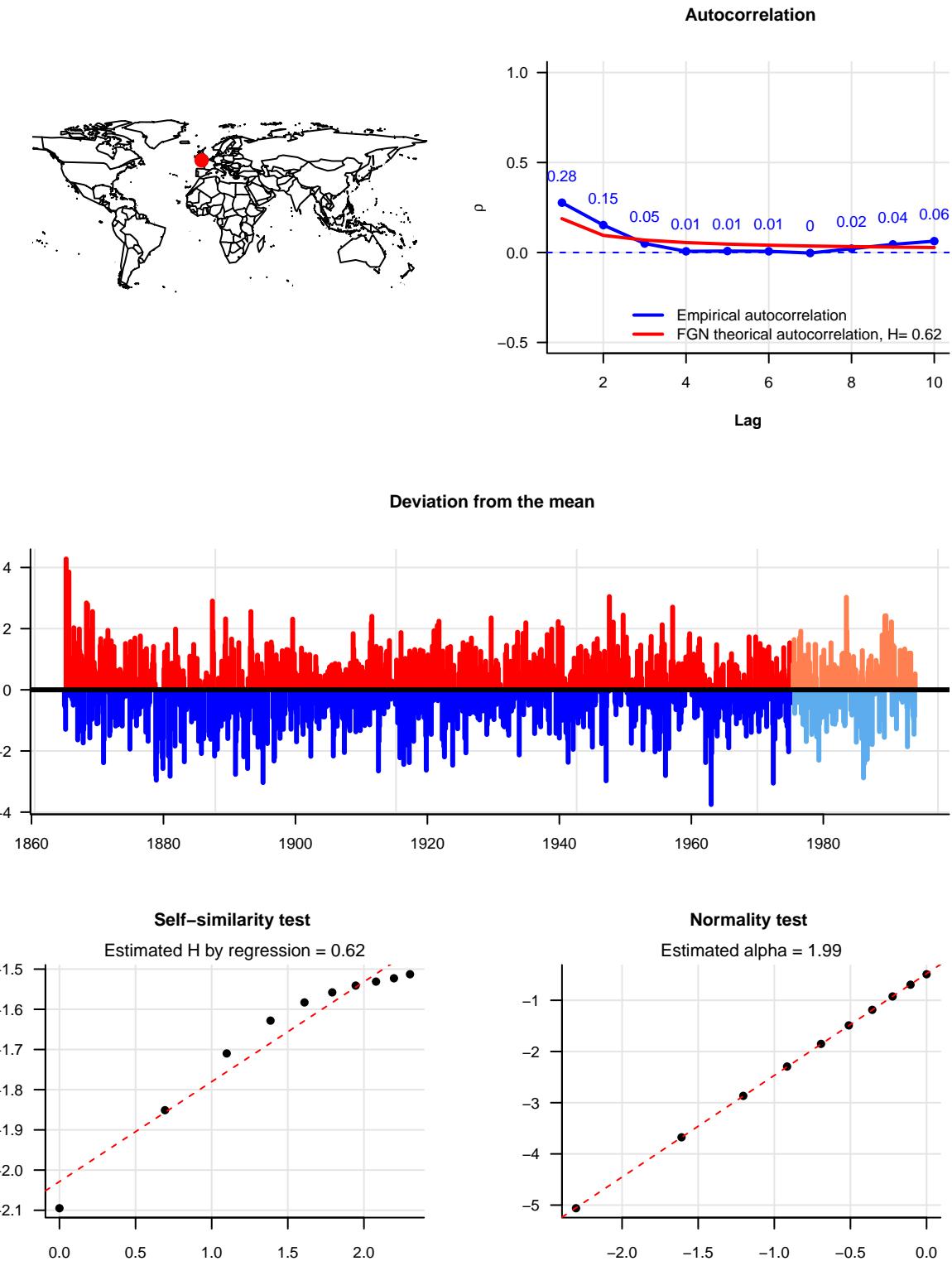
UK, Edinbourg



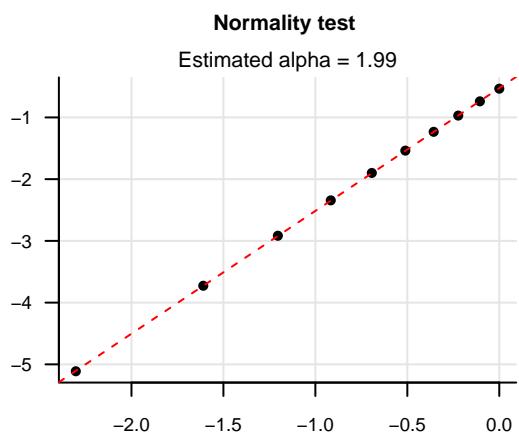
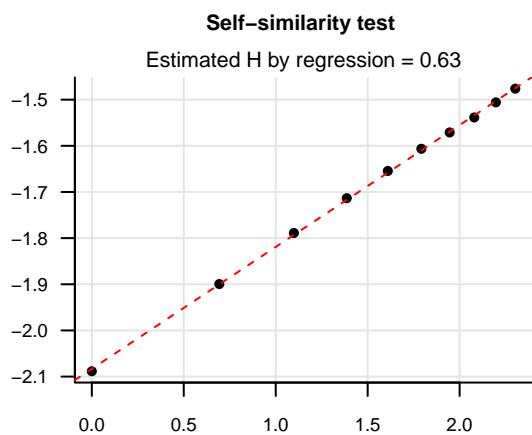
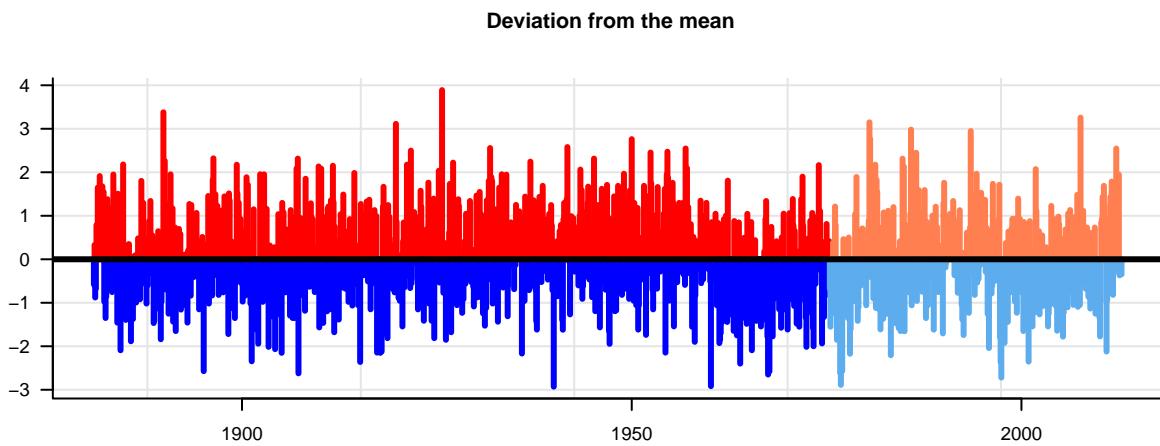
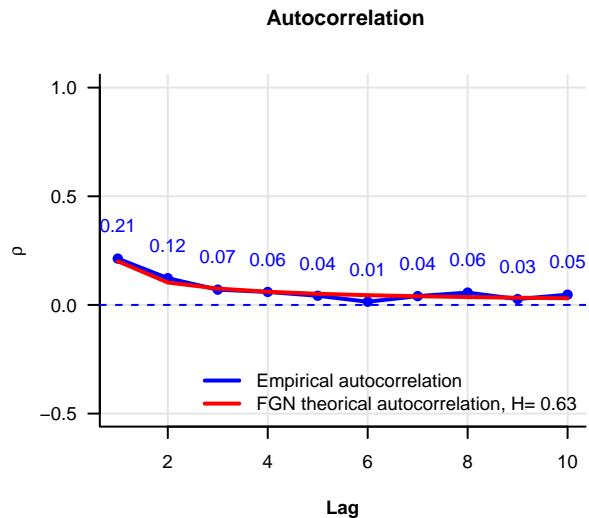
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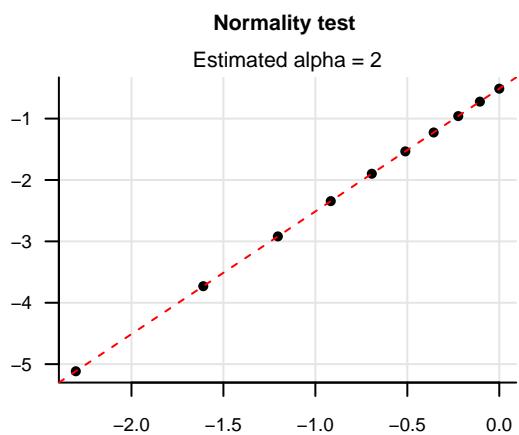
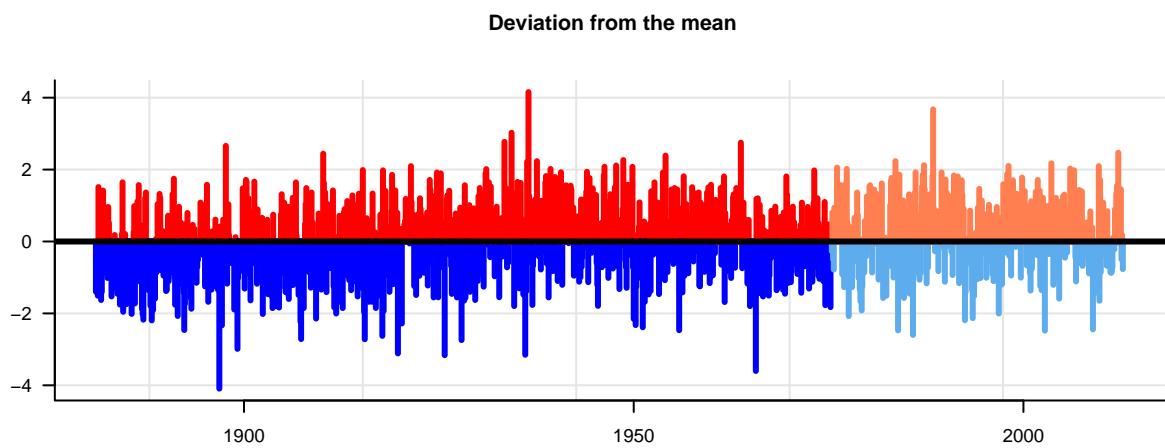
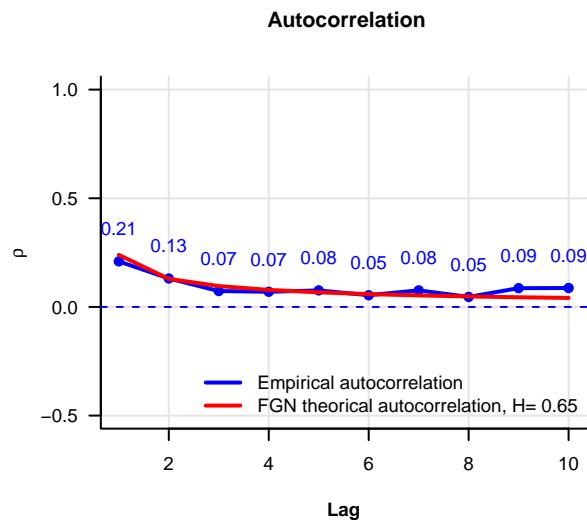
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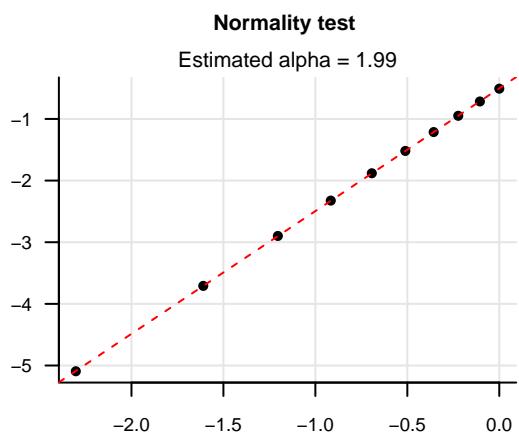
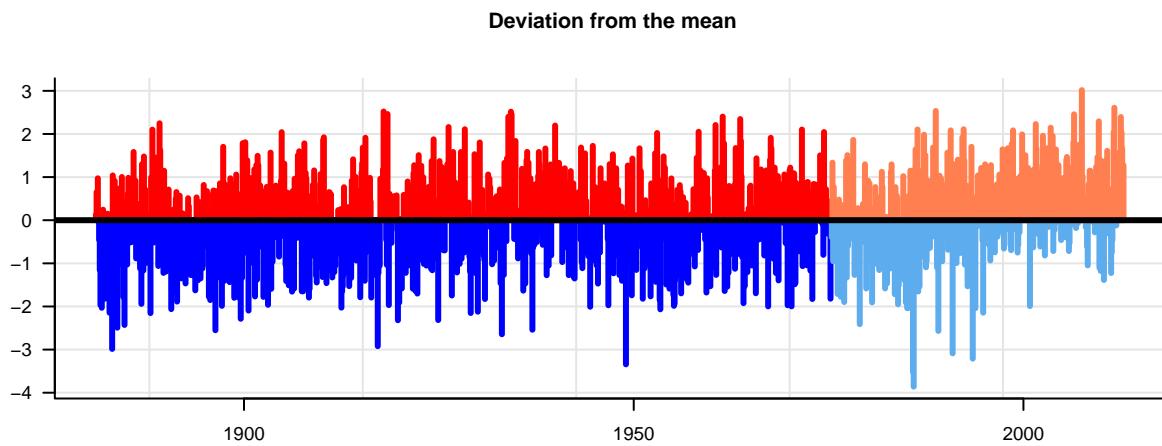
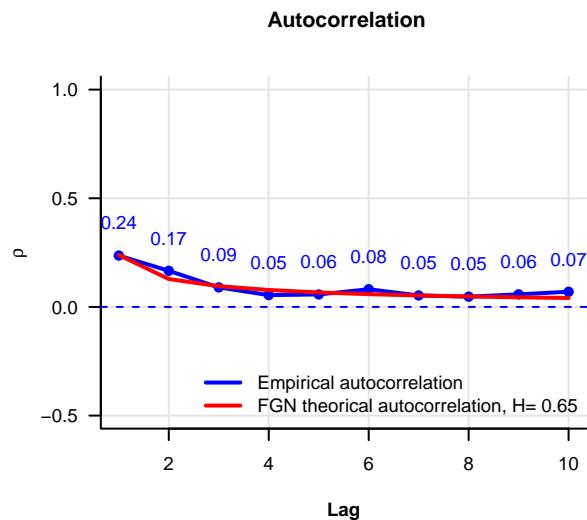
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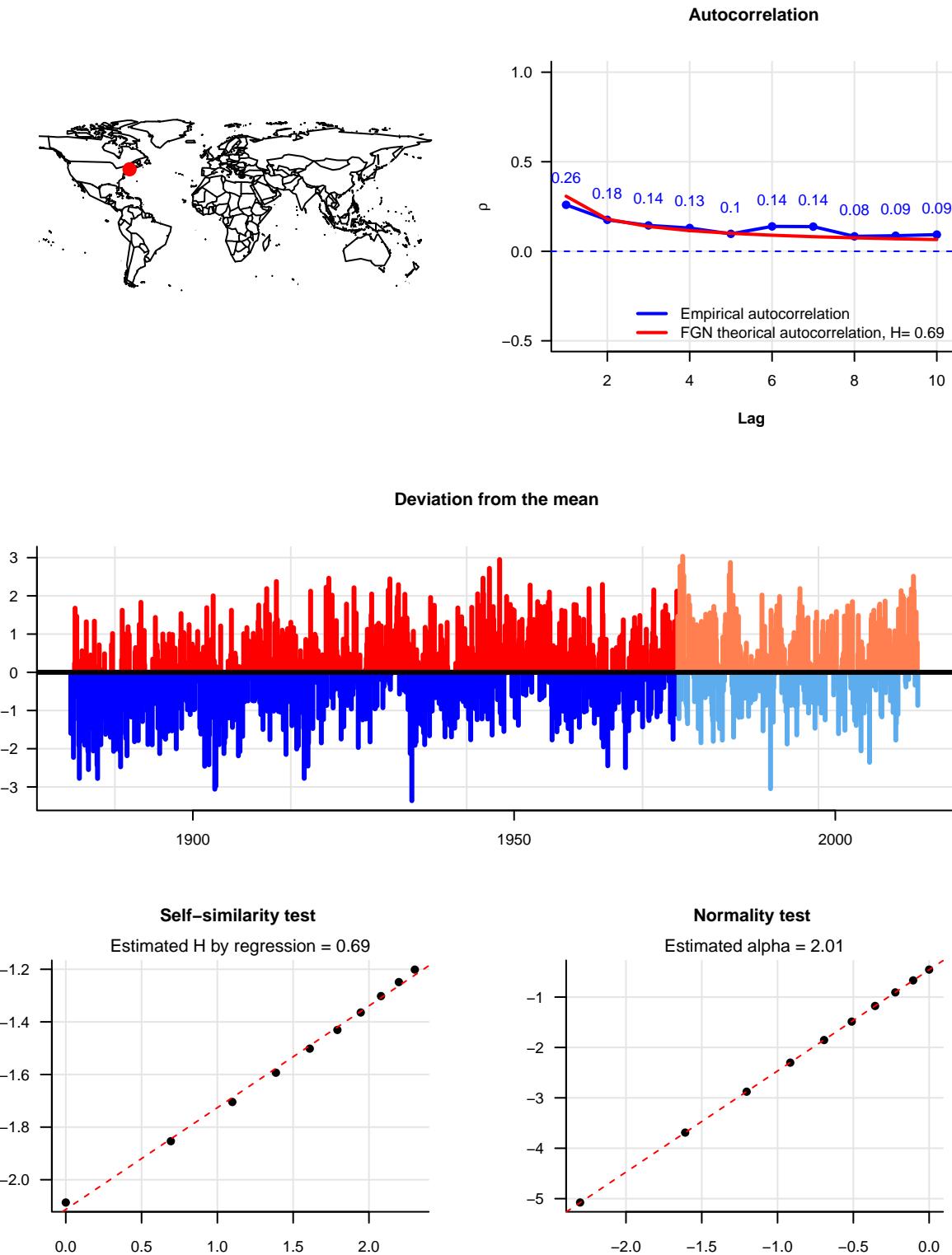
USA, Bismarck



