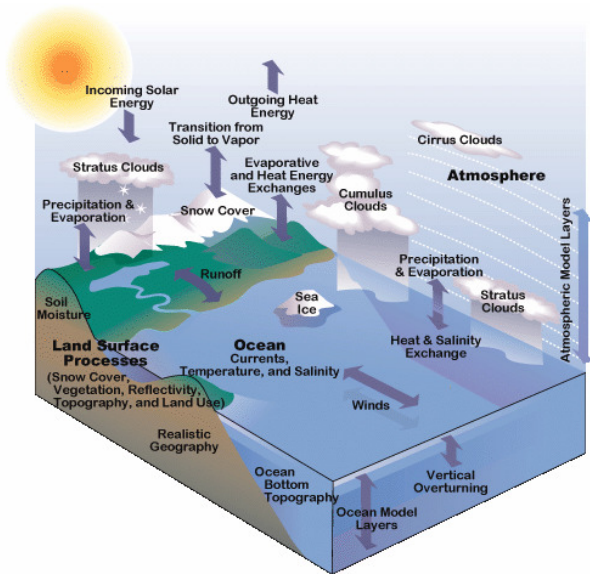


Tree cover variability increases from 2005 to 2100 in Sub-Saharan Africa

Eric Kalosa-Kenyon, Cody Carroll, Amy Kim

University of California, Davis

Introduction: climate system



<https://www.ucar.edu/communications/CCSM/overview.html>

Introduction: climate system modeling

- ▶ Climate change is driven by anthropogenic carbon forcing
- ▶ IPCC has developed representative carbon forcing trajectories
- ▶ Computer simulations are run predicated on particular forcing pathways
- ▶ These simulations are realizations of gridded meteorological PDEs

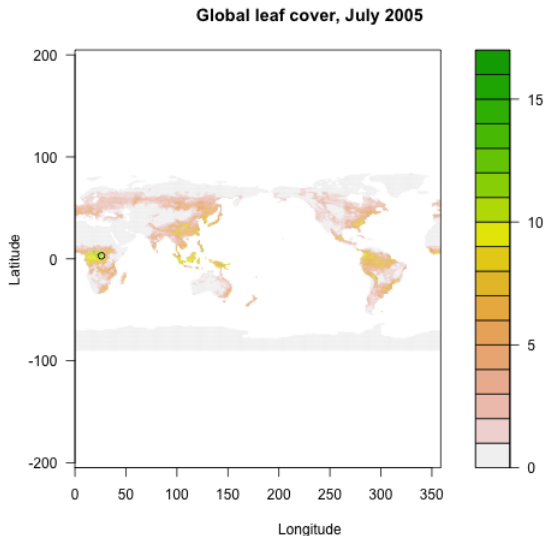


Introduction: climate system modeling

- ▶ The Community Climate Model System has 5 components and a coupler: atmosphere, sea, land, sea ice, and land ice.
- ▶ We focus on the land system output from a single ensemble under the RCP4.5 experiment.
- ▶ $\theta \in \Theta, \{X_t | t \in \mathbb{Z}\}$ where $X_t \sim \text{ARMA}_\theta$

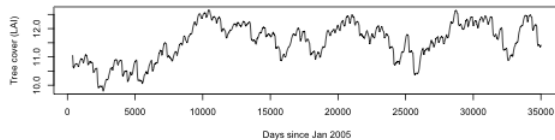
Introduction: leaf area index (LAI)

- ▶ LAI is unitless quantity (leaf area (m^2))/(ground area (m^2))
- ▶ "Comparative Physiological Studies on the Growth of Field Crops" Watson 1947 Annals of Botany
- ▶ Bounded below by 0, above by physiological limits
- ▶ We interrogate a location in a tropical rainforest

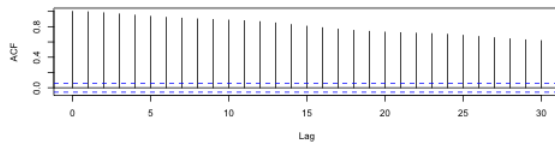


Raw data

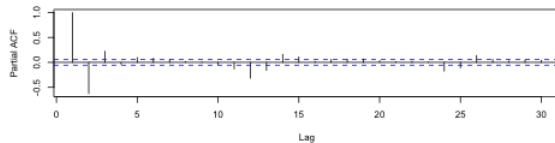
Sub-Saharan Africa, 2005-2100



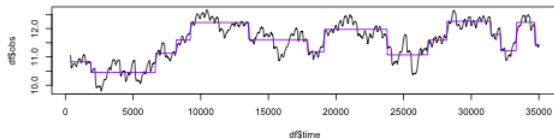
Raw data (ACF)



