

Detecting the human fingerprint on land-atmosphere carbon cycle coupling

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Office of
Science



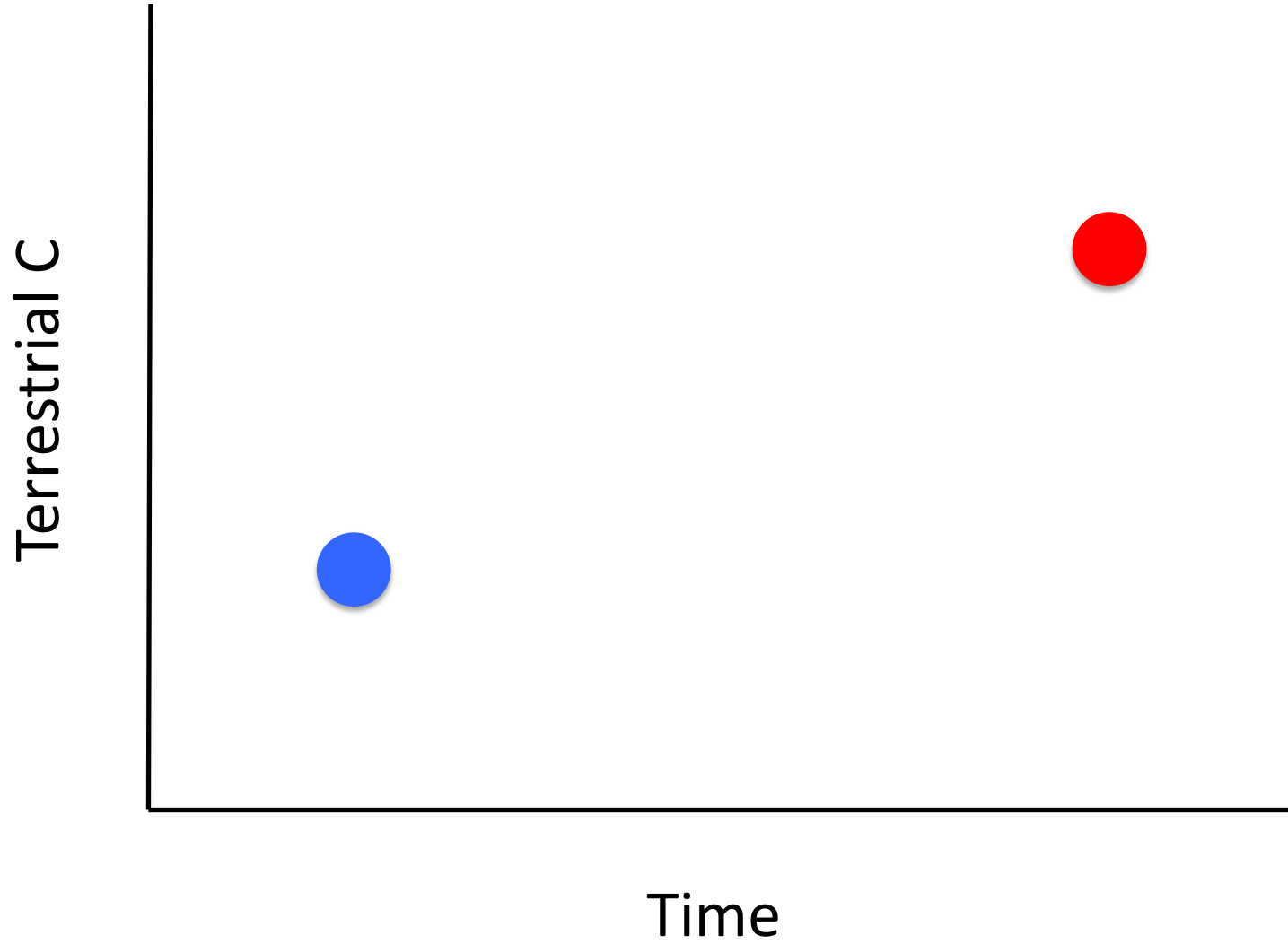
Detection

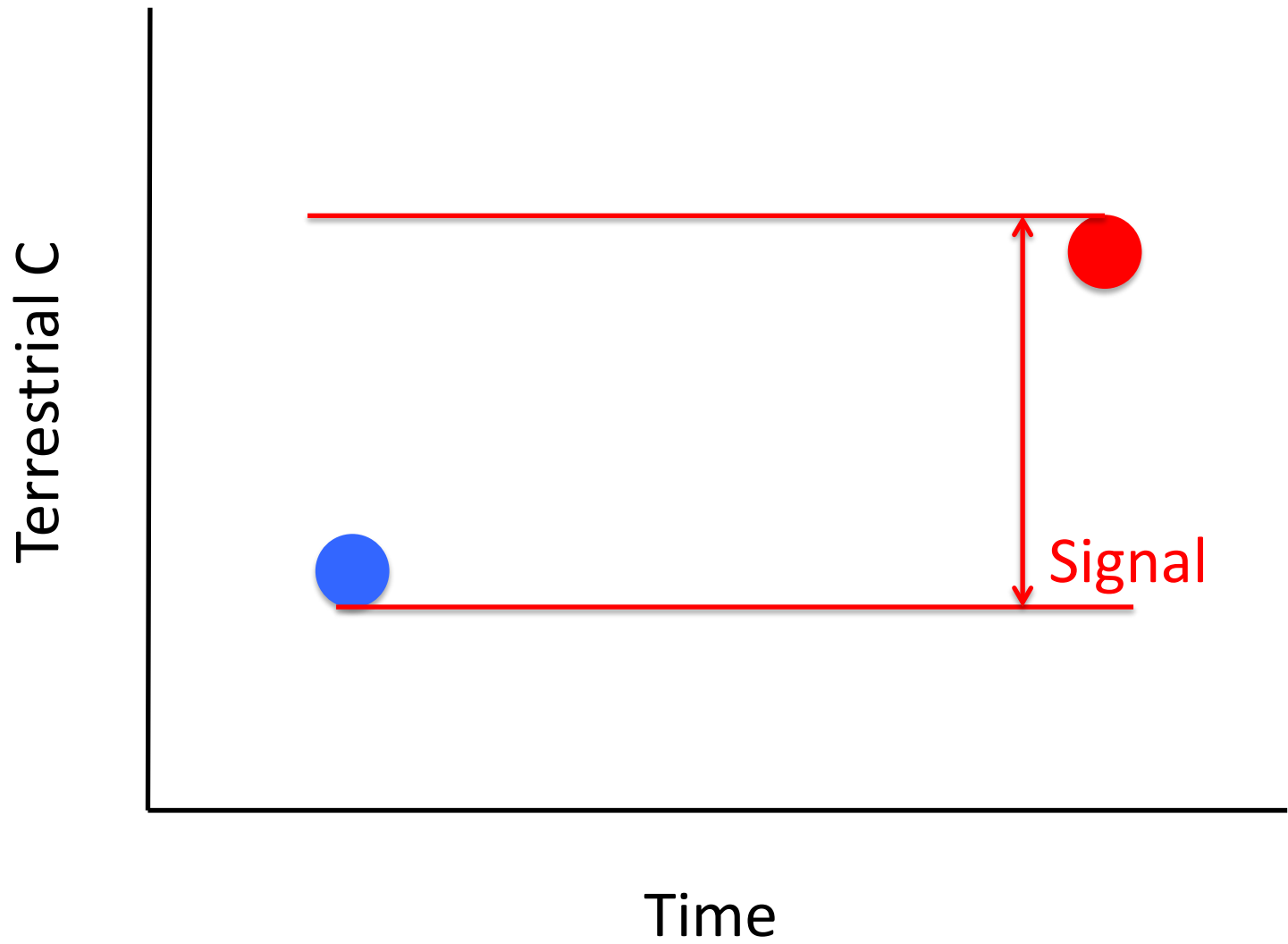
Time when the **change in a signal** is **larger than** the **natural variability**

