Mammoth snow depth

A Time Series Analysis

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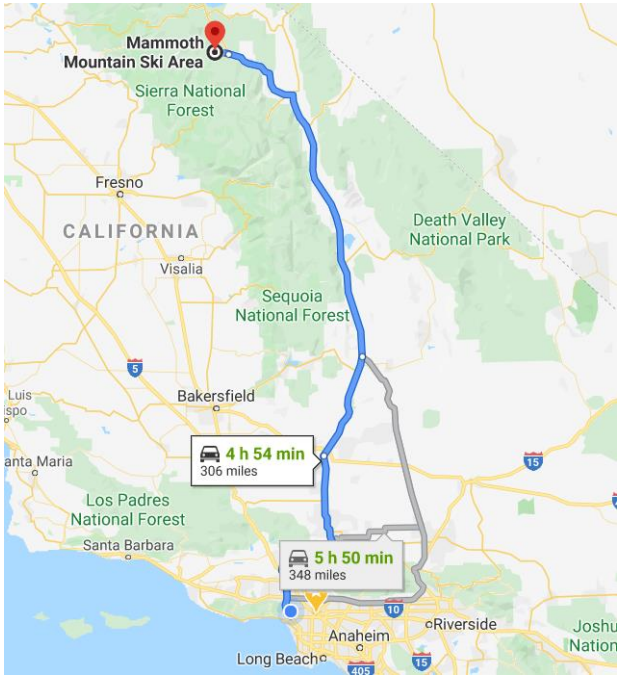
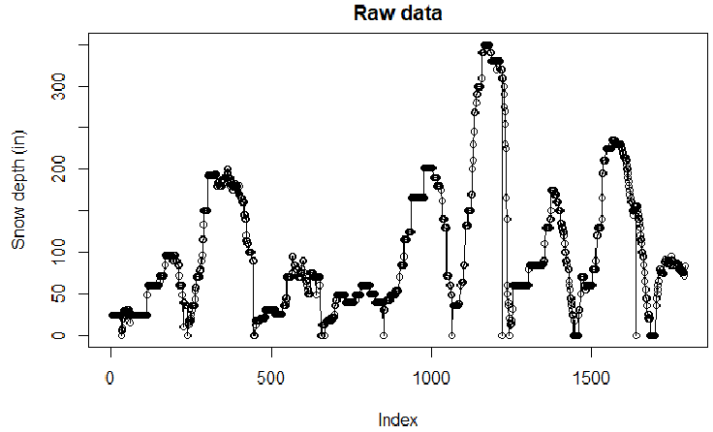
Mammouth mountain