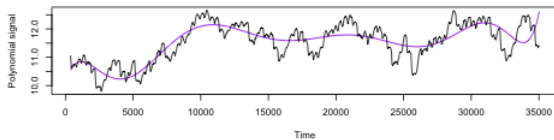
Raw data (PACF)



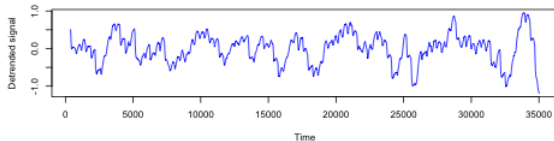
Detrended data



Polynomial trend (poly.degree=10)

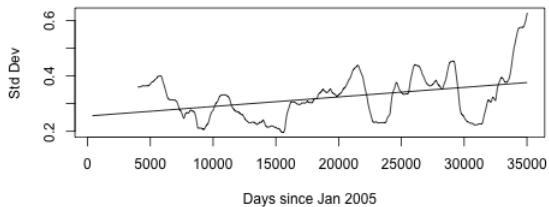


Detrended

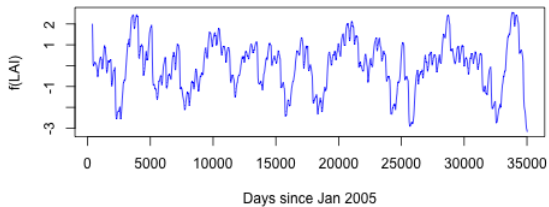


Standardize variance

Running standard deviation 10 year window

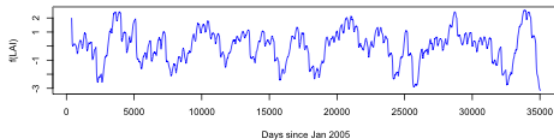


Detrended obsv with standardized StDev

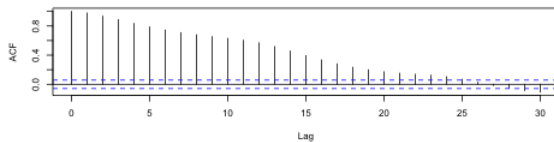


Standardized variance

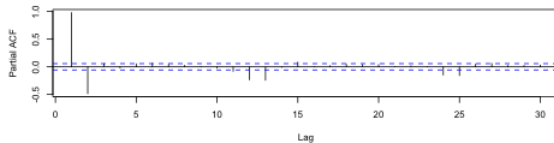
Detrended obsv with standardized StDev



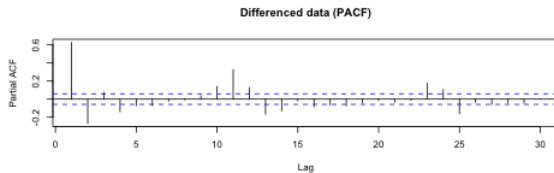
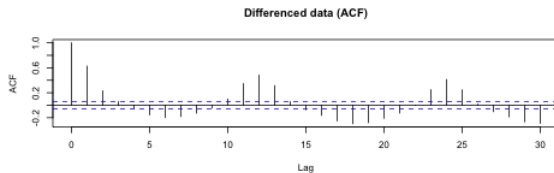
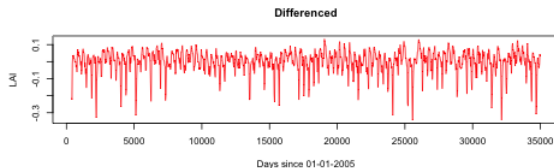
Detrended data (ACF)



Detrended data (PACF)



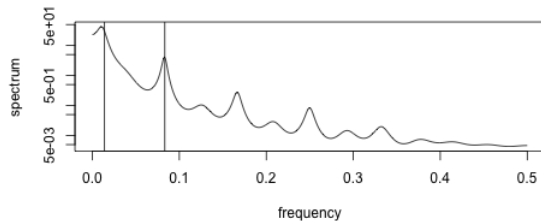
Differenced data



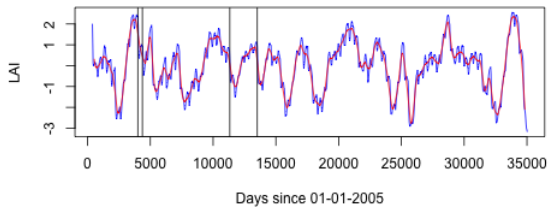
Perhaps we need to deseason the data before differencing to find stationarity.