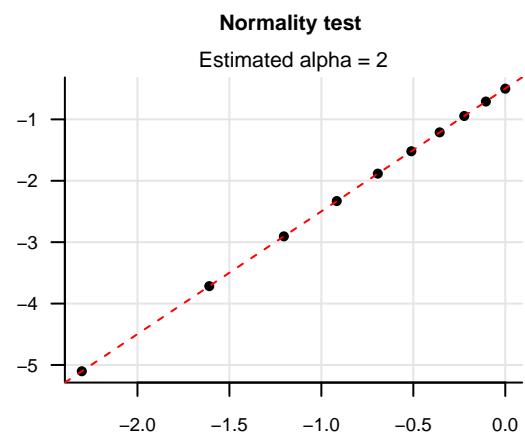
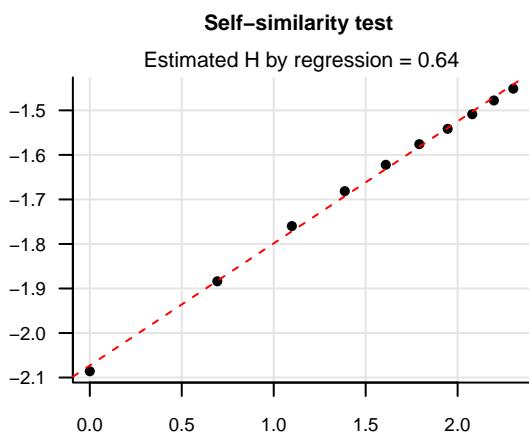
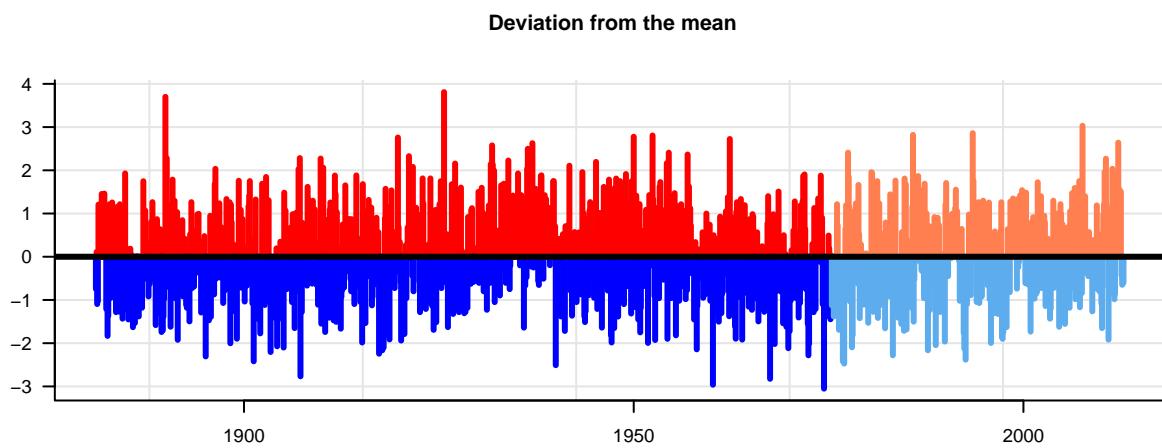
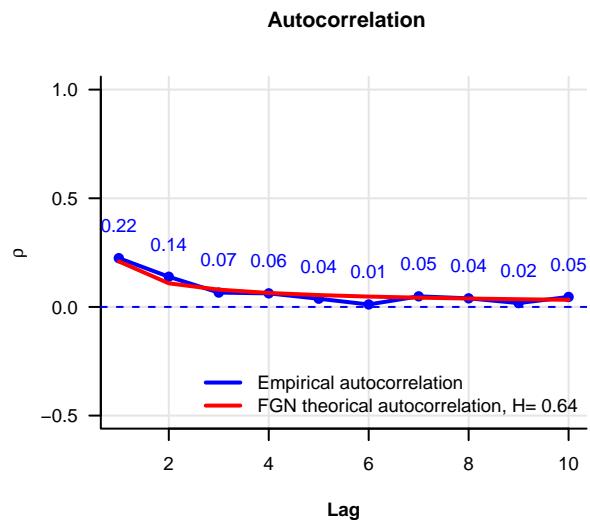
USA, Boise