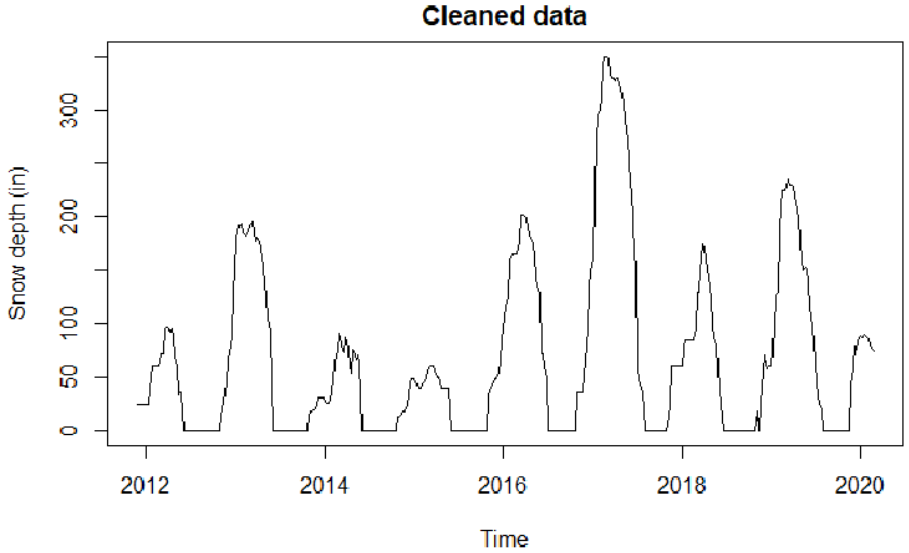
Dataset

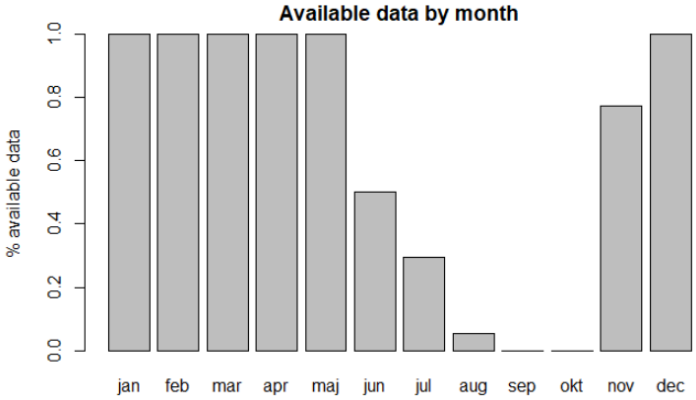
- Snow depth data from Mammoth website (Main lodge)
- Collected by https://www.onthesnow.com/california/mammoth-mountain-ski-area/historical-snowfall.html
- Problem with missing data
  - During off season and missing measurements



Data cleaning

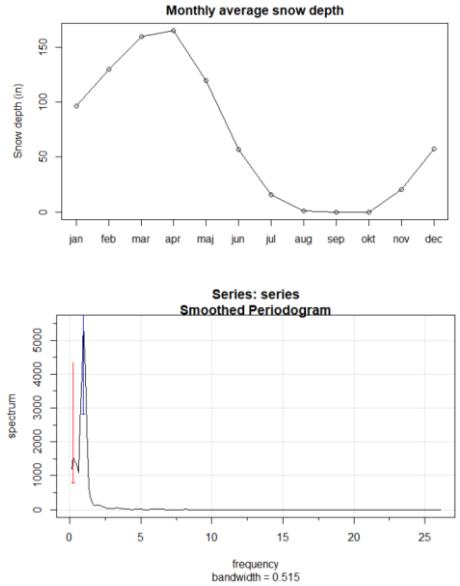
- Weekly average
- Fill 0s in missing values