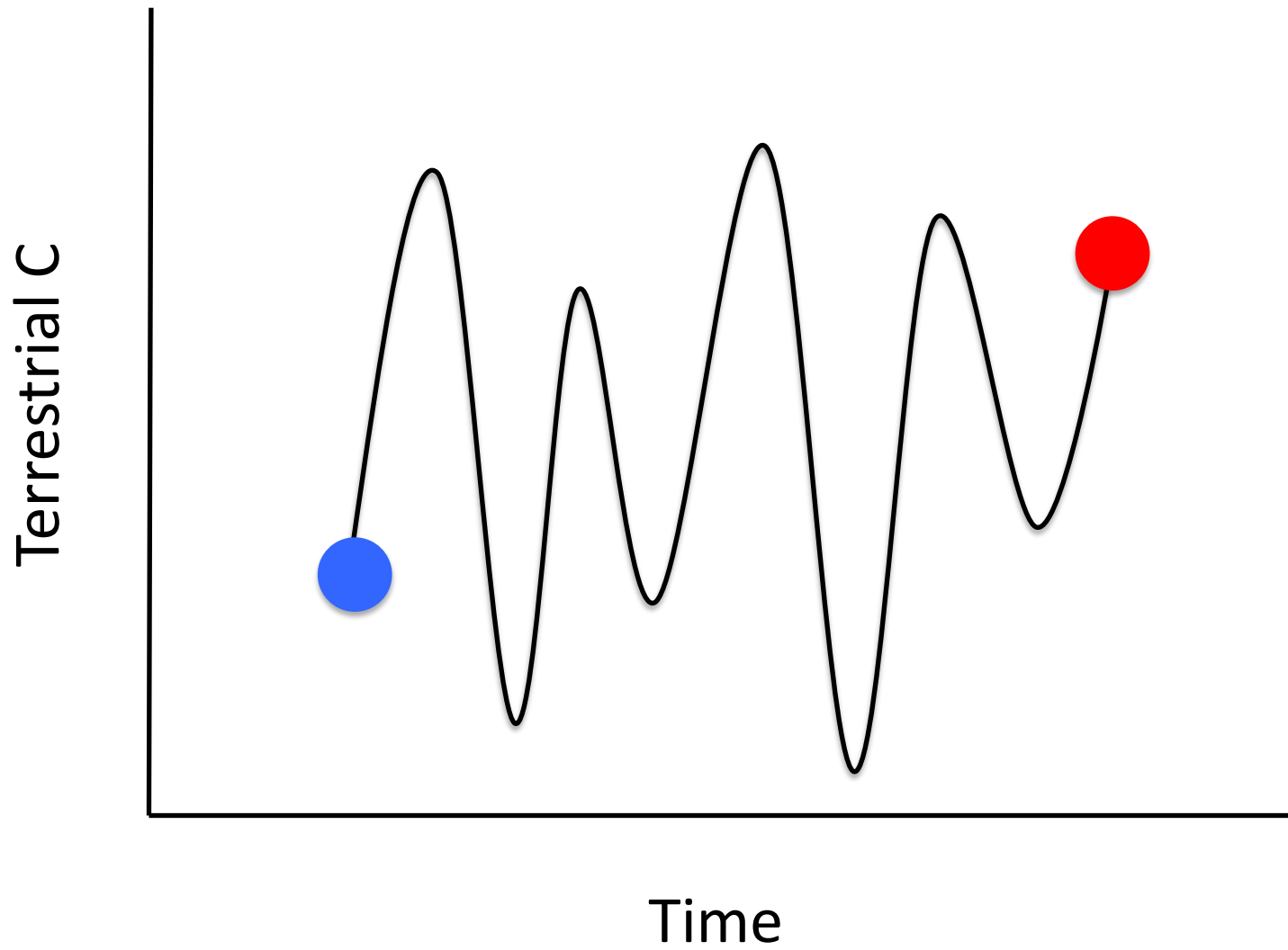
Terrestrial C

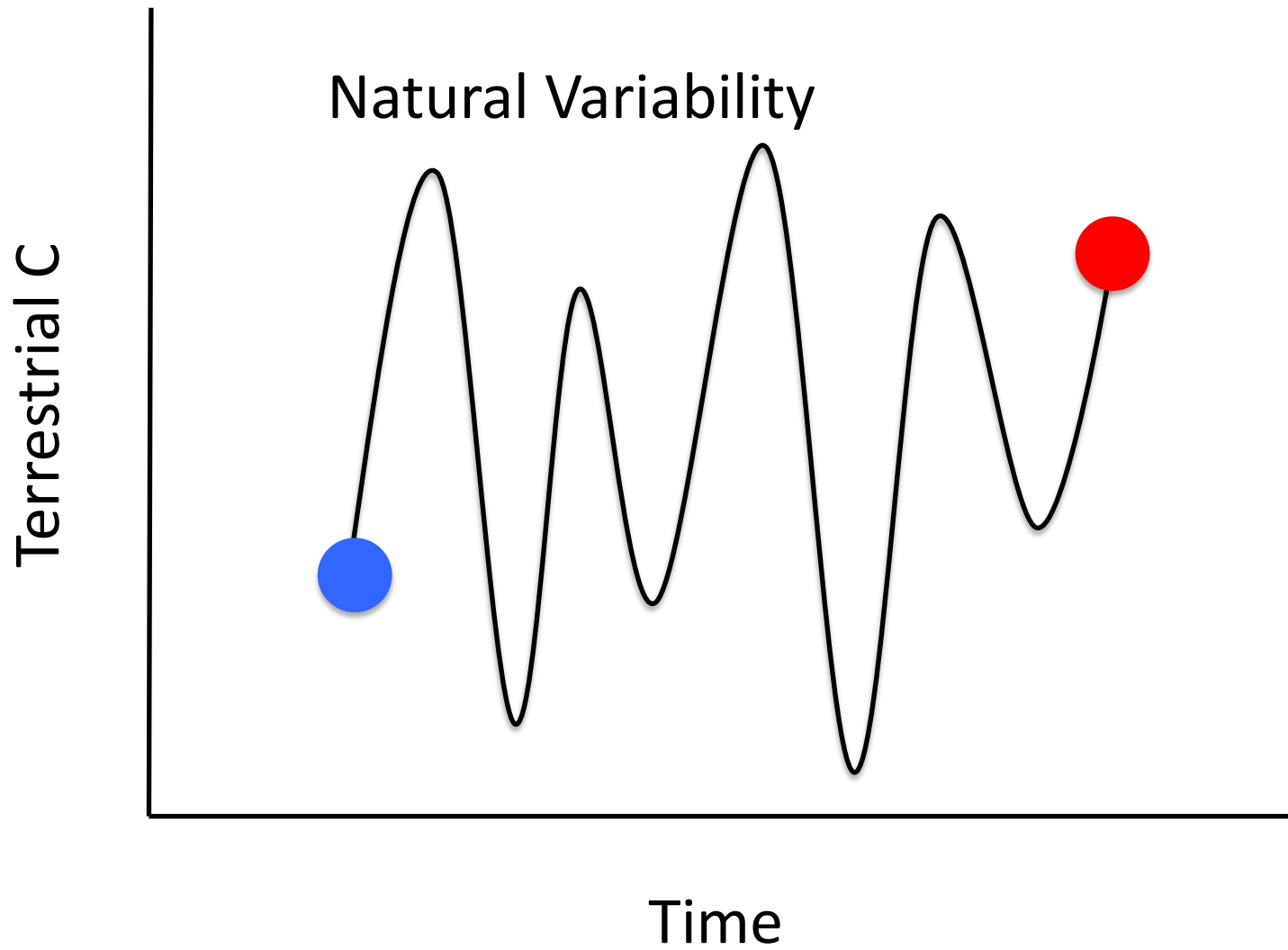


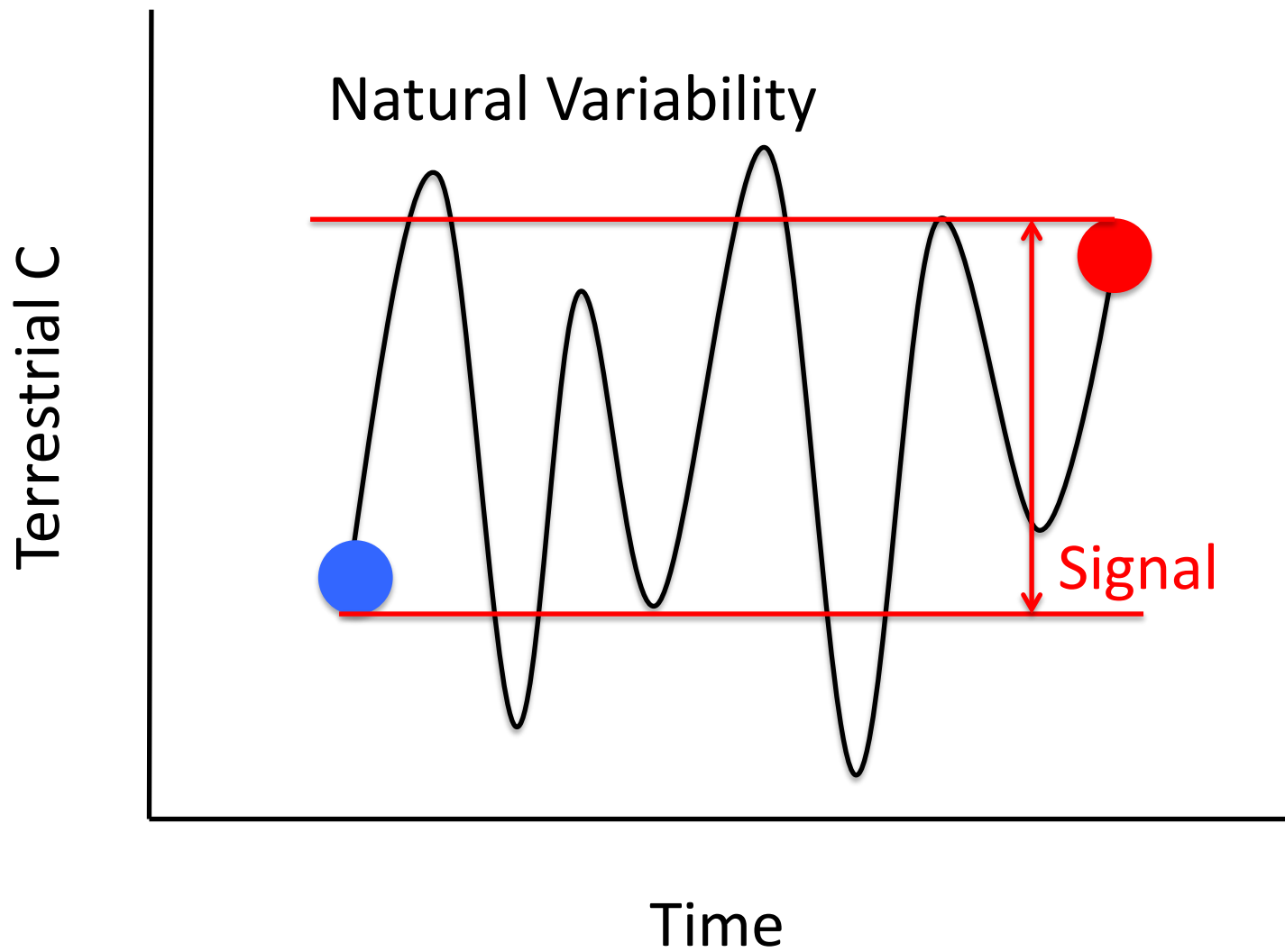
Time

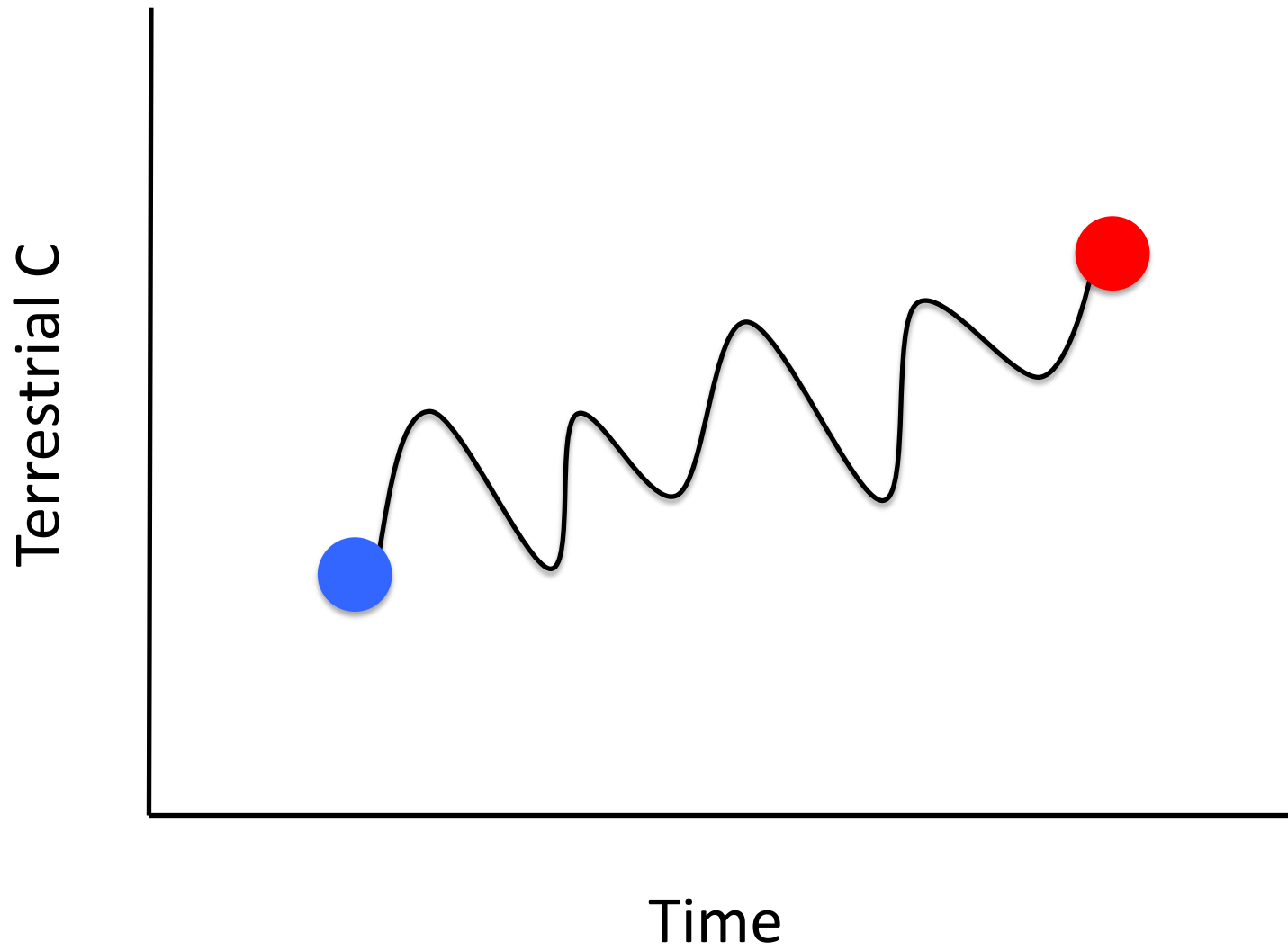