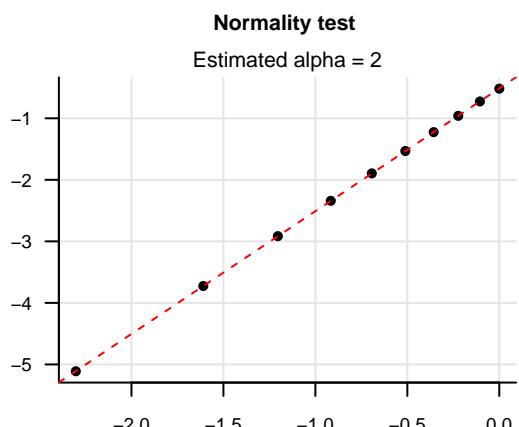
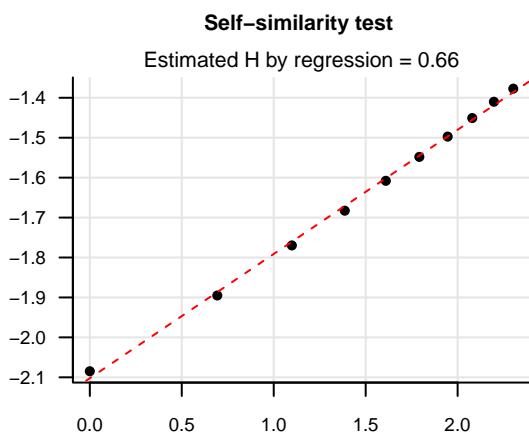
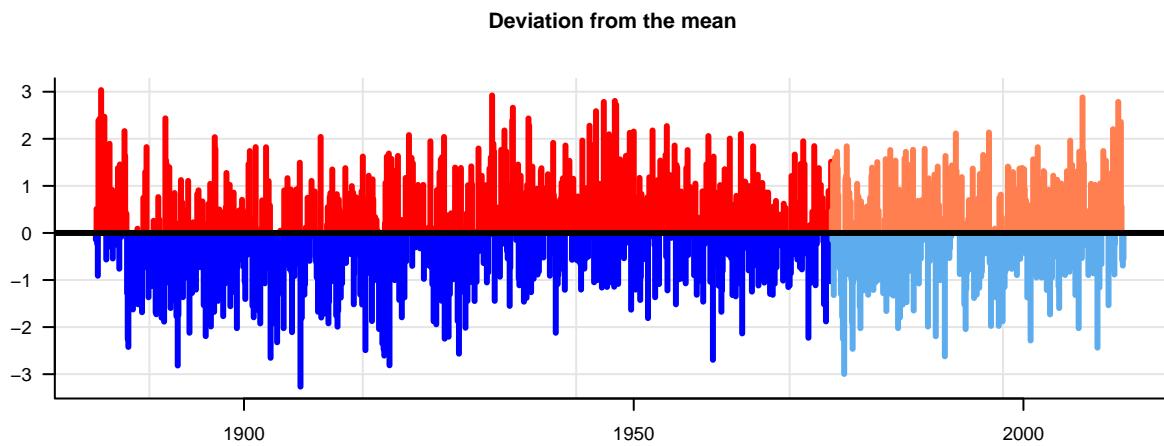
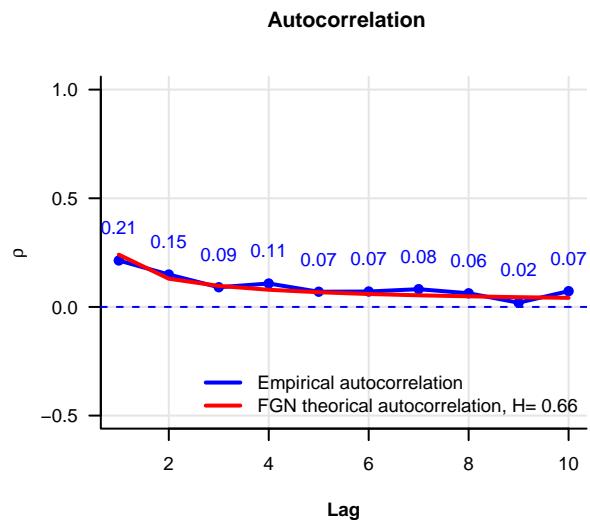
USA, Boston



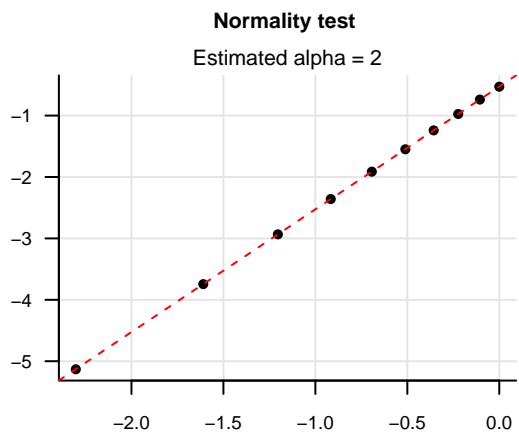
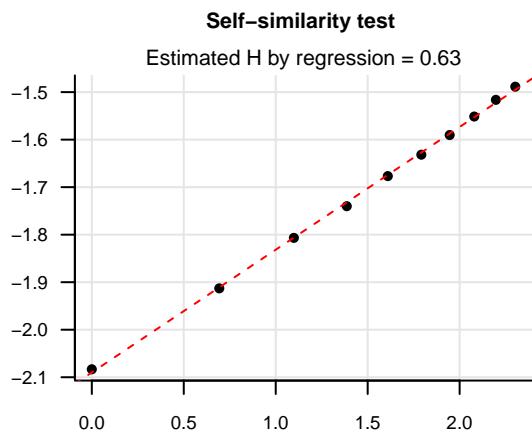
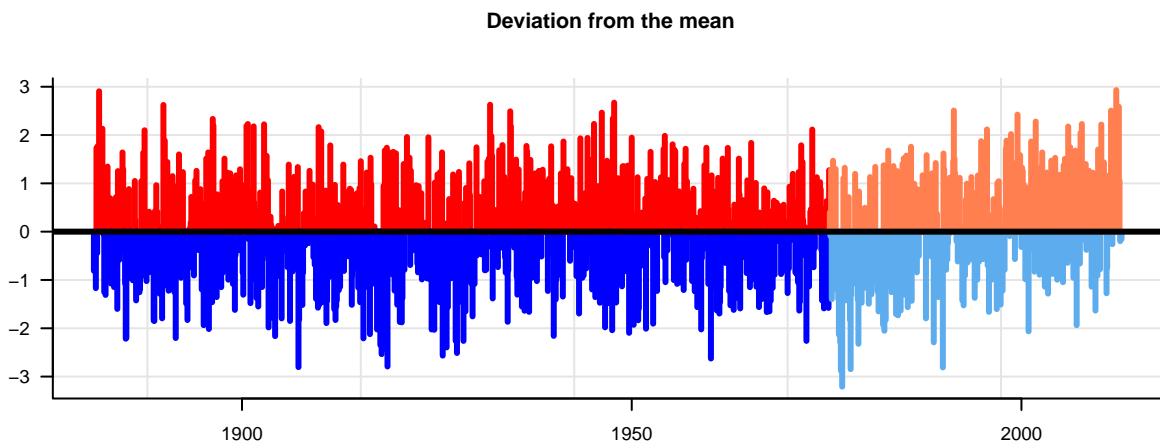
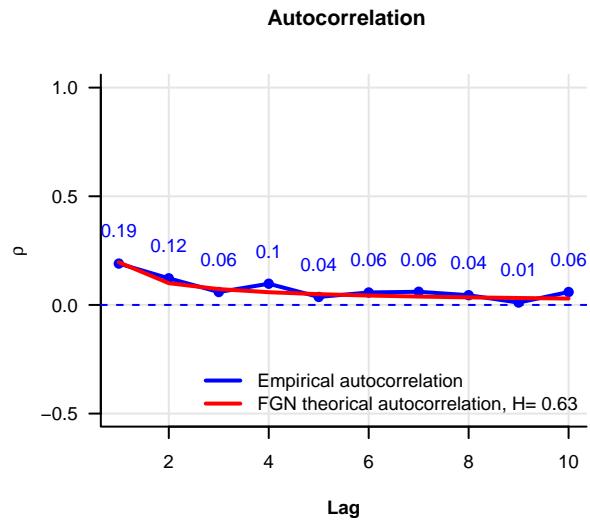
USA, Chattanooga



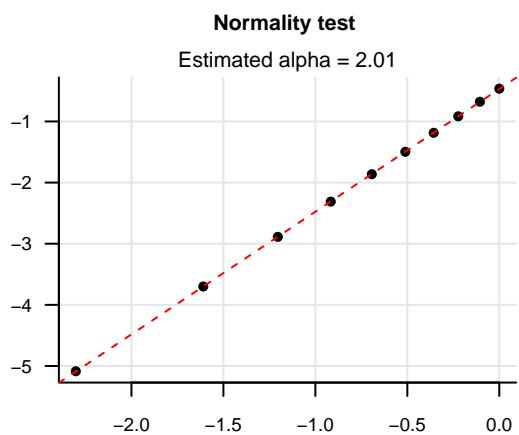
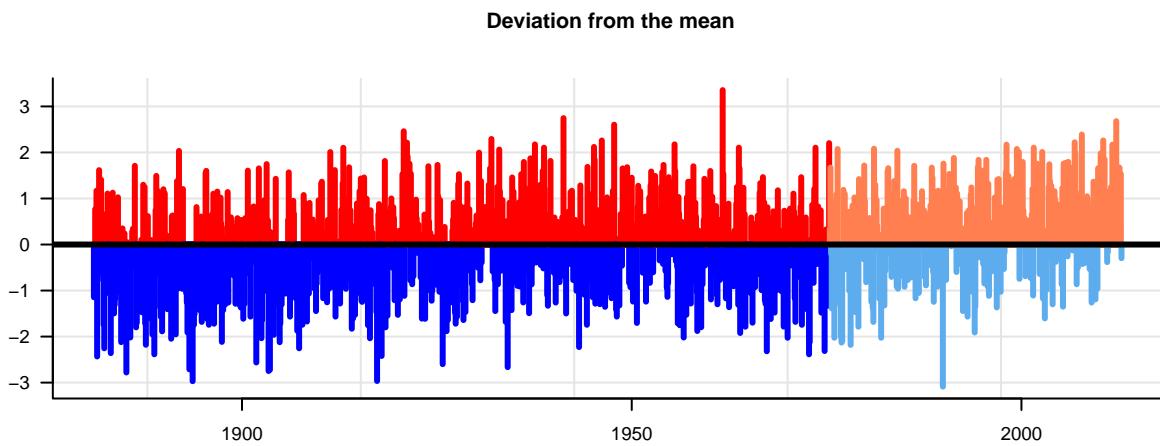
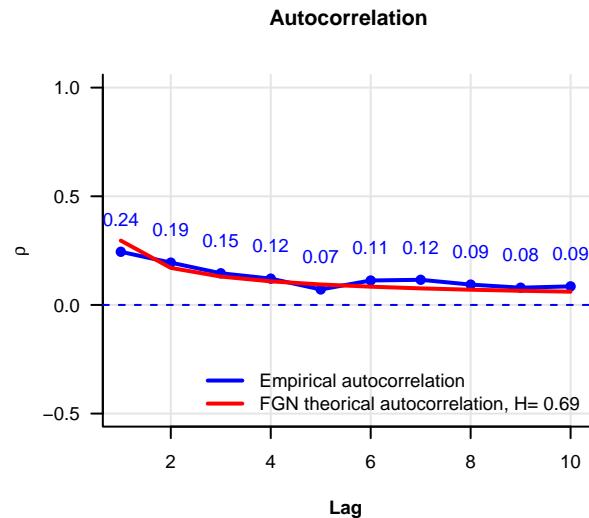
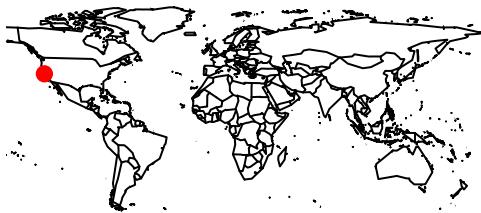
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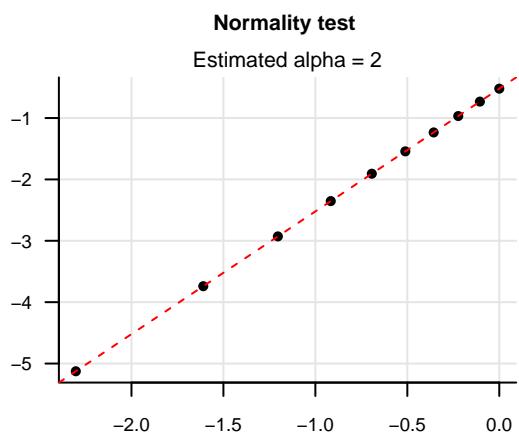
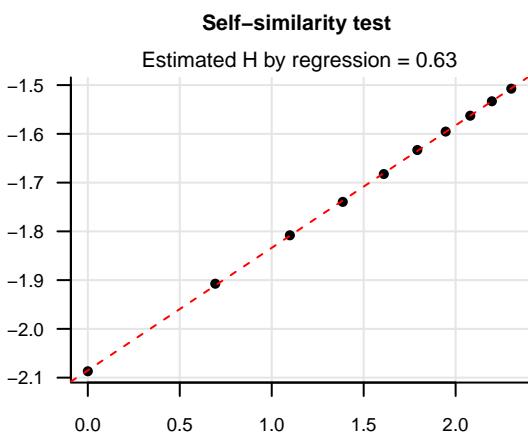
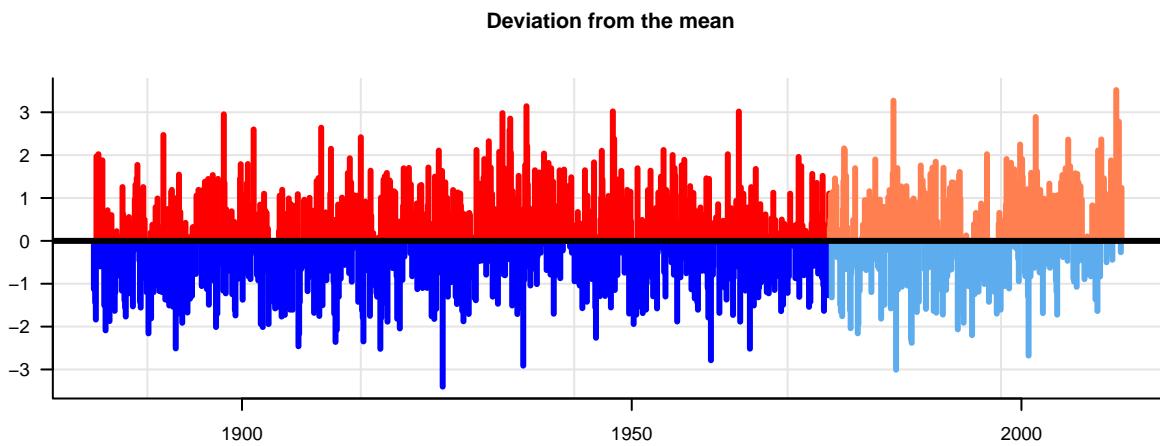
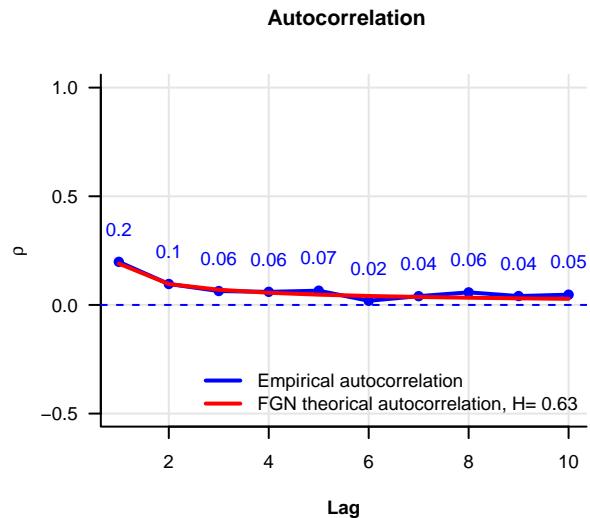
USA, Columbus