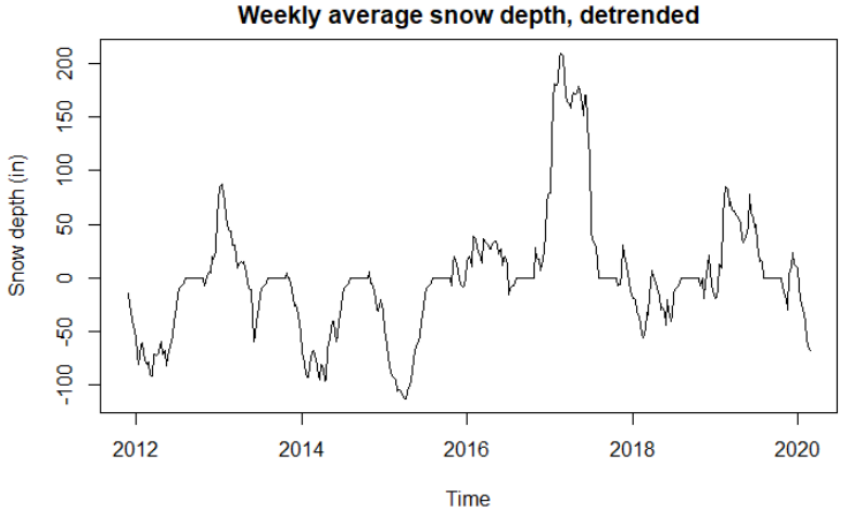




Detrending

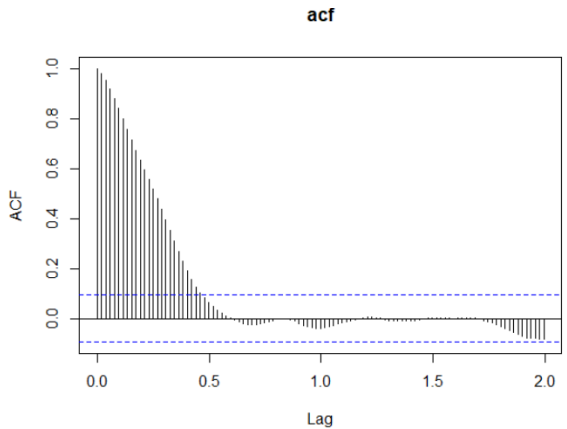
- Clear and obvious yearly trend (additional 4 year trend)
- Detrend as depth – weekly_average(depth)

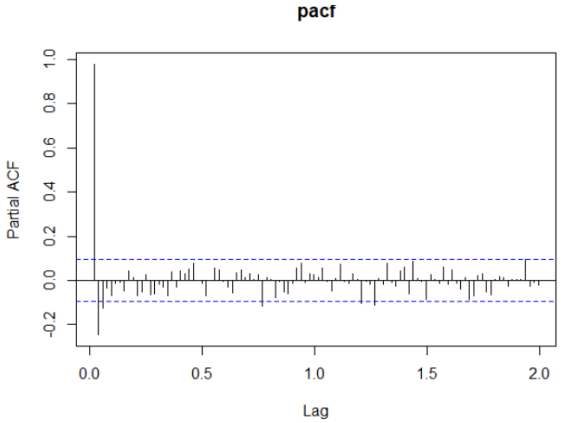


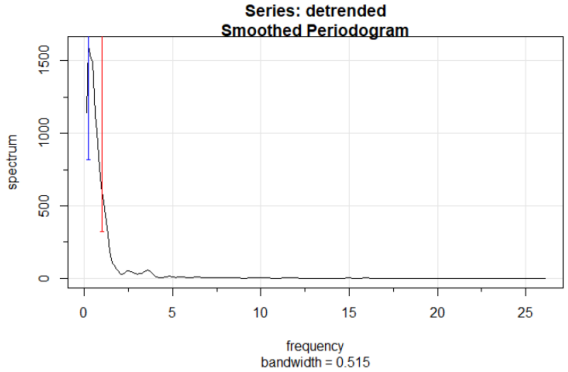


Detrended series properties

- Looks like AR(1)
- No yearly peak in periodogram







Model fitting

- Best model ARMA(1,1,1) according to AIC
- All terms significant
- High sigma^2 estimate: 108.4

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Coefficients:
          ar1      ma1
      0.6526  -0.4252
s.e.  0.1127   0.1340