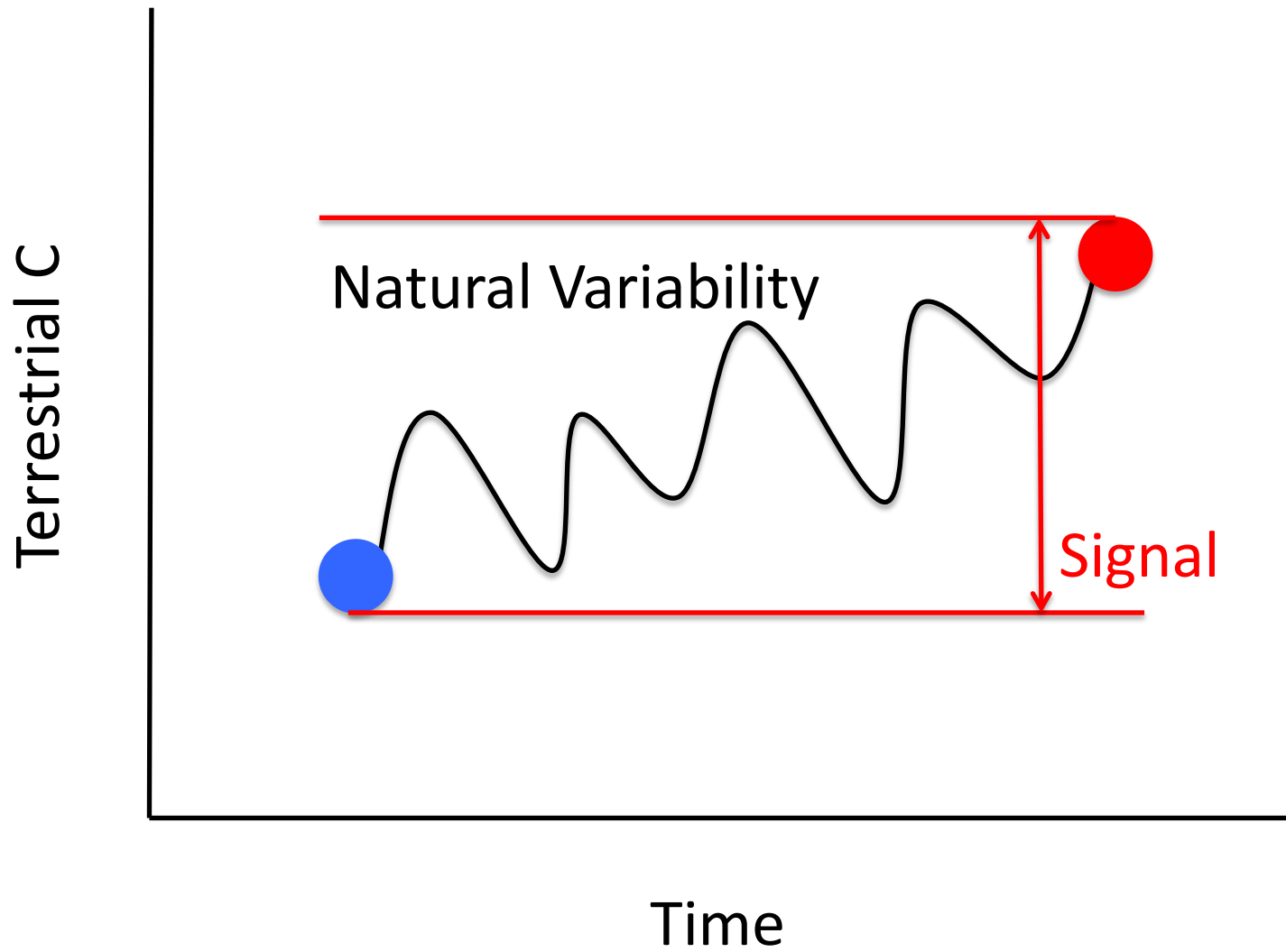


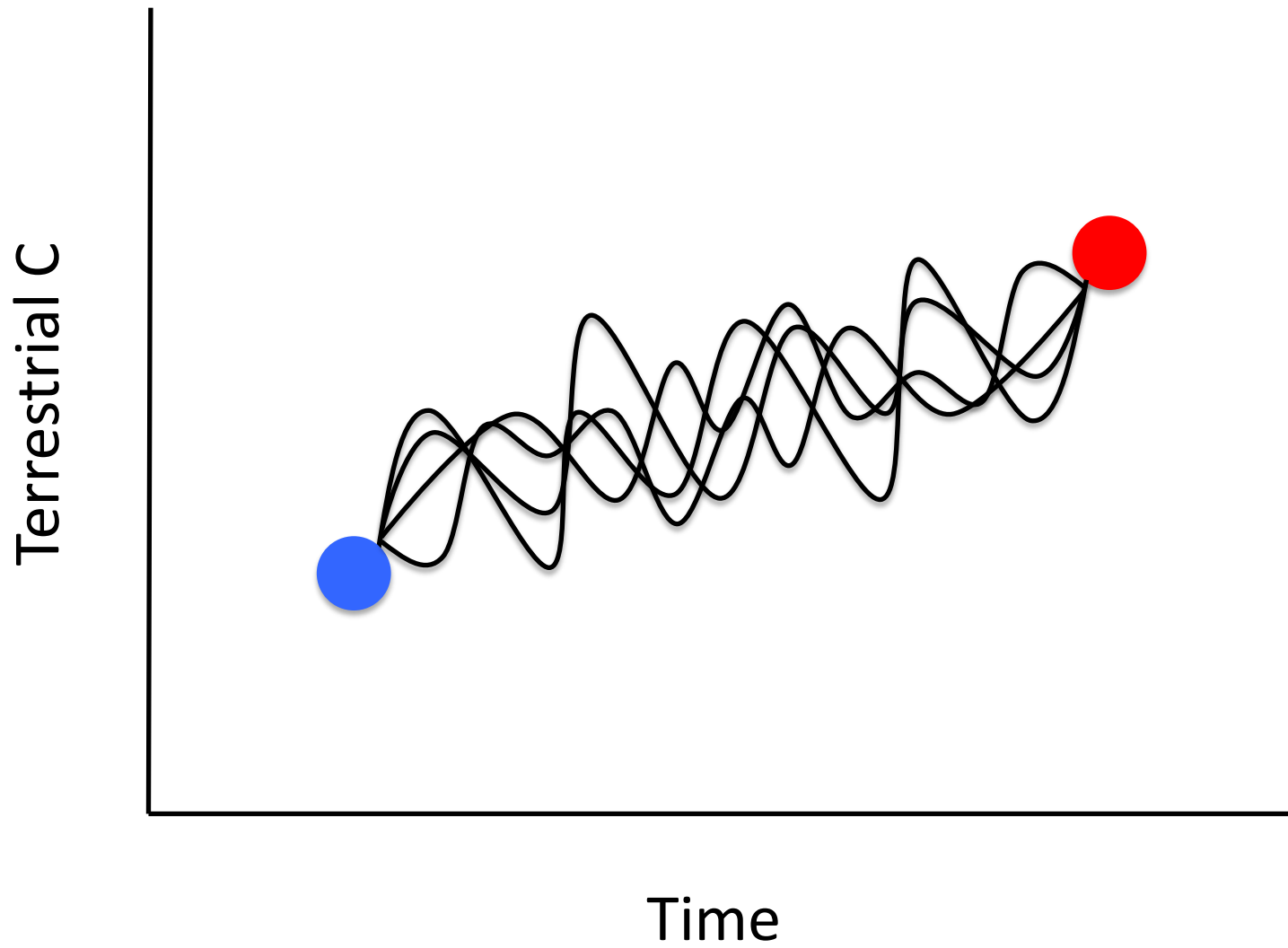




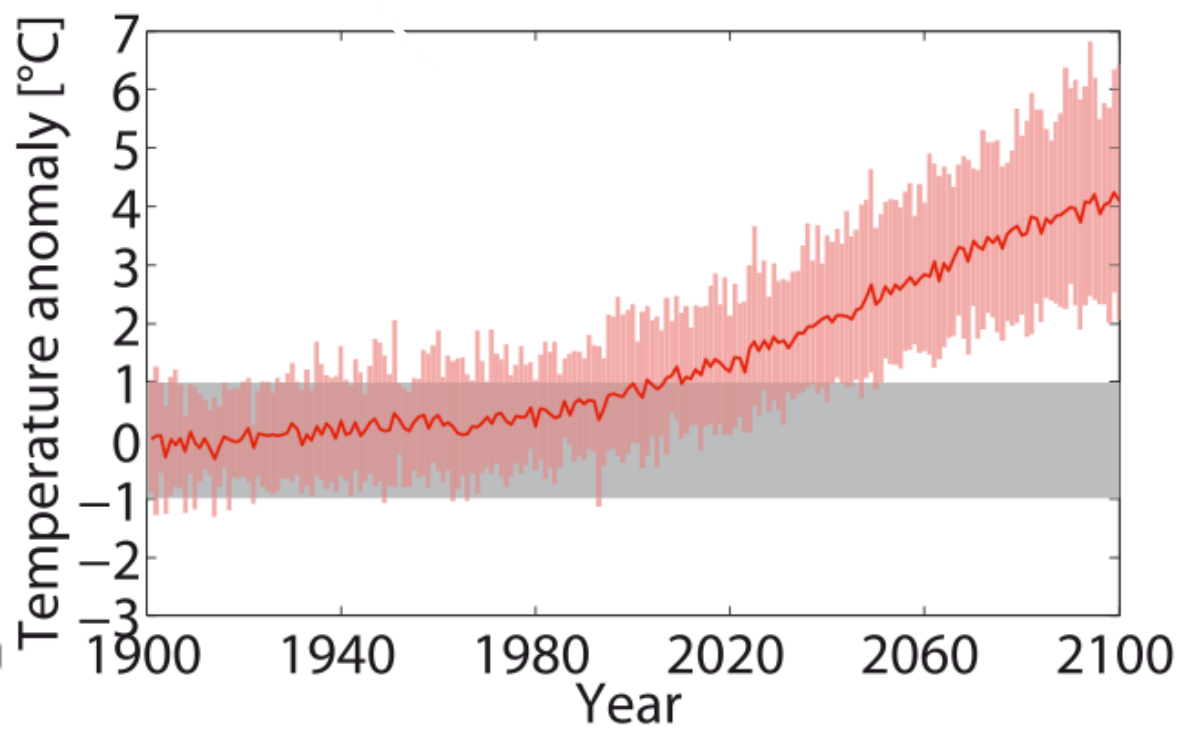