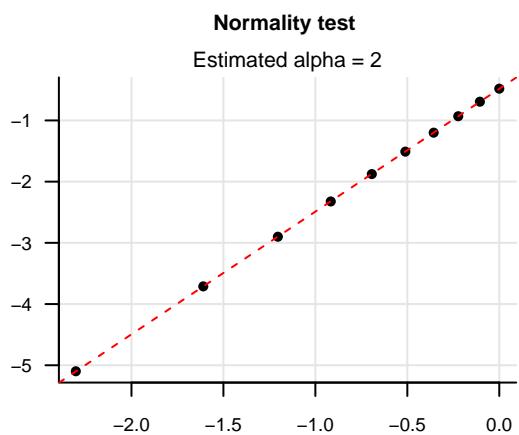
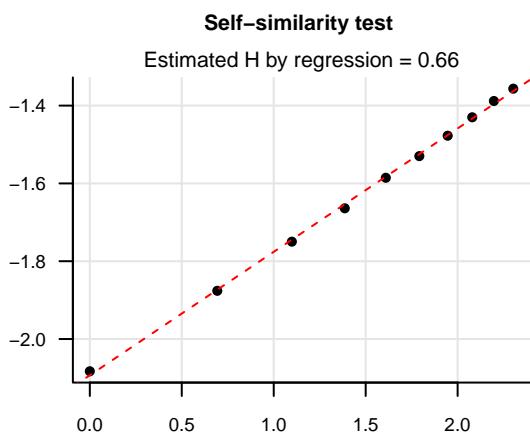
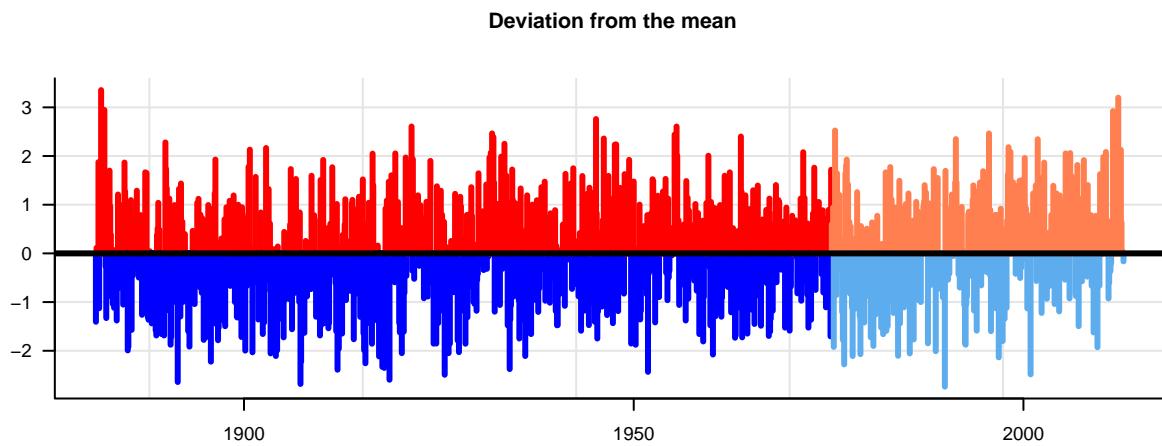
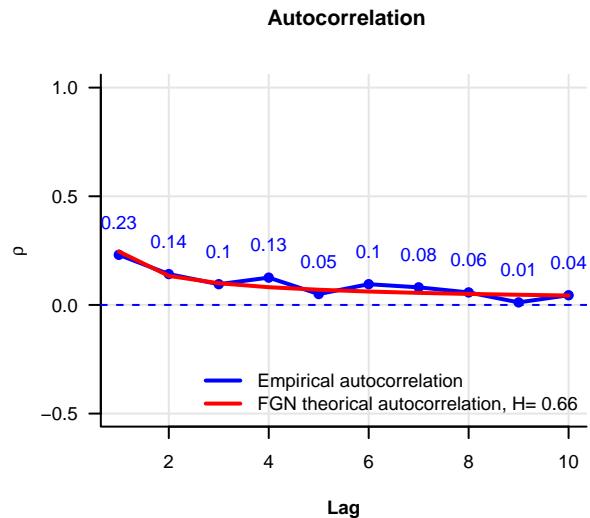
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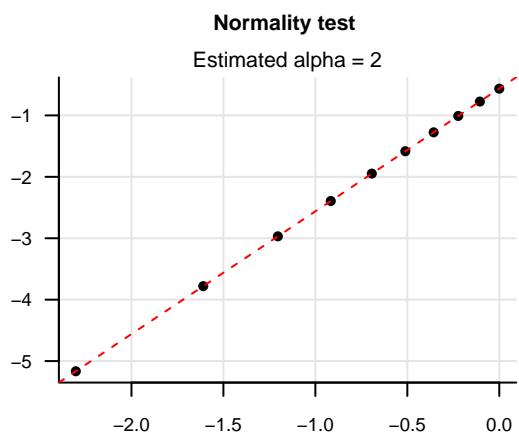
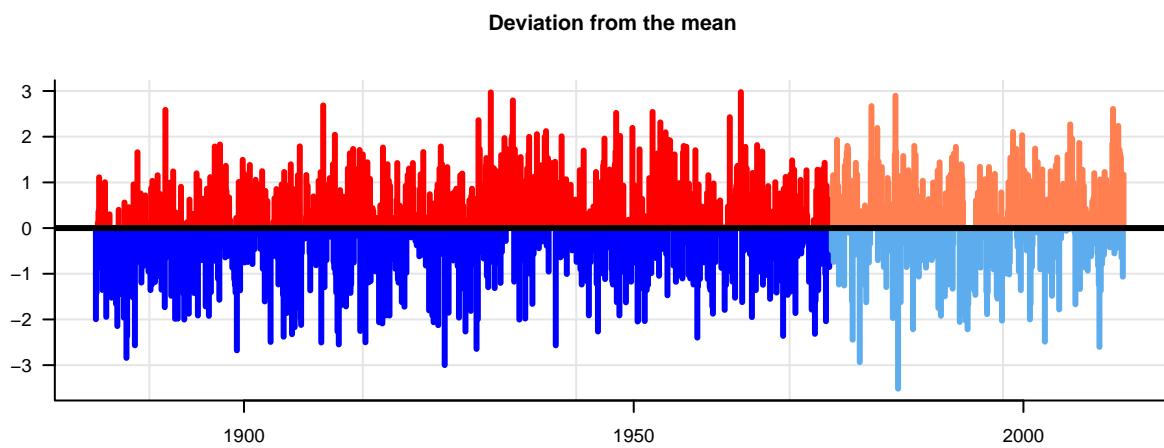
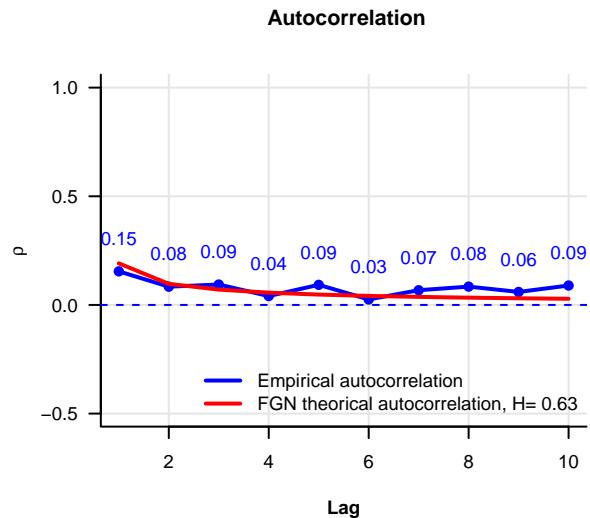
USA, Des Moines