sigma^2 estimated as 108.4:  log likelihood = -1617.6,  aic = 3241.2
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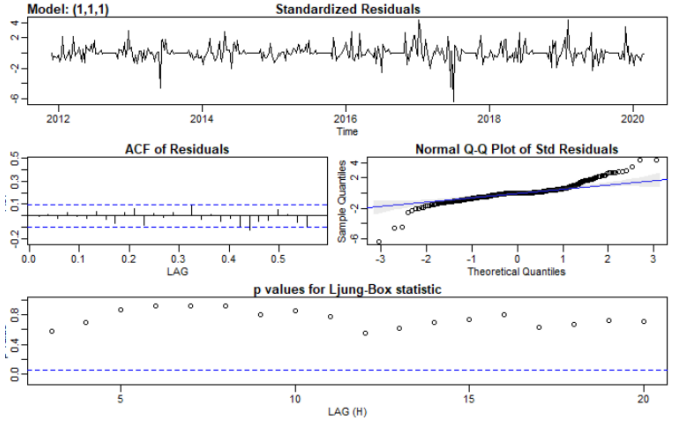
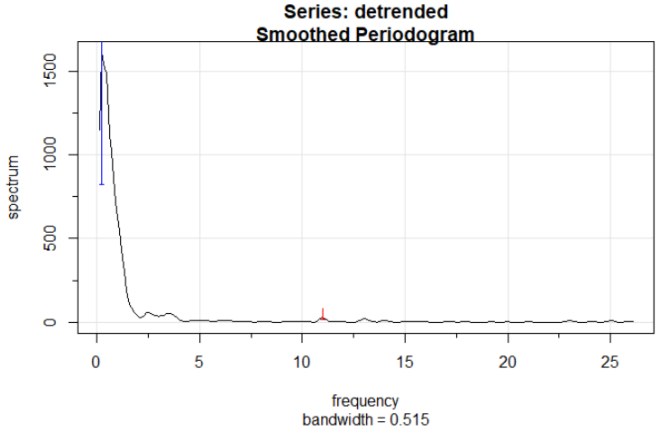
Residuals and smoothness

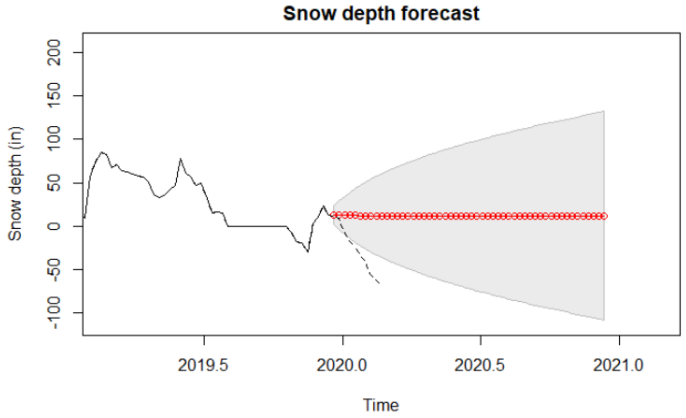
- Residuals doesn’t meet assumptions
  - Big non-normal residuals
  - ACF and Ljung-Box OK
- Low frequency variance
  - Smooth, however big jumps