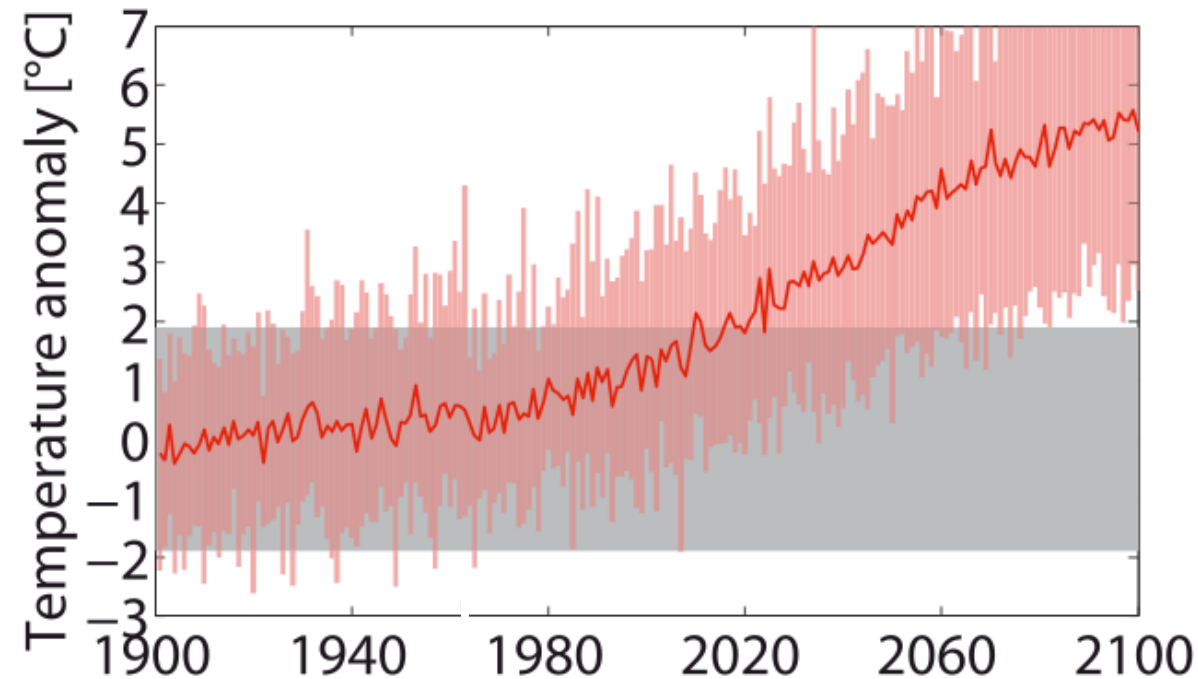




Democratic Republic of the Congo



United States





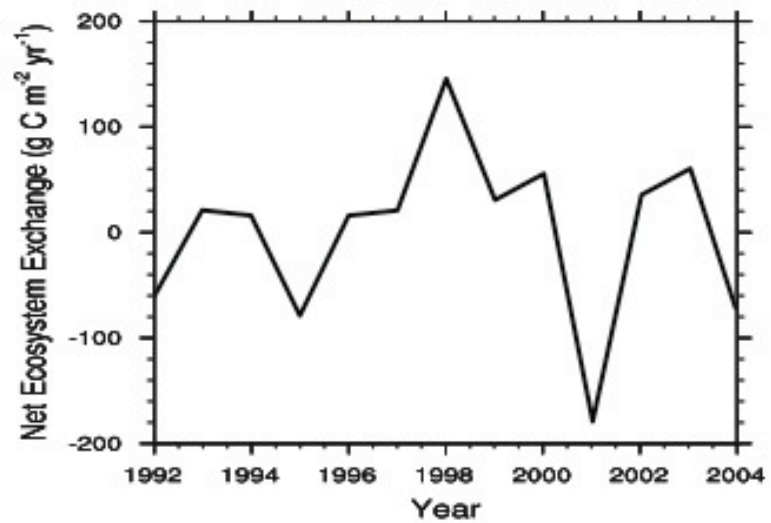
Natural Variability

Net Ecosystem Exchange (NEE)