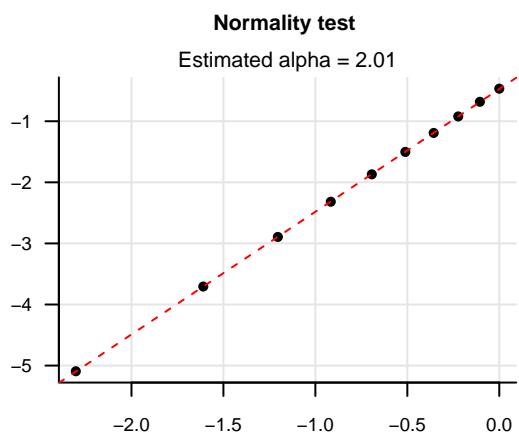
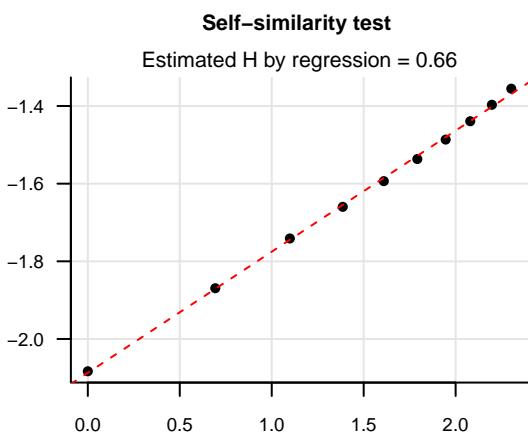
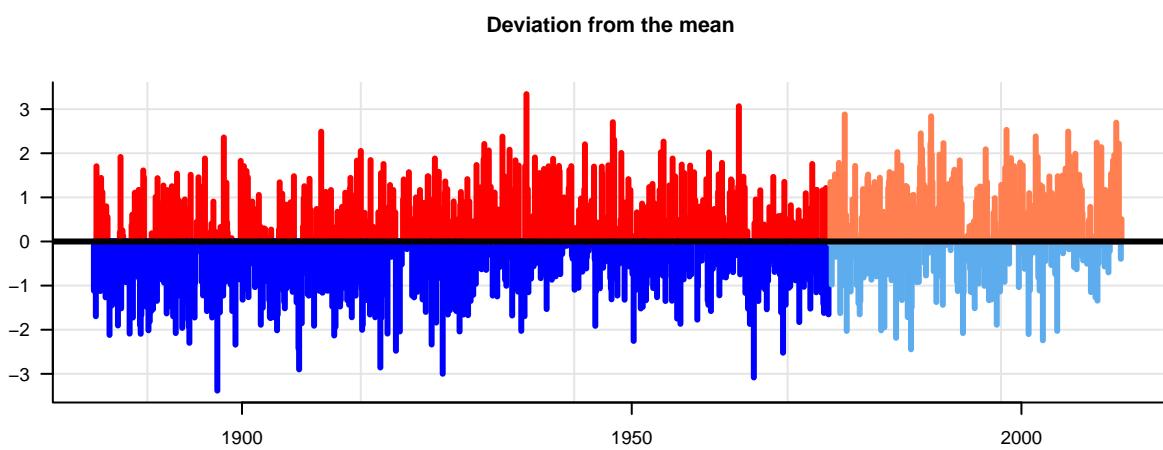
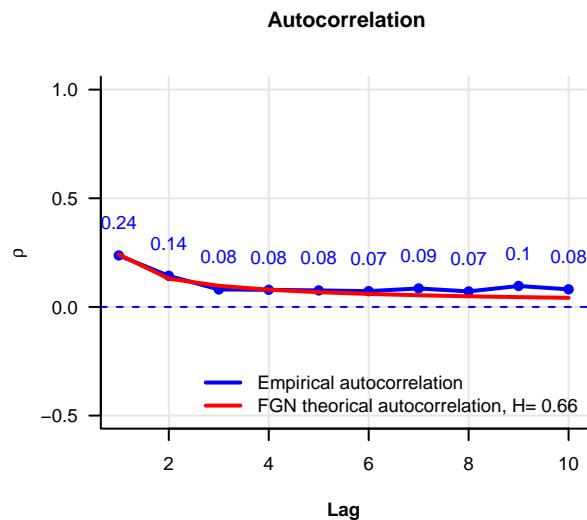
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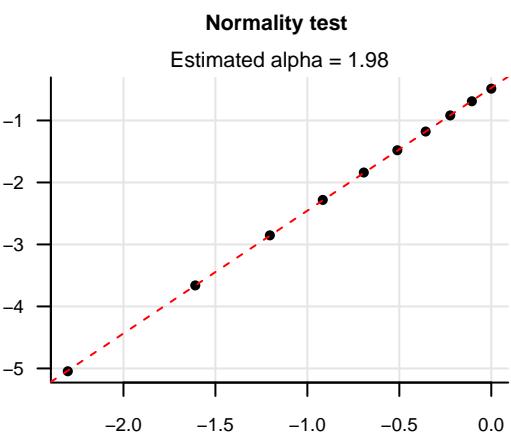
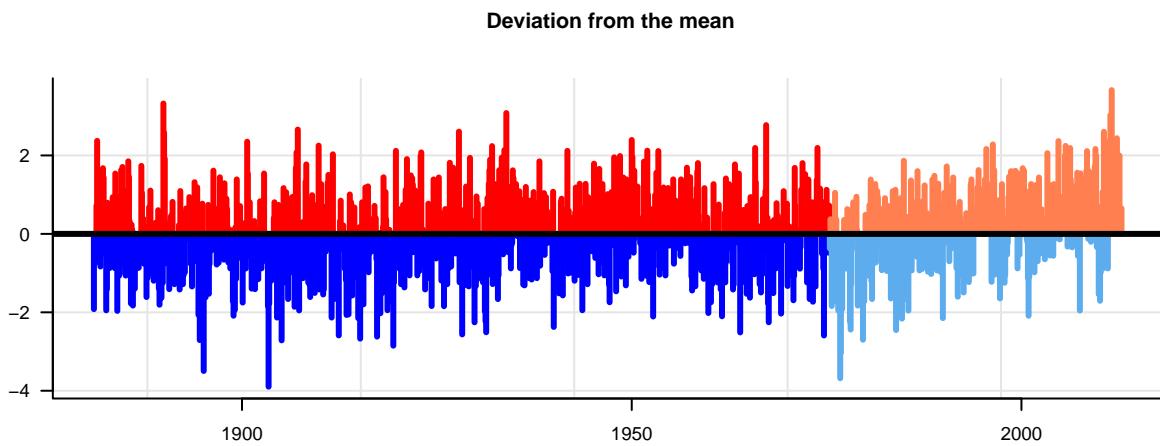
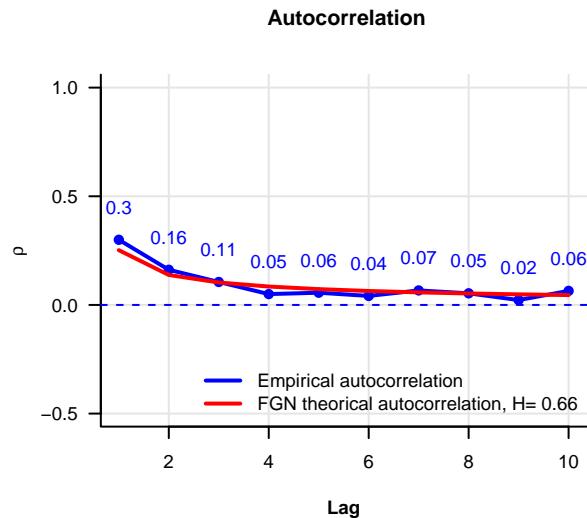
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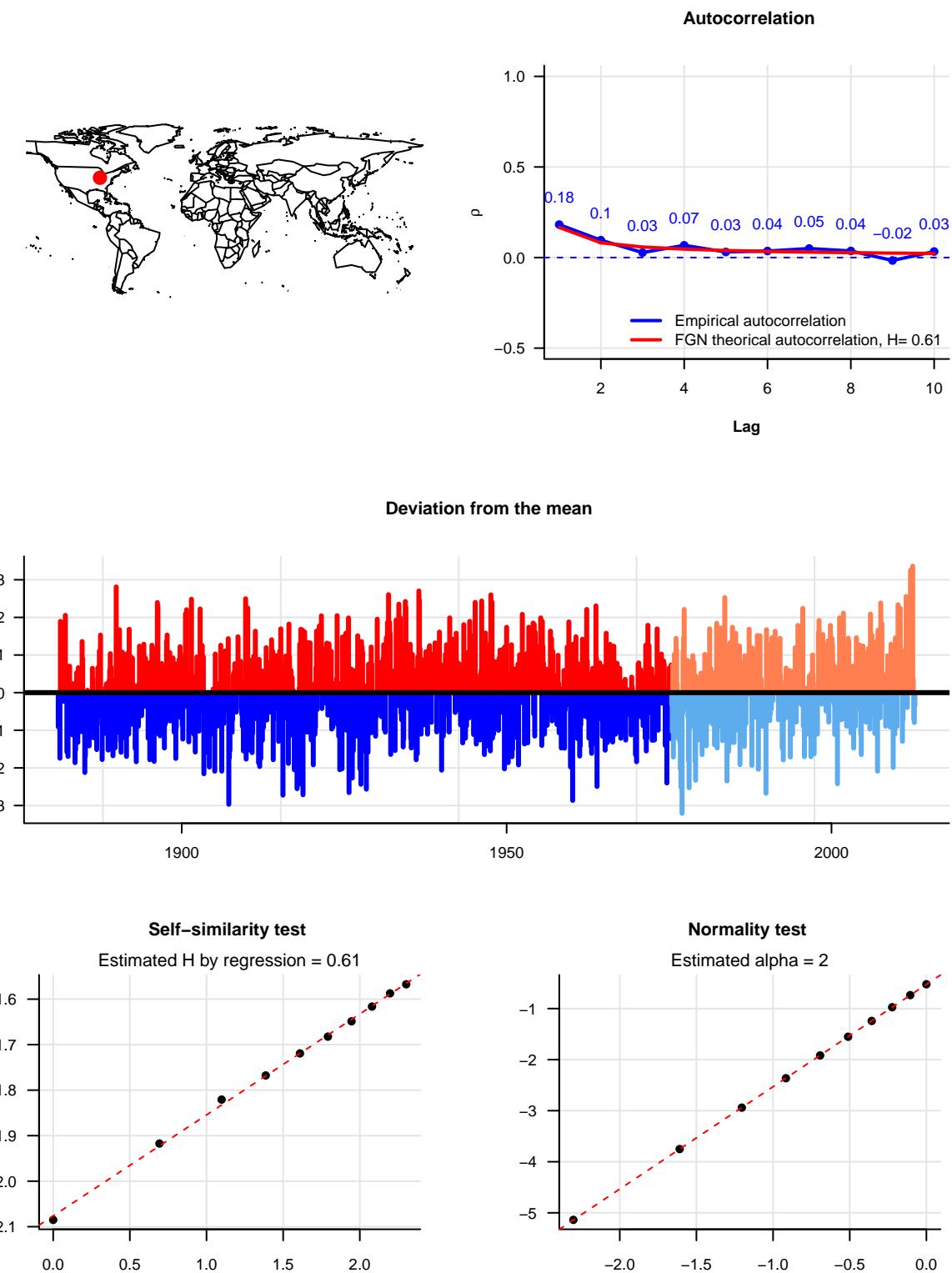
USA, Fargo