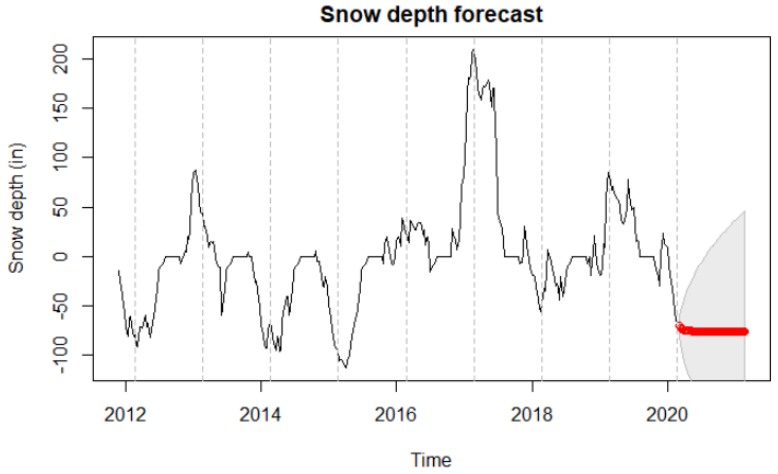




Prediction

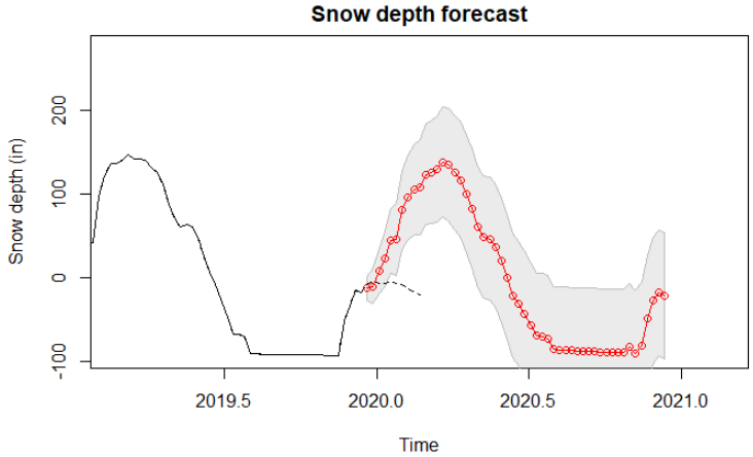
- Predicting snow depth continue according to seasonal trend
- Big standard errors, not predicting last 5 weeks





Prediction different model

- Linear detrending, ARMA(2,0,1)x(1,1,0)[52]
- Better Ljung-Box and residual ACF, high variance
- Predicts snow will increase

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Coefficients:
         ar1      ar2      ma1     sar1
      1.7950  -0.8071  -0.6263  -0.404
s.e.  0.0777   0.0759   0.1039   0.049

sigma^2 estimated as 187.9:  log likelihood = -1536.44,  aic = 3082.89
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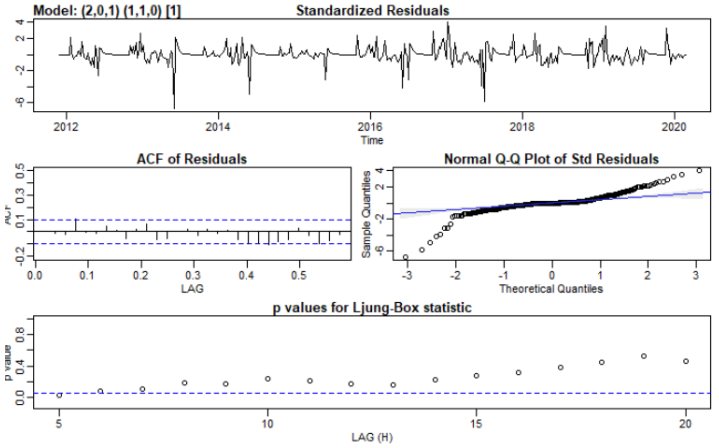
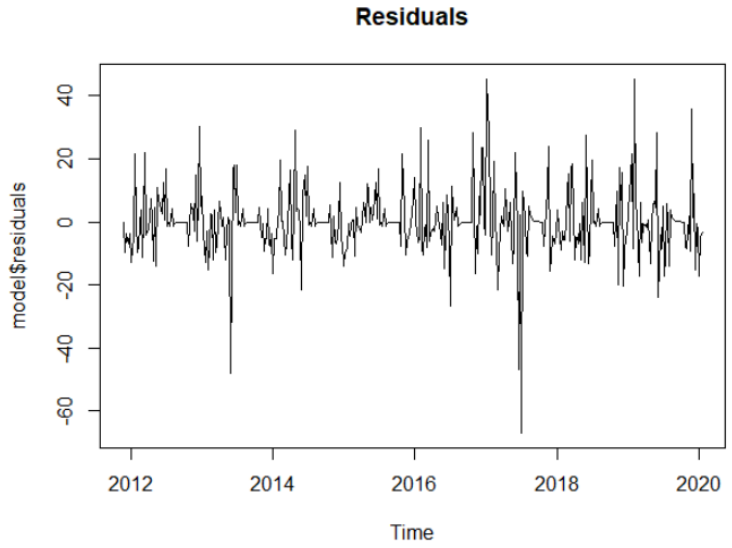


Next steps

- More transformations on data
  - E.g. log, removing trend
- Other weather predicting features
  - E.g. radar, temperature
- Other models
  - GARCH, varying variance?



Questions?