a

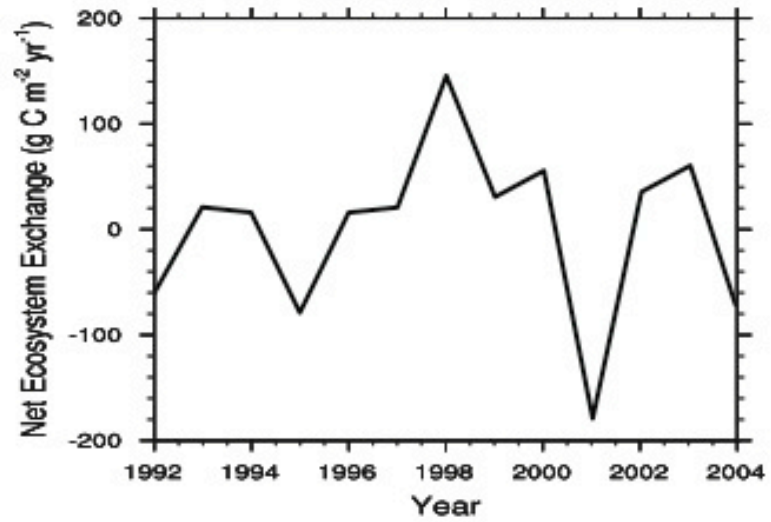
Harvard Forest

Detrended AmeriFlux Data

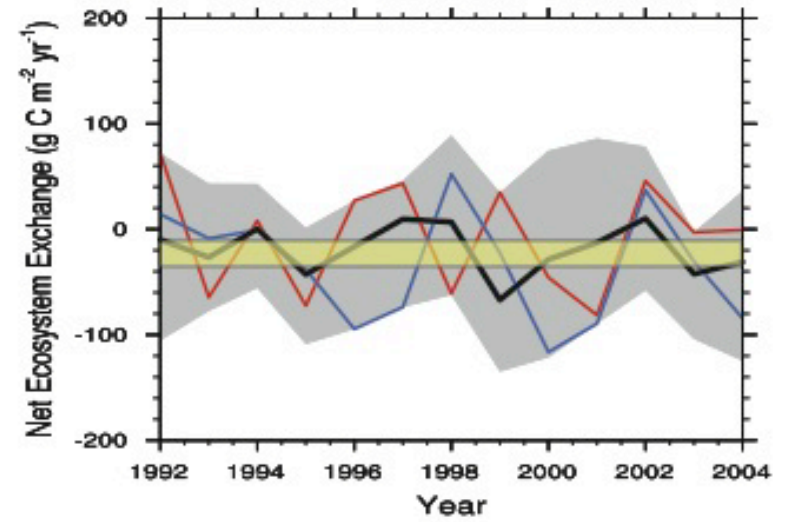


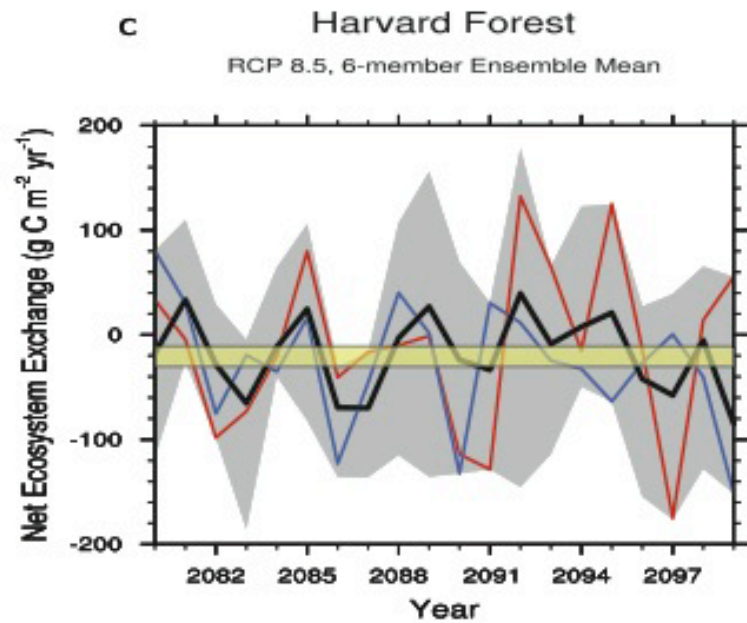
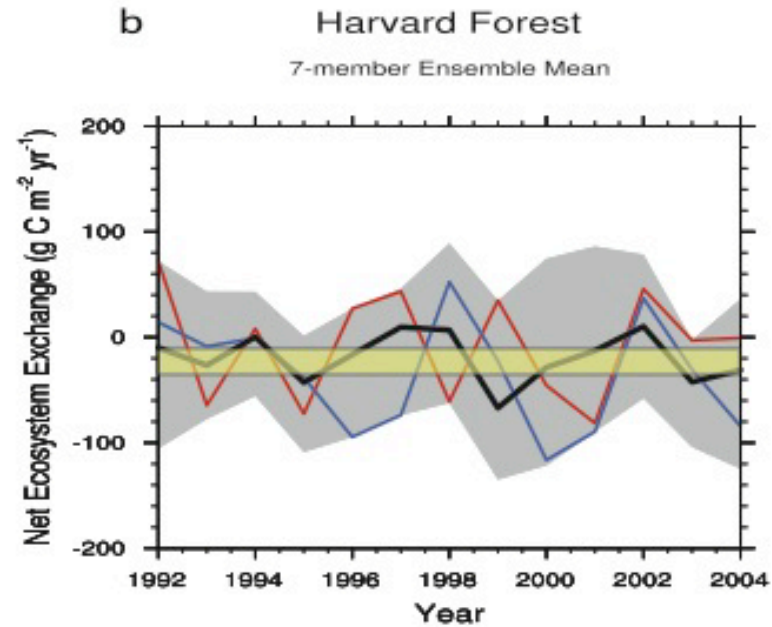
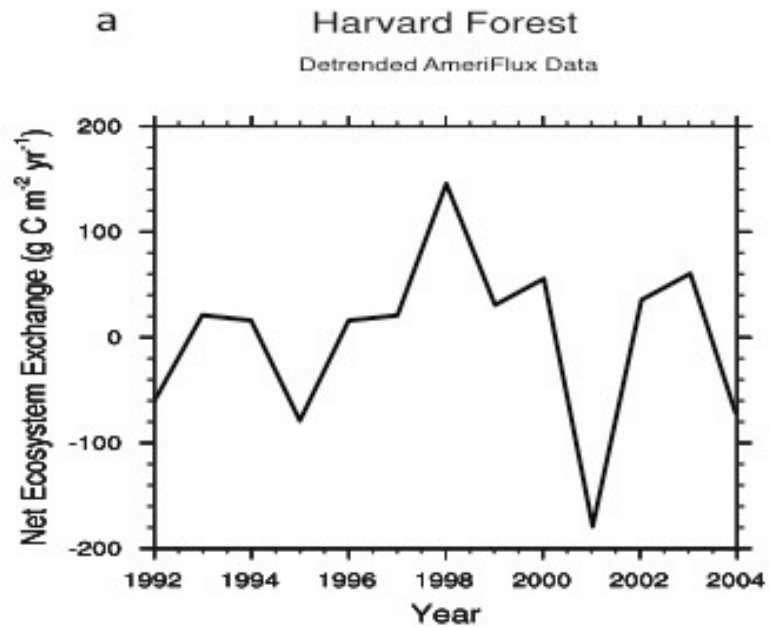
a**Harvard Forest**

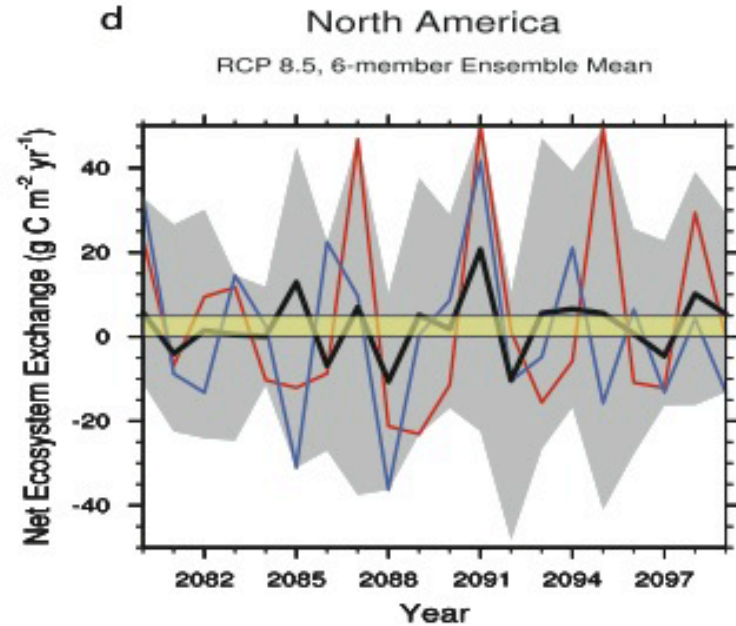
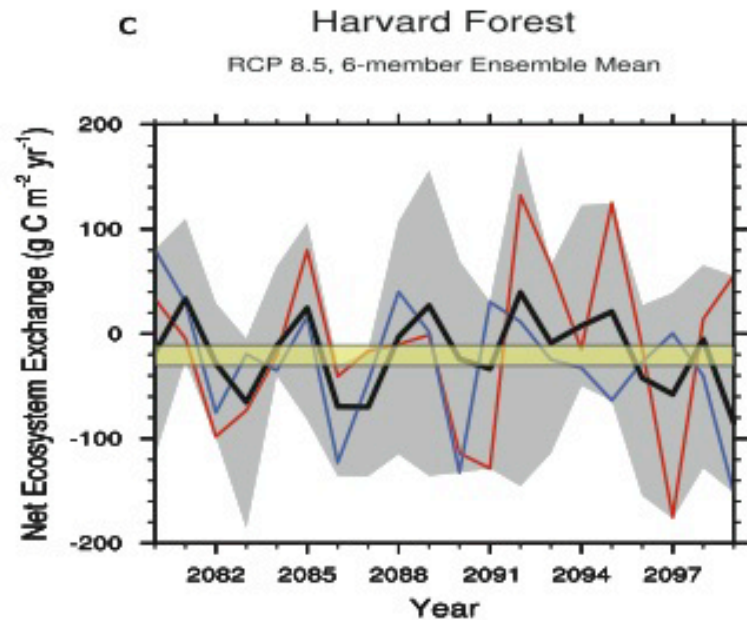
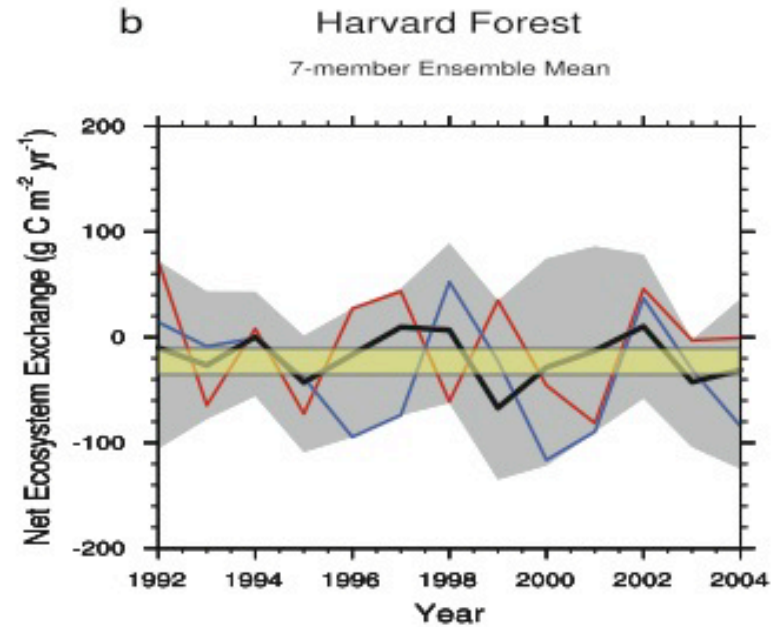
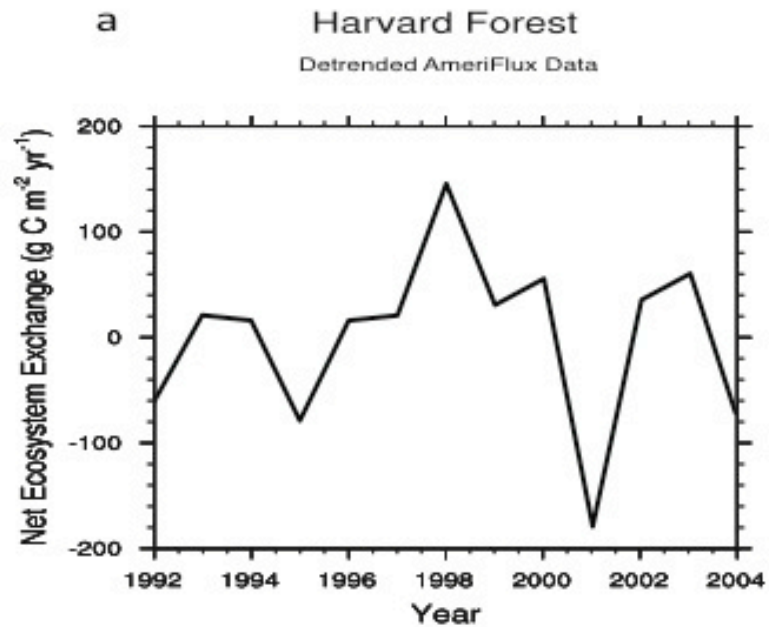
Detrended AmeriFlux Data