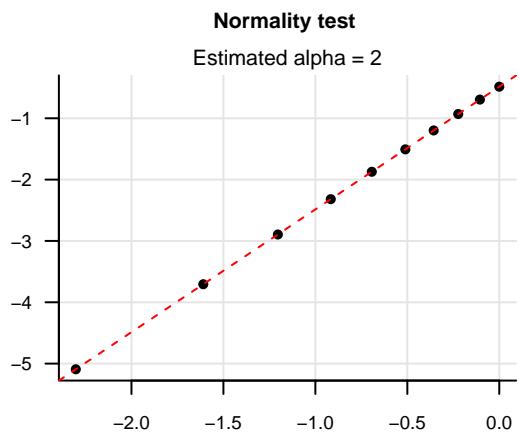
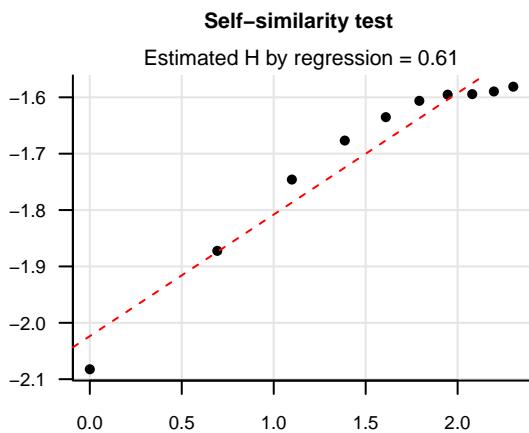
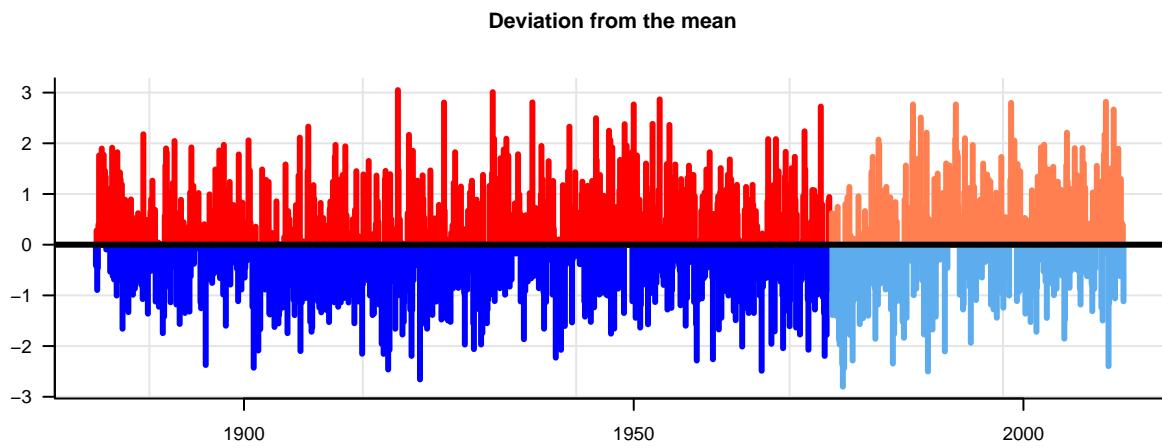
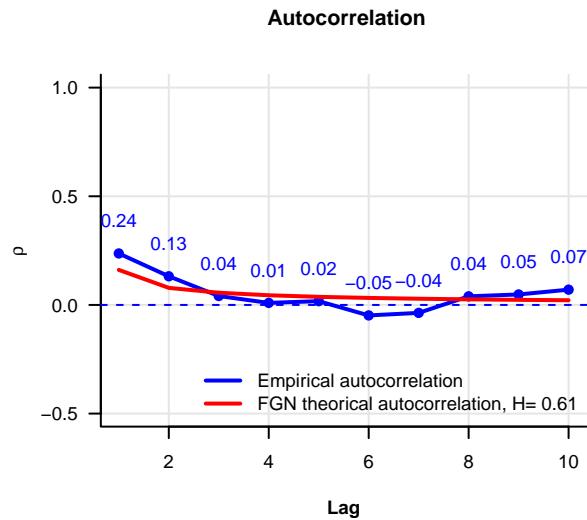
USA, Galveston



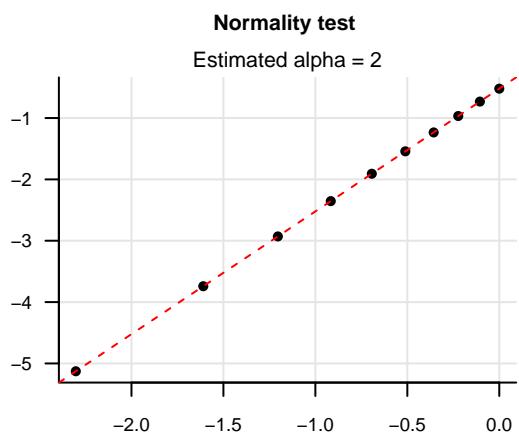
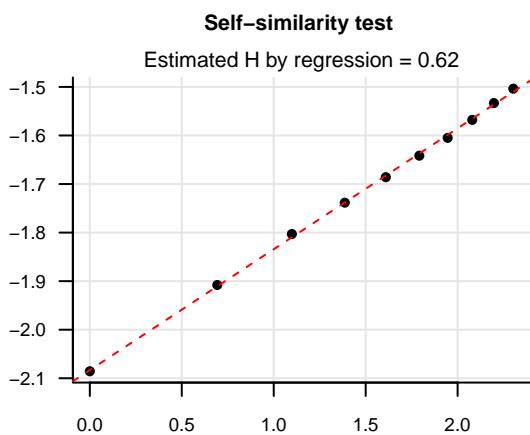
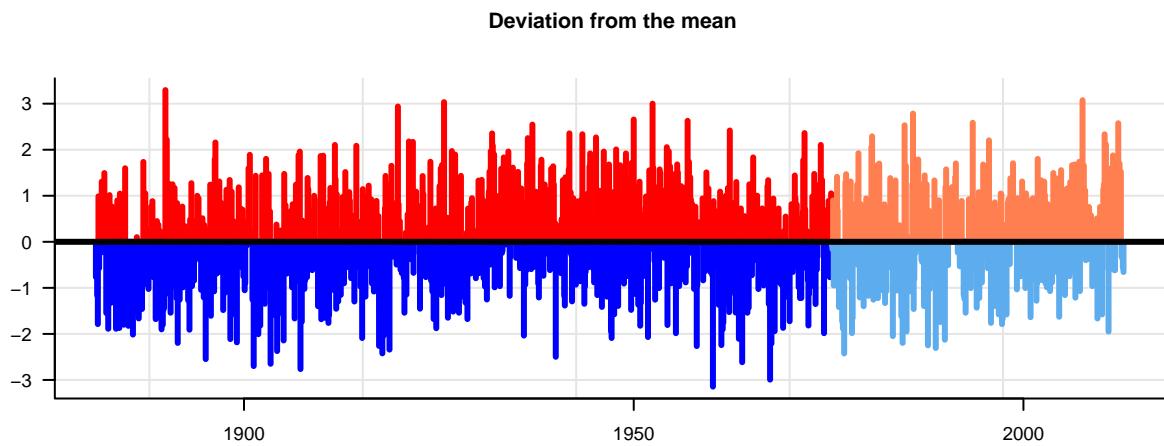
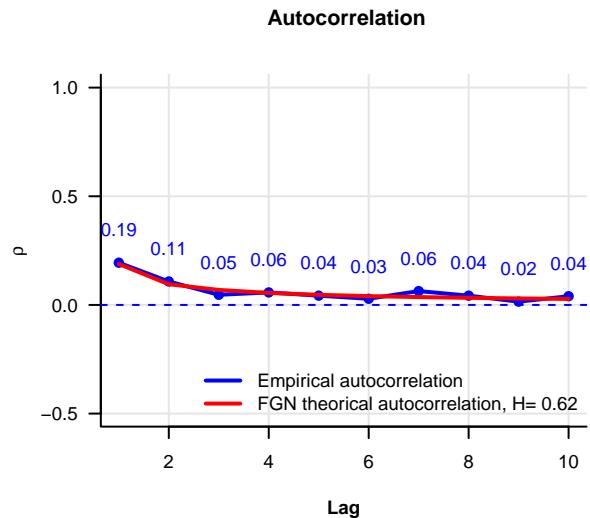
USA, Indianapolis



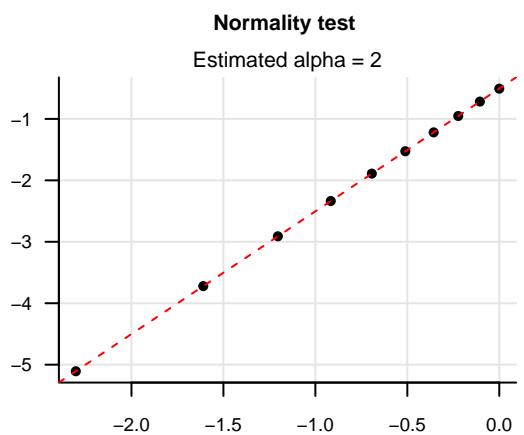
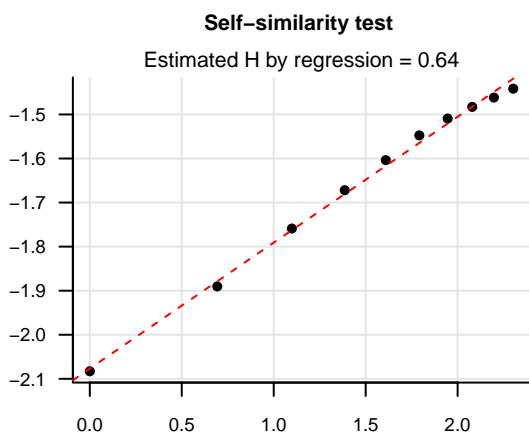
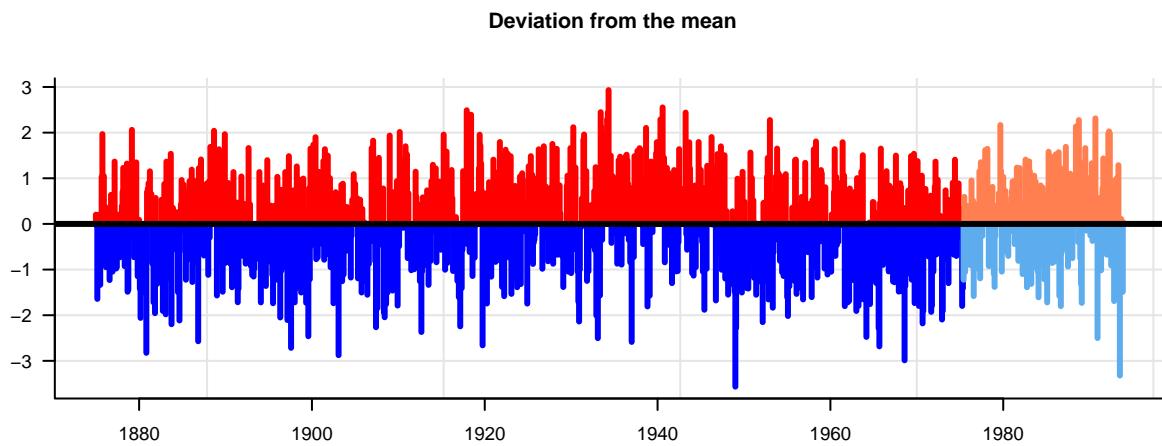
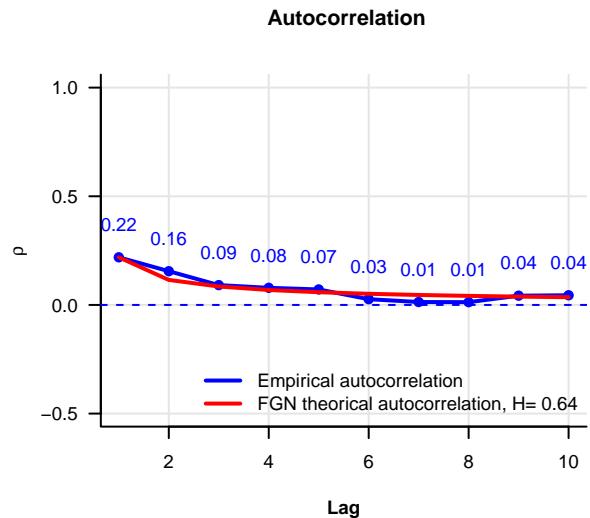
USA, Jacksonville



