ARMA-GARCH

SHIHENG SHEN

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1 Temperature Model

1.1 Objective

Build a robust time series model to forecast future temperature's interval.

1.2 Data Source

HadCRUT4 is a gridded dataset of global historical surface temperature anomalies relative to a 1961-1990 reference period. Data are available for each month since January 1850, on a 5 degree grid. `http://www.metoffice.gov.uk/hadobs/hadcrut4/data/current/time_series/HadCRUT.4.5.0.0.monthly_ns_avg.txt`.

1.3 Data adjustment

From the shown url, grab the monthly global mean of temperature anomalies from 1850-2016, which amounts to a length of 2004. Using decompose() function in R to get the adjusted value.(See appendix)

1.4 Road Map

We went through a lot of difficulties during the construction of a proper model. Below is the basic idea I've thinked about.

- Dealing with Statonarity: diff() or time trend?
- Dealing with stochastic volatility: taking logarithm or exclude some data or both? Stochastic volatility model?
- Choosing model: ARIMA or ARFIMA or ARMA-sGARCH or ARMA-eGARCH or ARFIMA-sGARCH or ARFIMA-eGARCH?

2 Appendix

2.1 R Code

2.1.1 Data Adjustment

```
library(curl)
tmpf <- tempfile()
curl_download(url, tmpf)
gtemp <- read.table(tmpf)[, 1:2]
temp = gtemp$V2[1:2004]
library(TSA)
myTS = ts(as.numeric(temp), start = c(1850, 1), frequency = 12)
myTS.additive = decompose(myTS)
myTS.adjusted = myTS.additive$x - myTS.additive$seasonal
```

2.2 Figures

2.3 Details about *decompose()* used in seasonal adjustment

Type 'decompose' in R console, we can see the source code of this function. The process of 'type = additive' is listed below:

- the argument passed into decompose() is a 'ts' object
- denote the argument ts(x, frequency = f). Create a filter using: filter = c(0.5, rep(1, f - 1), 0.5)/f.
- trend = filter(x, filter)
- season = x - trend, then compute f means of season with interval length f, the f means denoted by figure. Adjusting figure figure = figure - mean(figure)
- seasonal is just length(x)/f times repetition of figure.
- random = x - seasonal - trend