**b****Harvard Forest**

7-member Ensemble Mean







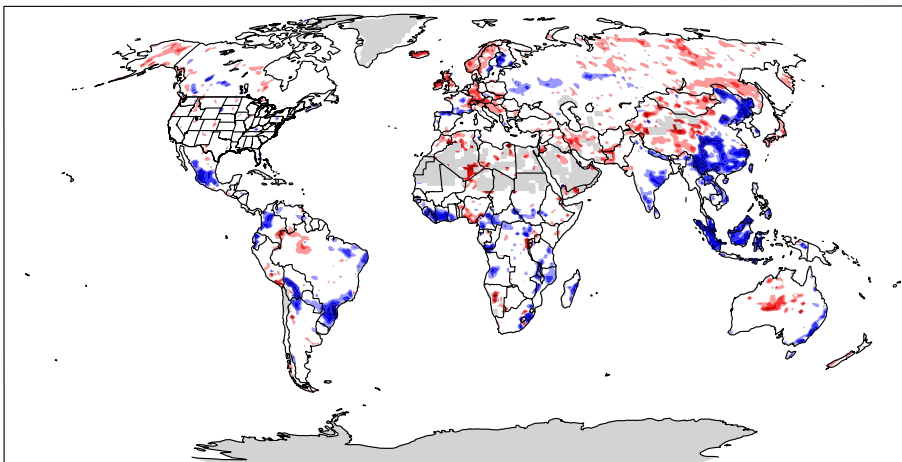


Signal Detection

Signal to Noise Ratio in Total Ecosystem C

a

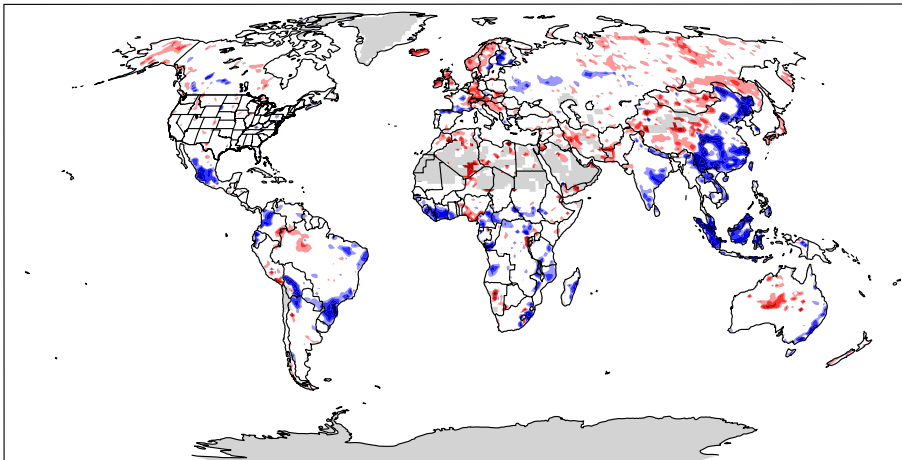
* Relative to 2011



-30 -15 -8 -4 -2 2 4 8 15 30

10-Year Climate Signal to Noise

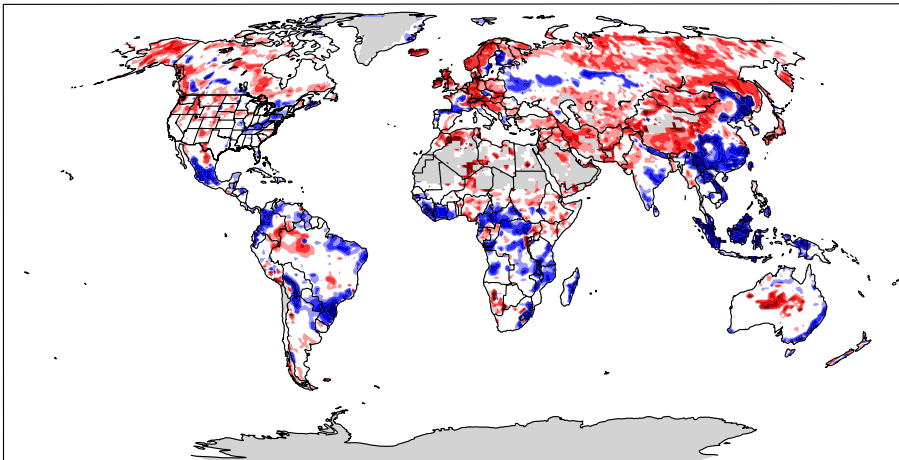
a



-30 -15 -8 -4 -2 2 4 8 15 30
10-Year Climate Signal to Noise

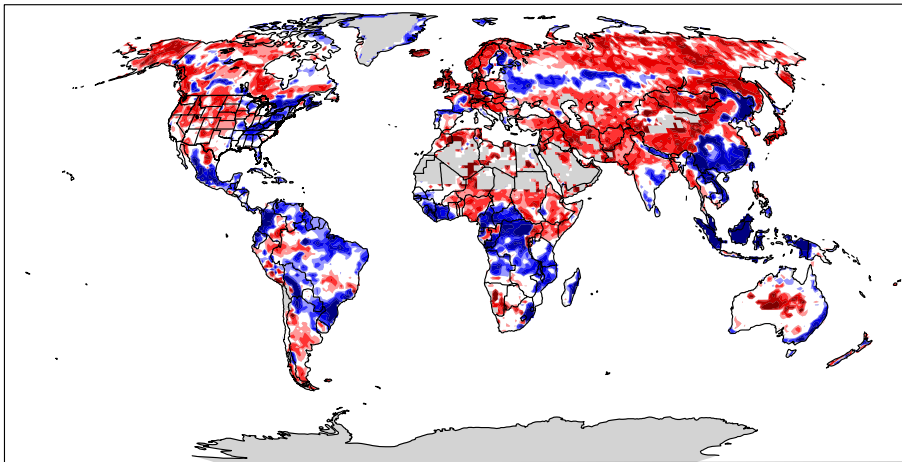
b

* Relative to 2011



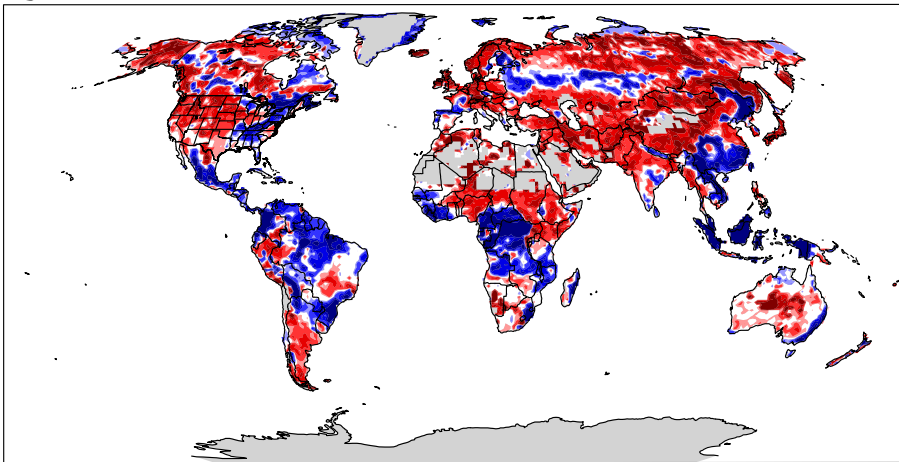
-30 -15 -8 -4 -2 2 4 8 15 30
25-Year Climate Signal to Noise

c



-30 -15 -8 -4 -2 2 4 8 15 30
50-Year Climate Signal to Noise

d



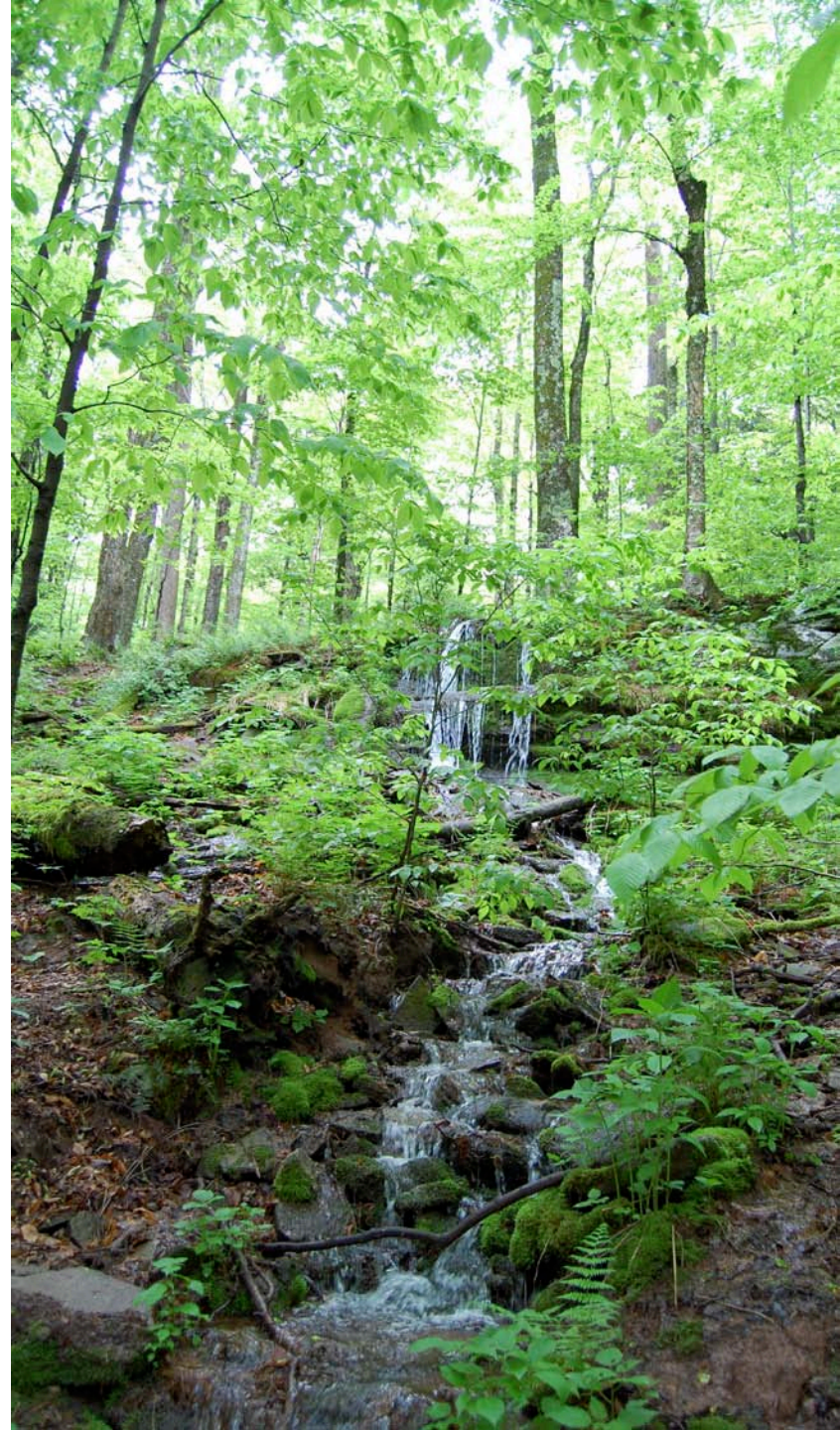
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90-Year Climate Signal to Noise