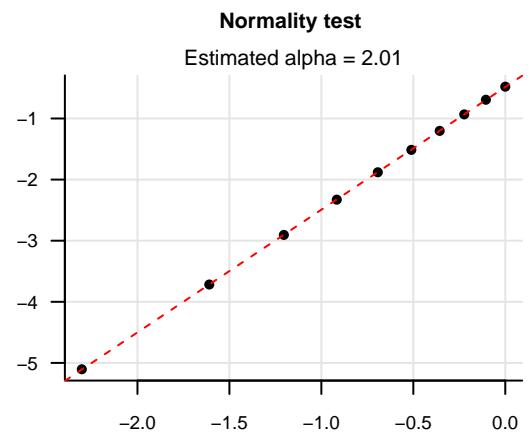
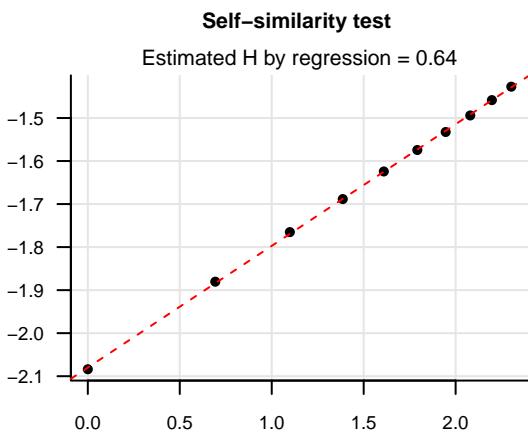
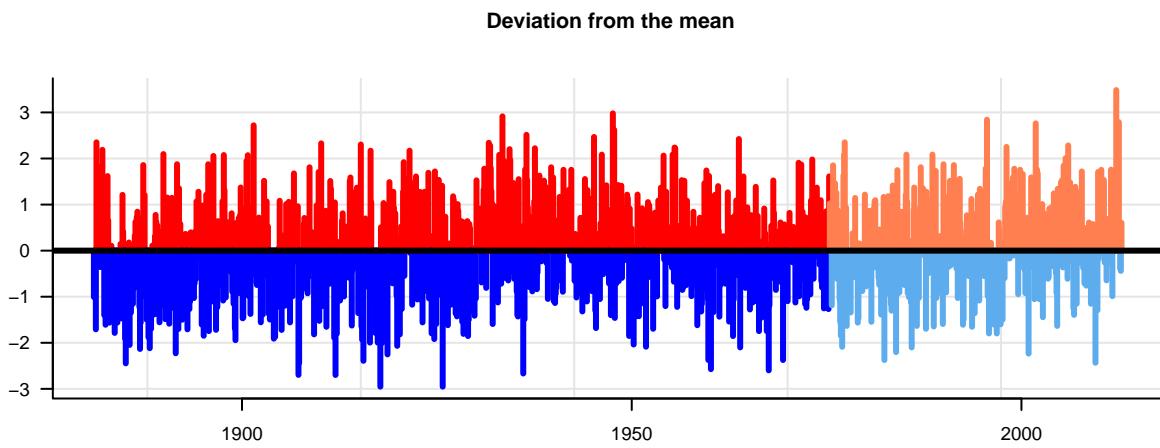
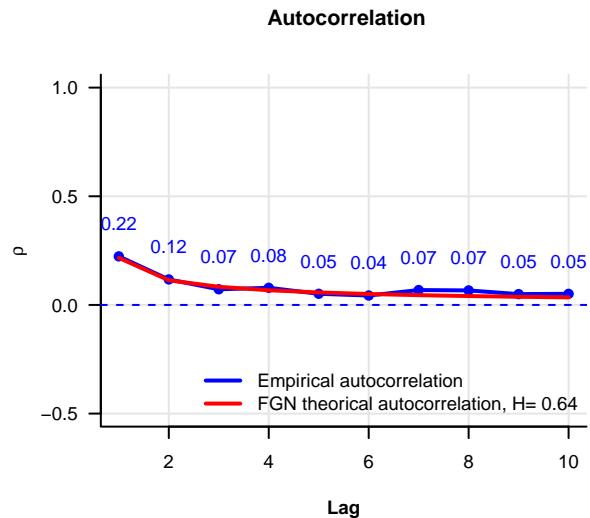
USA, Knoxville



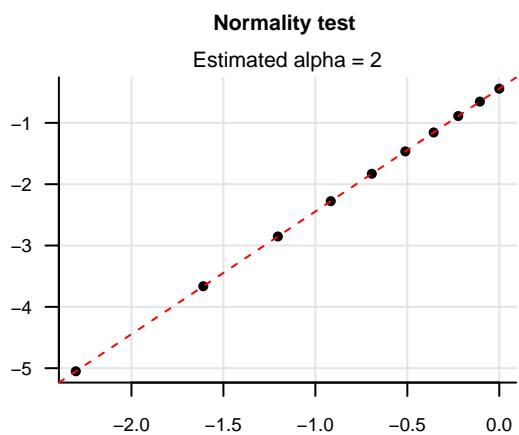
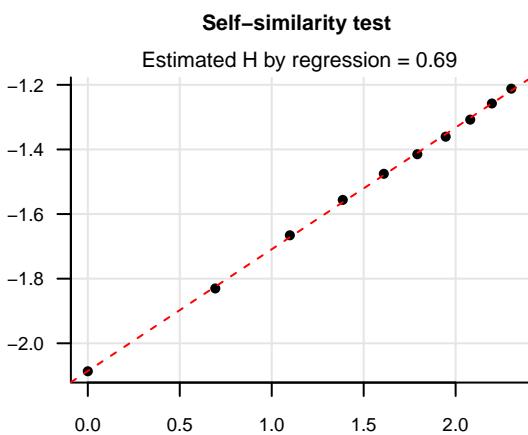
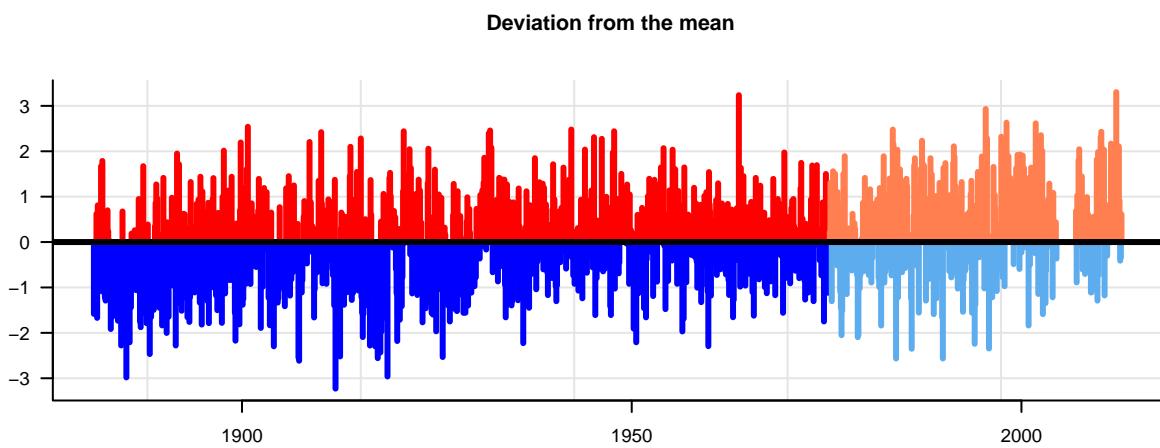
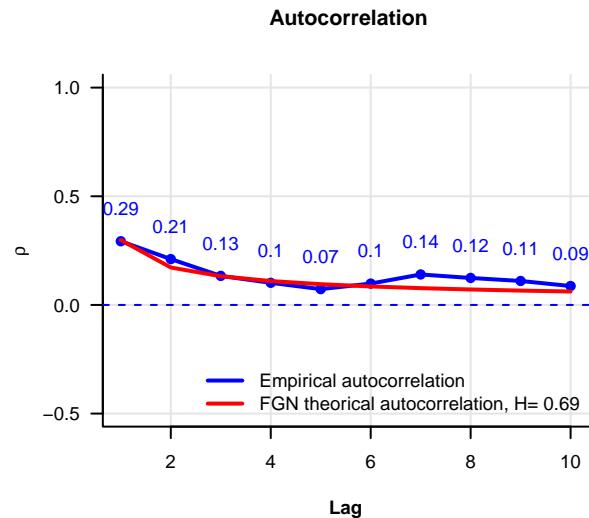
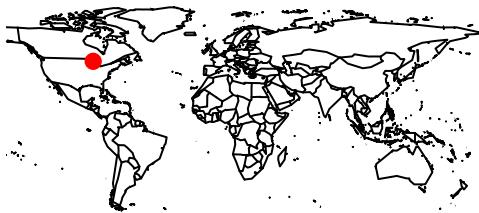
USA, Las Vegas



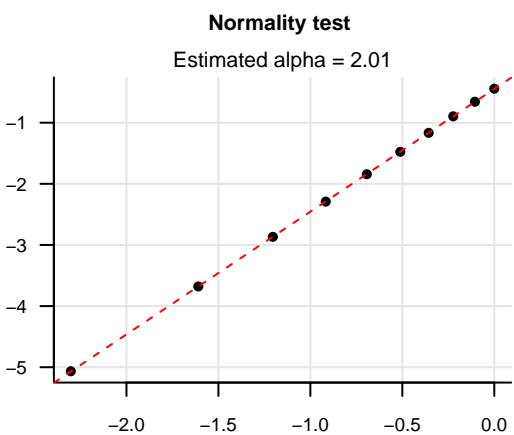
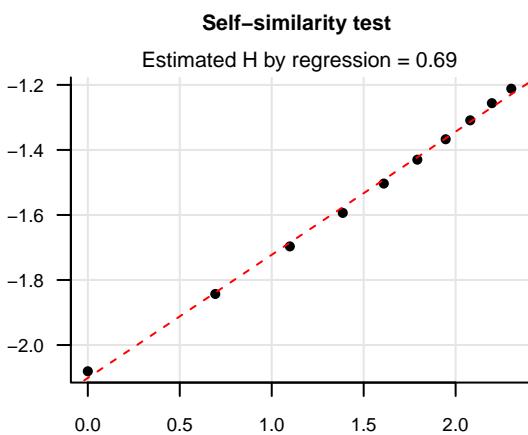
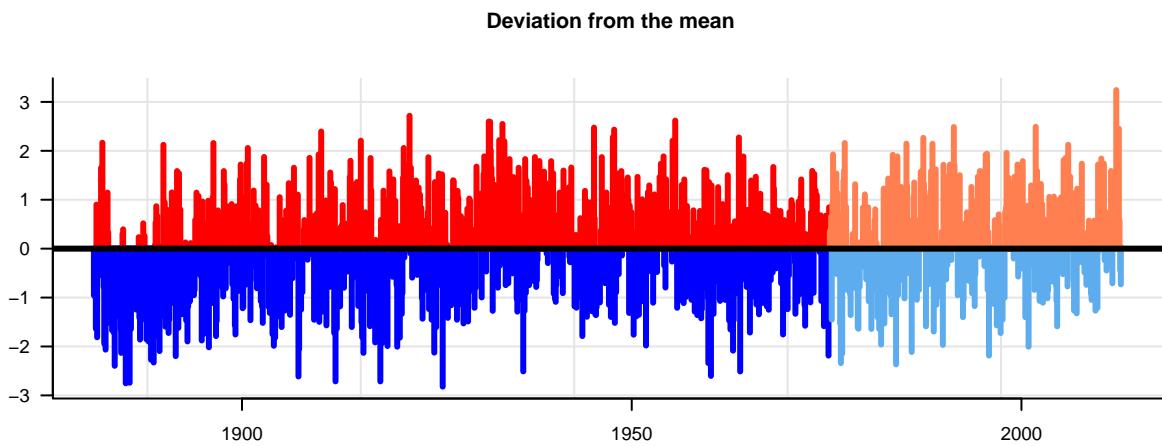
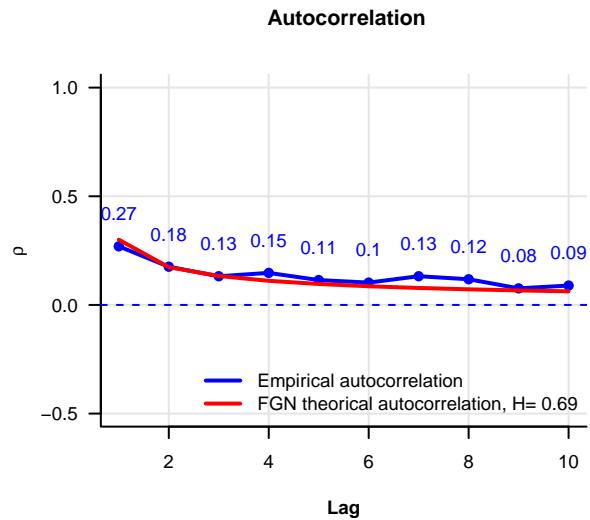
USA, Madison