Deseasonized data

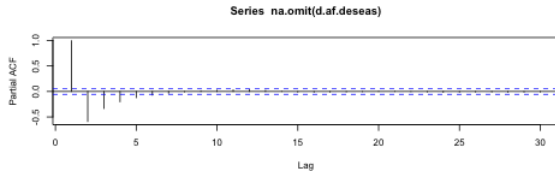
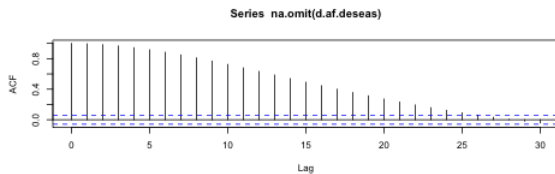
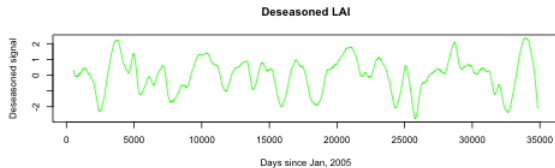
Spectrum of AR(27) ~ detrended



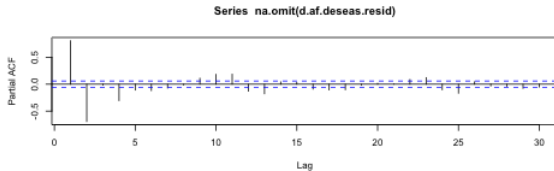
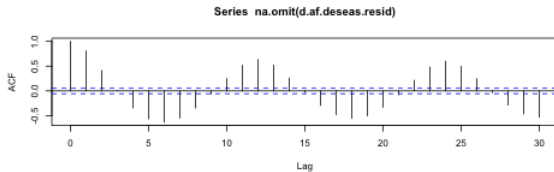
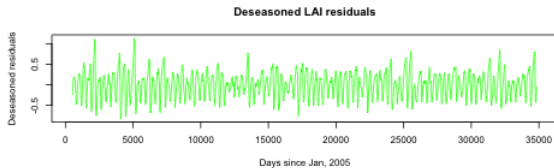
Moving average seasonality (filter.width=1yr)



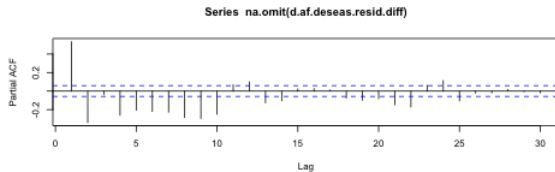
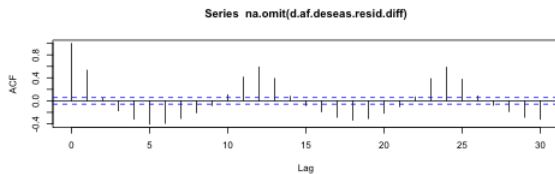
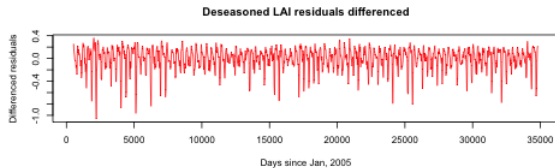
Deseasonized data



Deseasonized data

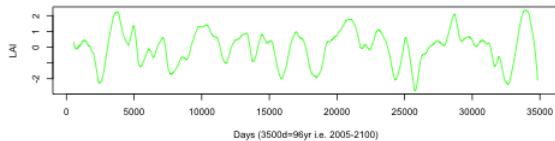


Deseasonized data

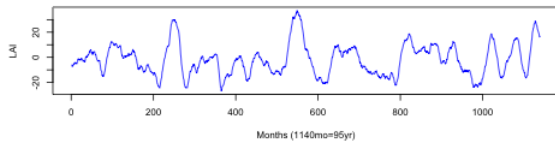


AR(4)

Deseasoned data



Simulated from AR(4) - deseasoned



Spectral density of AR(4)