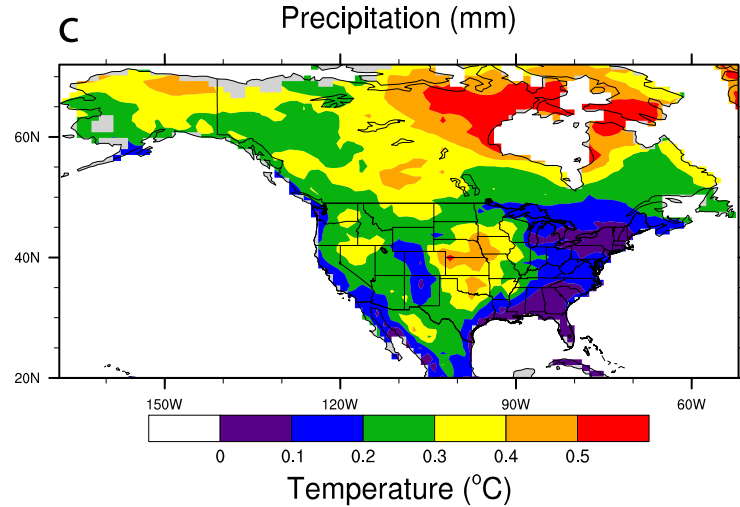
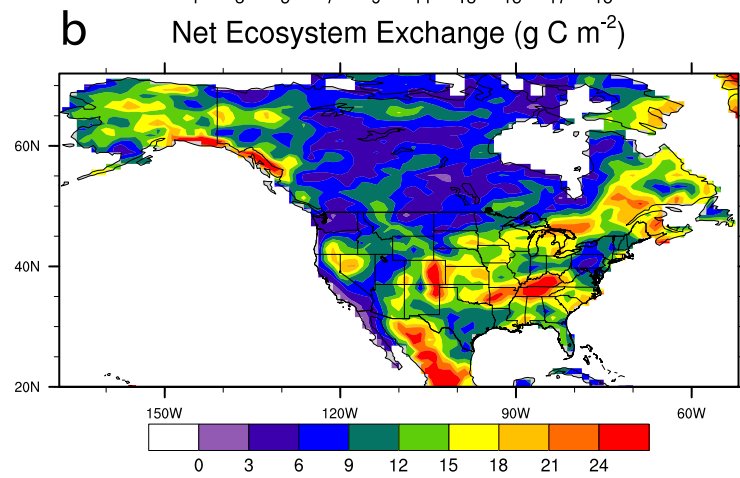
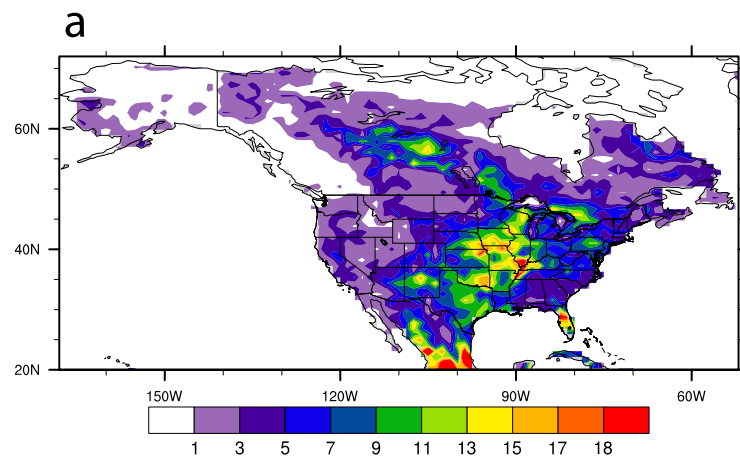
Conclusions

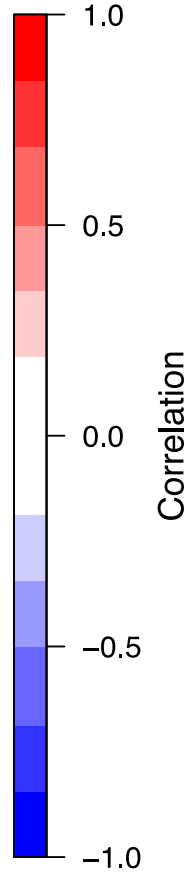
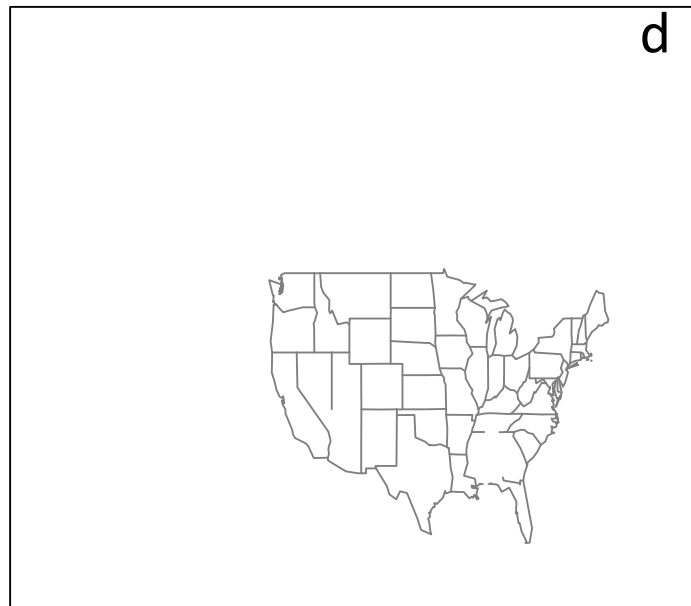
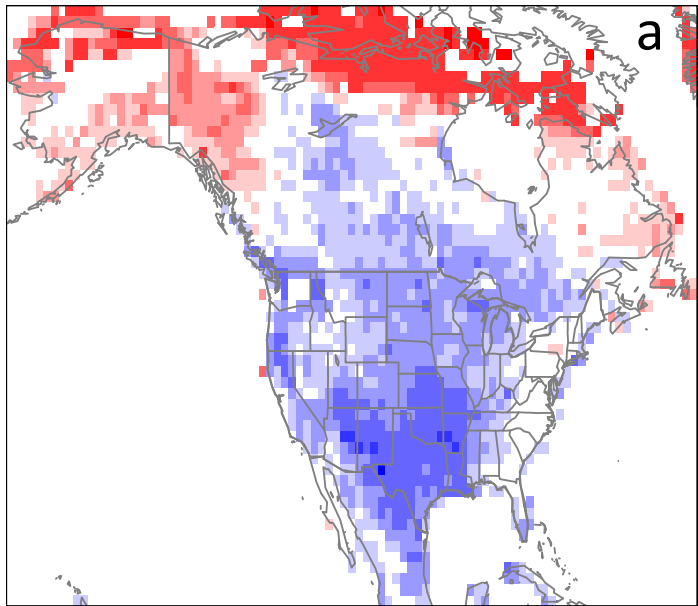
Magnitude of variability changes with averaging through space & time

Changes in total ecosystem C are only detectable on multi-decadal timescales

Detection, attribution, and prediction methodology must be applied to C cycle to understand Earth system change