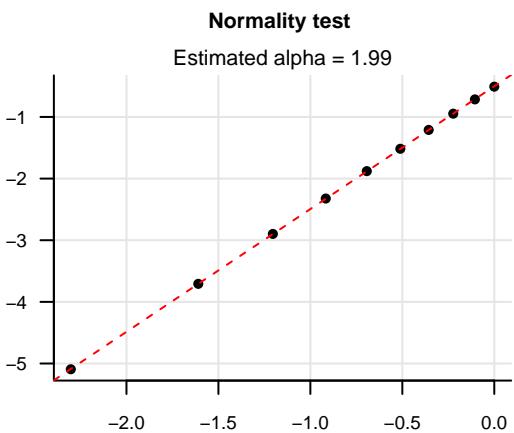
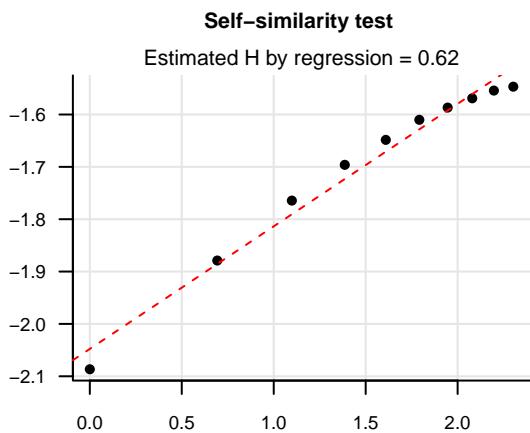
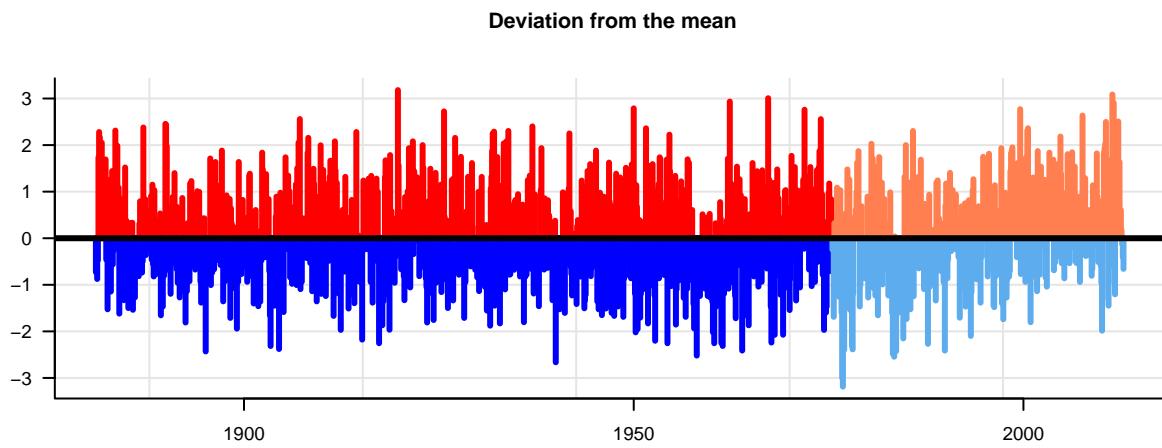
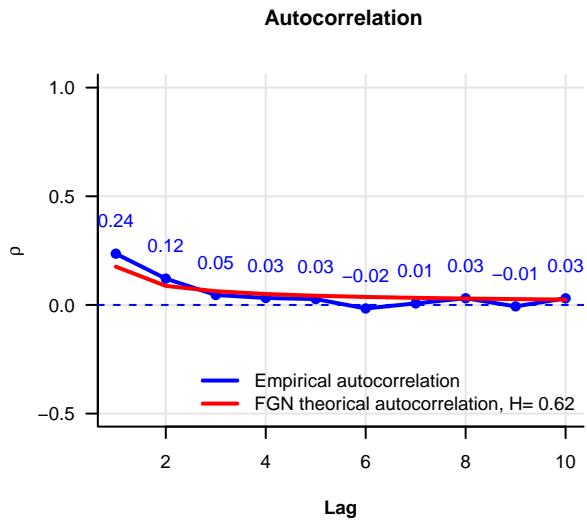
USA, Marquette



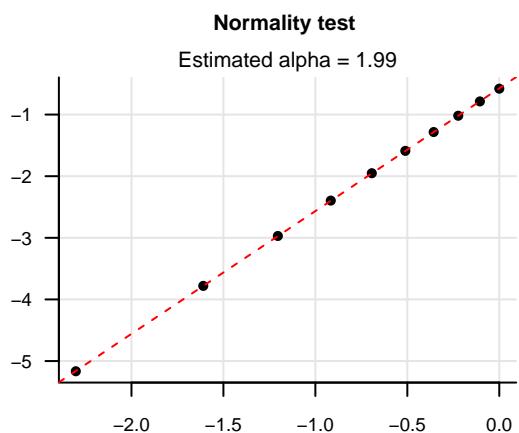
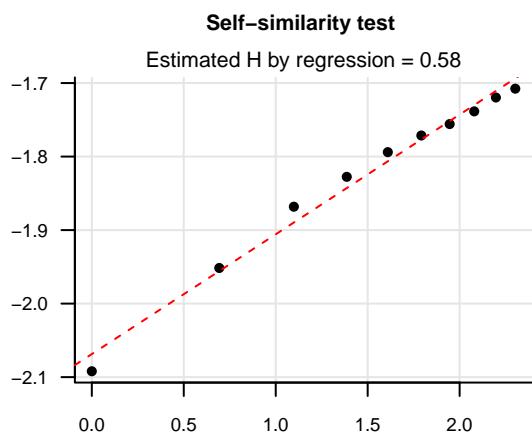
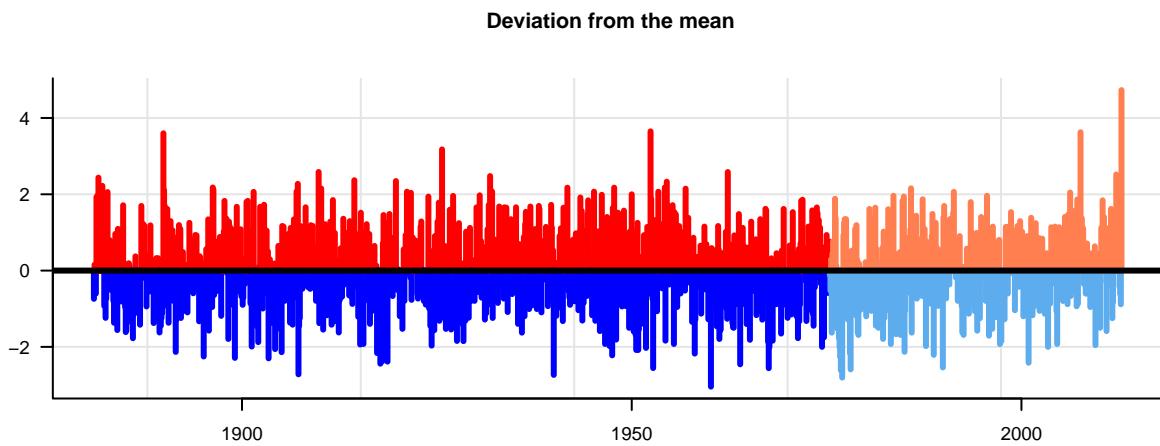
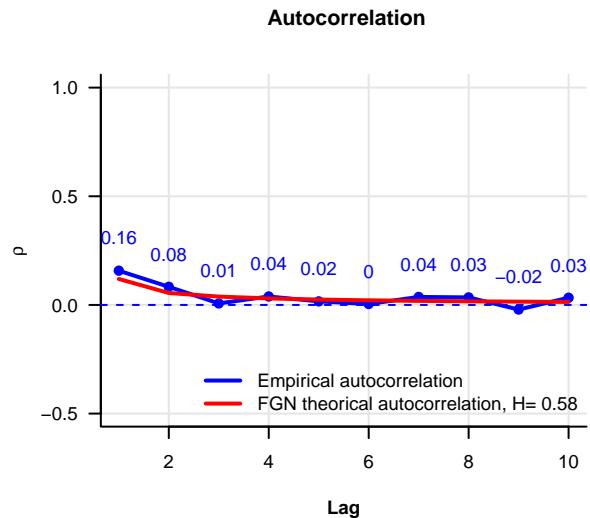
USA, Milwaukee



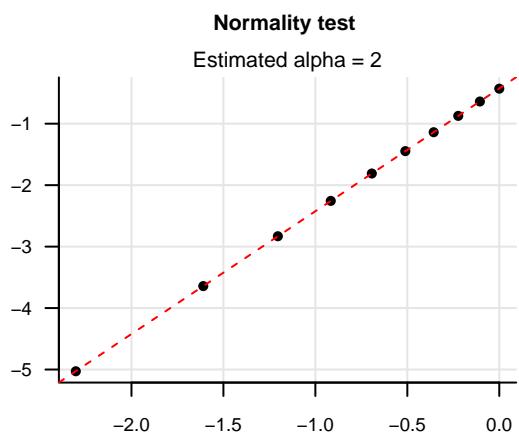
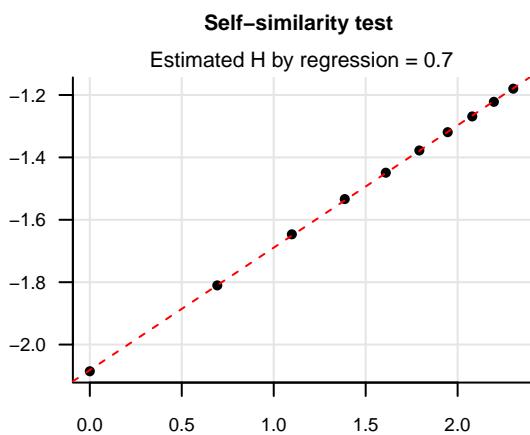
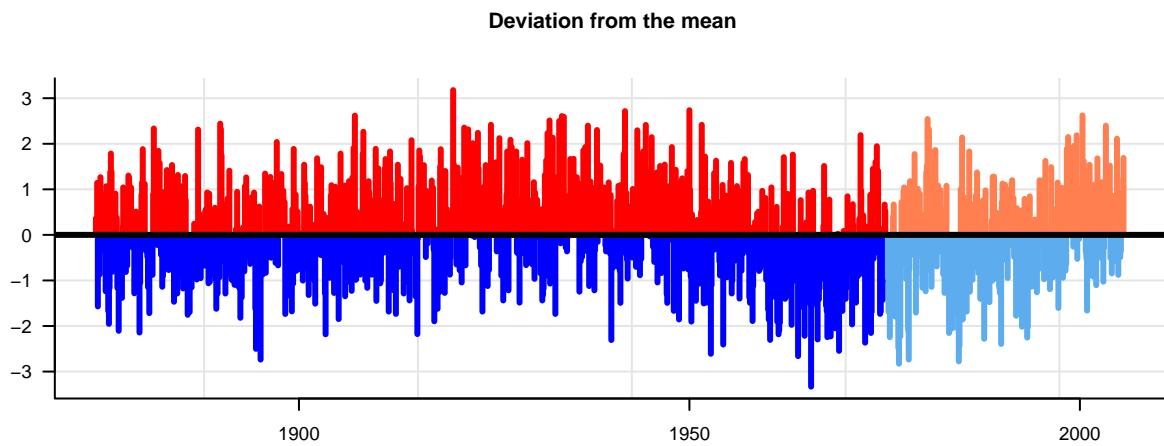
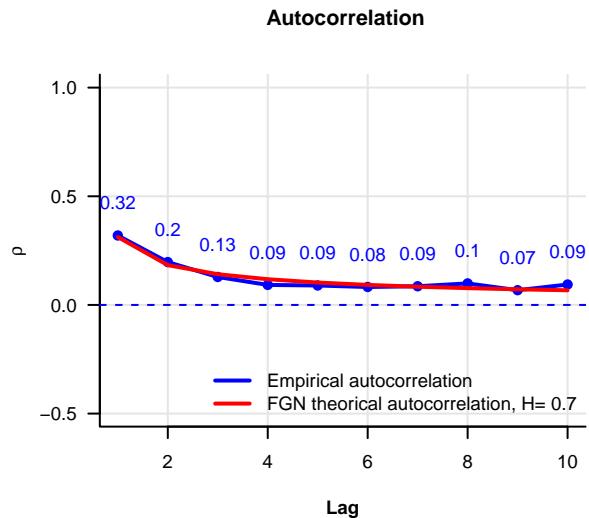
USA, Mobile



USA, Nashville



USA, New Orleans



USA, New York

