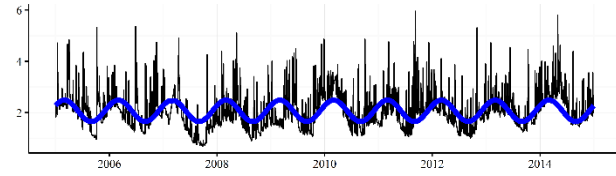


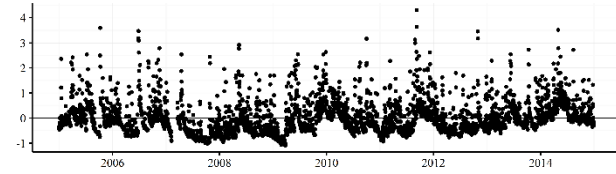
1a) Observed flow record, used to represent seasonal model

$$\ln Q = Q_{seas}$$



1b) Estimate stationary seasonal model of flow

$$\hat{Q}_{seas} = \beta_0 + \beta_1 \sin(2\pi T) + \beta_2 \cos(2\pi T)$$



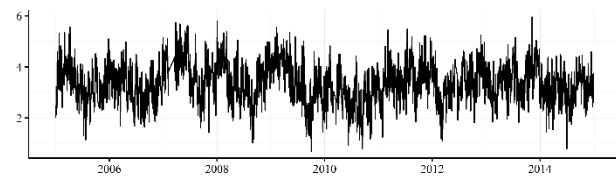
1c) Seasonal residuals of flow

$$\varepsilon_Q = Q_{seas} - \hat{Q}_{seas}$$



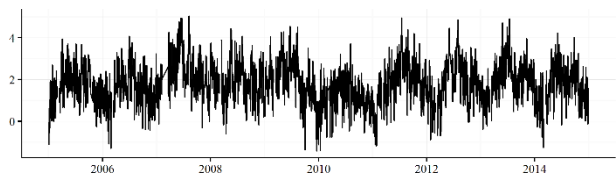
1d) Random errors based on ARMA(p, q) model of  $\varepsilon_Q$

$$\varepsilon_{Qsim} \sim \text{ARMA}(p, q)$$



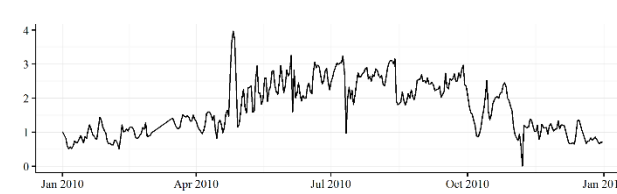
1e) Simulated flow time series, considered as  $Chl_{flo}$ , equal to seasonal component plus the s.d. of the seasonal residuals times random errors

$$Chl_{flo} = I(\hat{Q}_{seas} + \sigma_\varepsilon \cdot \varepsilon_{Qsim})$$



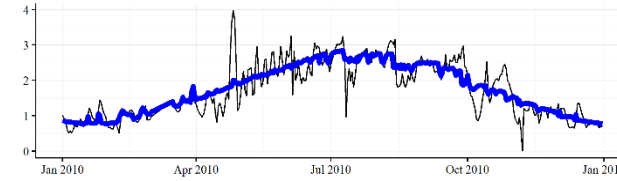
3) Observed chlorophyll as sum of biological and flow-related chlorophyll

$$Chl_{obs} = Chl_{flo} + Chl_{bio}$$



2a) One year chlorophyll time series to estimate seasonal model

$$Chl_{seas}$$



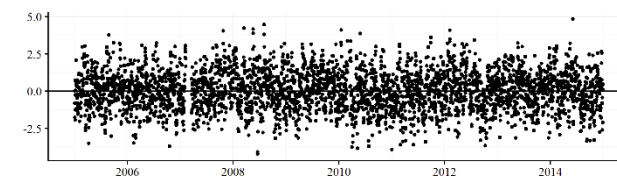
2b) Estimate seasonal model of chlorophyll with WRTDS

$$\widehat{Chl}_{seas} = \beta_0 + \beta_1 T + \beta_2 Q + \beta_3 \sin(2\pi T) + \beta_4 \cos(2\pi T)$$



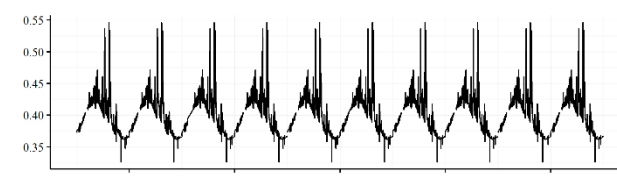
2c) Seasonal residuals of chlorophyll

$$\varepsilon_{chl} = Chl_{seas} - \widehat{Chl}_{seas}$$



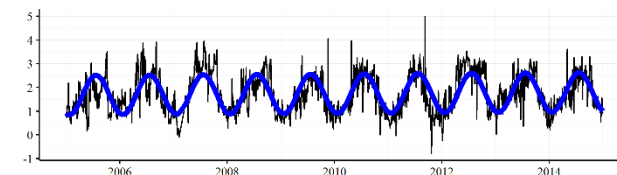
2d) Generate random errors for whole time series based on ARMA(p, q) model of  $\varepsilon_{chl}$

$$\varepsilon_{chl_{sim}} \sim \text{ARMA}(p, q)$$



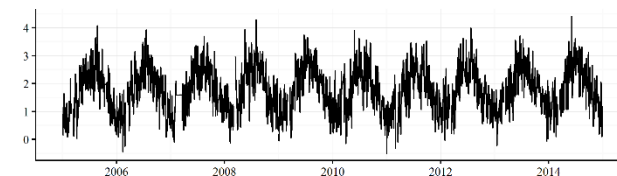
2e) Extend scale parameter from  $\widehat{Chl}_{seas}$  to whole time series

$$\sigma_{\widehat{Chl}_{seas}}$$



2f) Estimate complete model of chlorophyll with WRTDS, no weights

$$\widehat{Chl}_{seas} = \beta_0 + \beta_1 T + \beta_2 Q + \beta_3 \sin(2\pi T) + \beta_4 \cos(2\pi T)$$



2g) Estimate  $Chl_{bio}$  from seasonal component, errors, and scale parameters

$$Chl_{bio} = \widehat{Chl}_{seas} + \sigma_{\widehat{Chl}_{seas}} \cdot \varepsilon_{chl_{sim}}$$