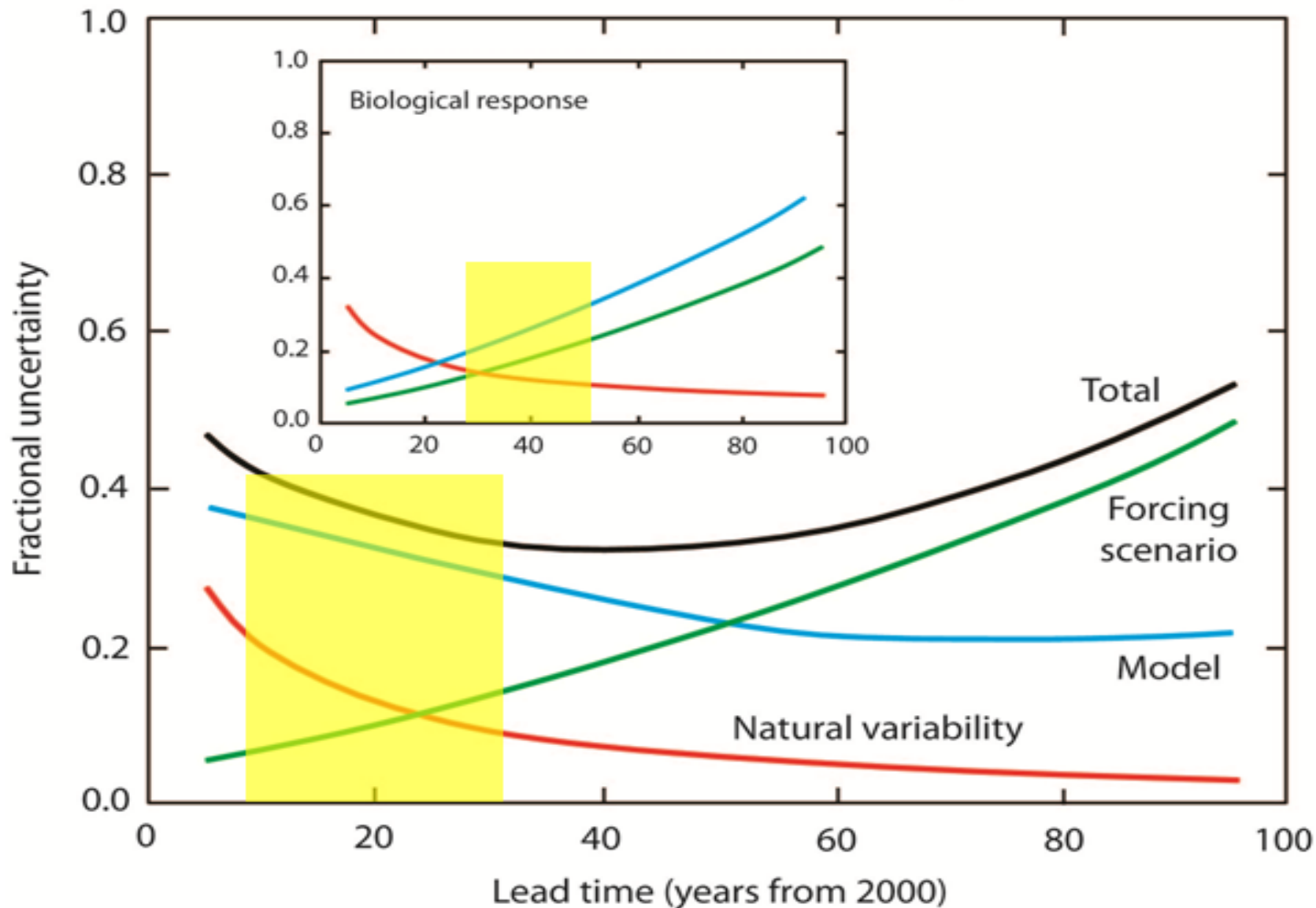


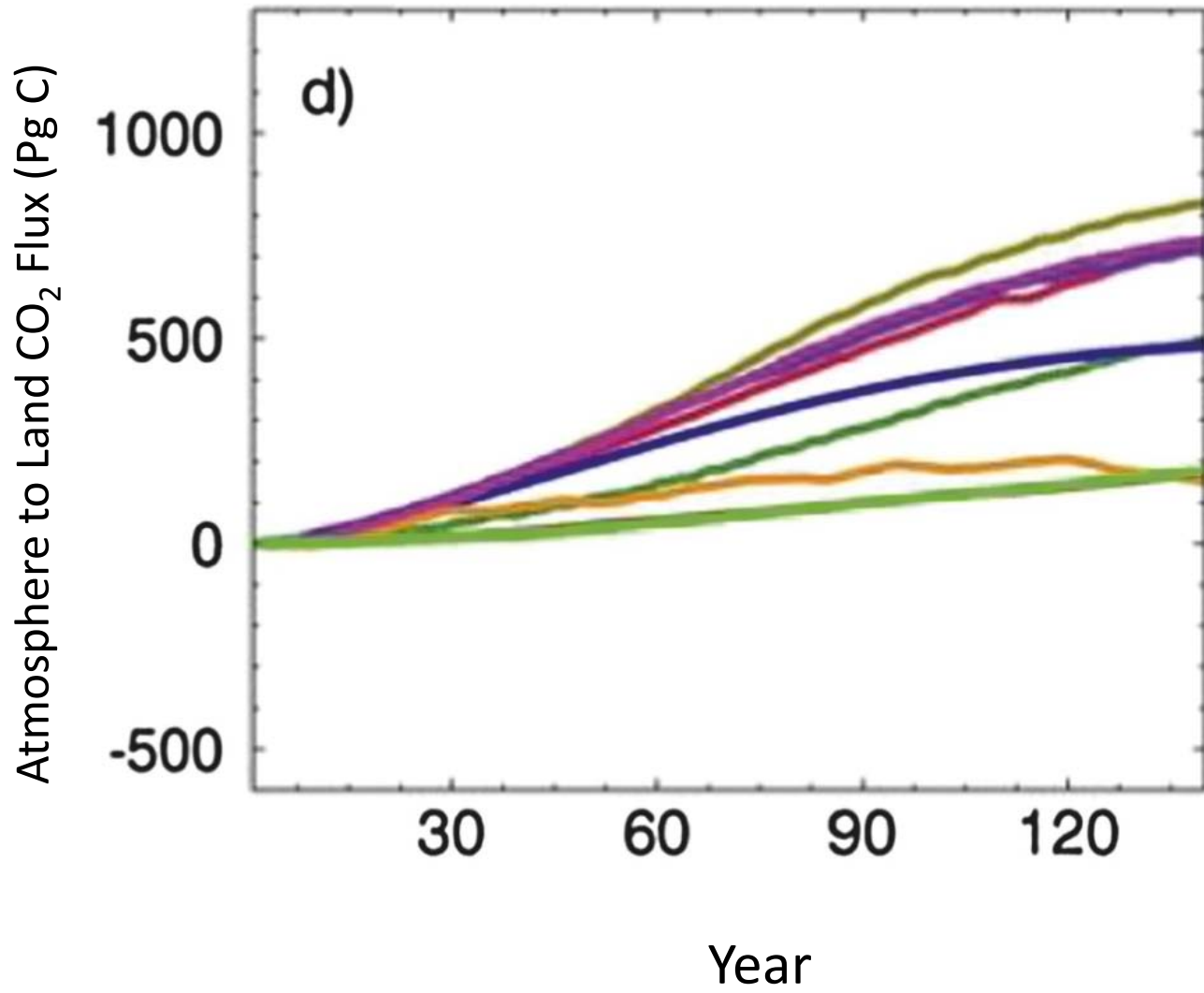


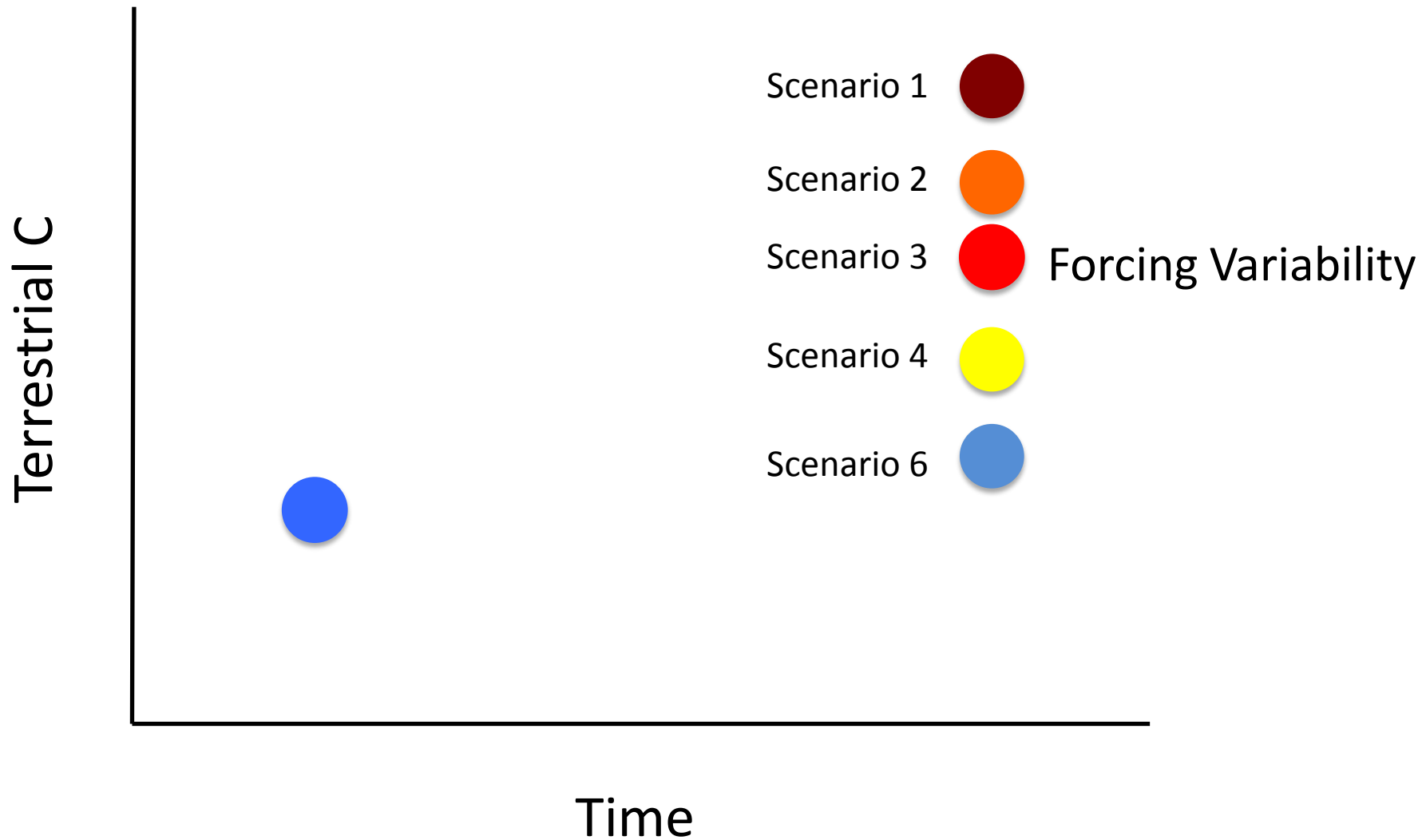


Precipitation


Global, decadal mean surface air temperature










Scenario 1


Model 1 

Model 2 

Model 3  Model Variability

Model 4 

Model 5 

Model 6 

Model 7 

Terrestrial C

Time

