

Attribution of the 2001- 2010 global temperature plateau

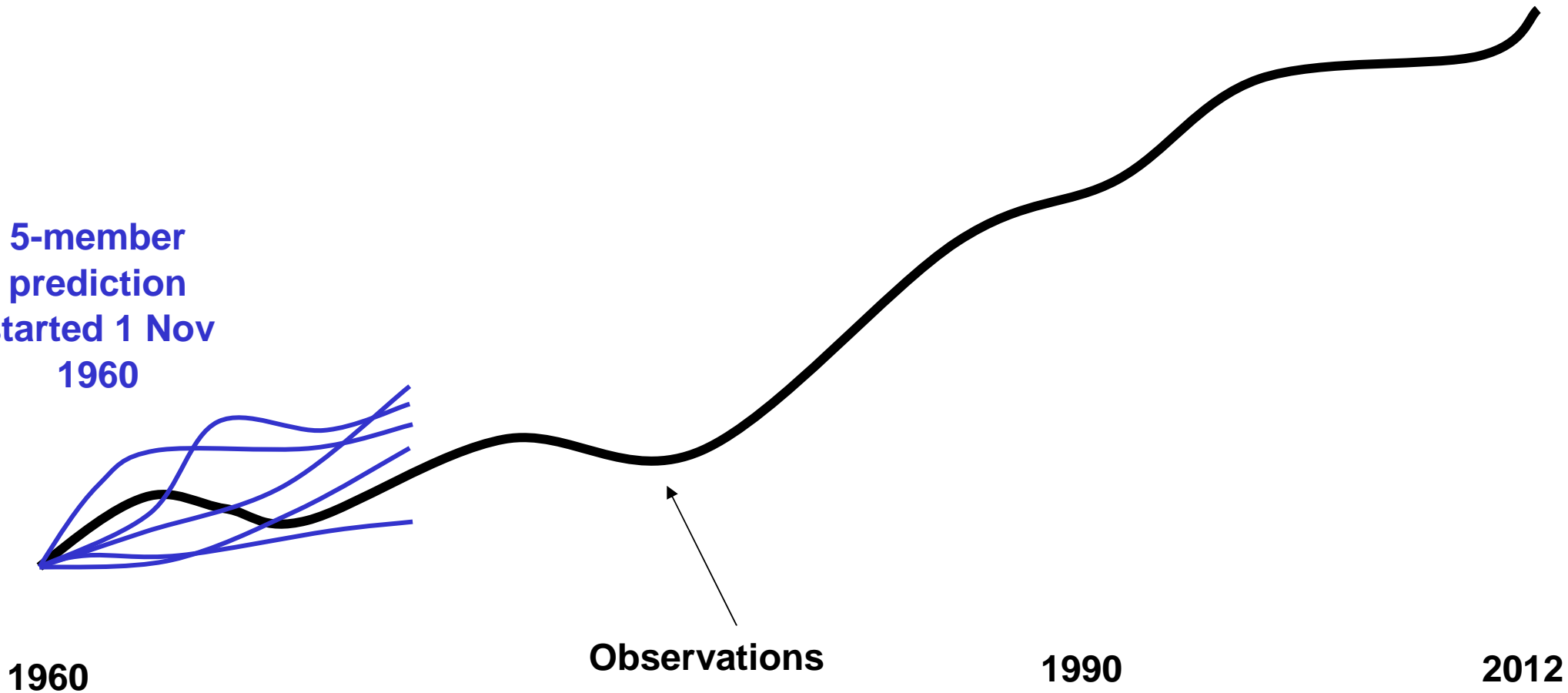
**Virginie Guemas, Francisco J. Doblas-Reyes, Isabel
Andreu-Burillo and Muhammad Asif**

**International Workshop on Seasonal to Decadal Prediction,
Toulouse, 13 May 2013**

Methodology

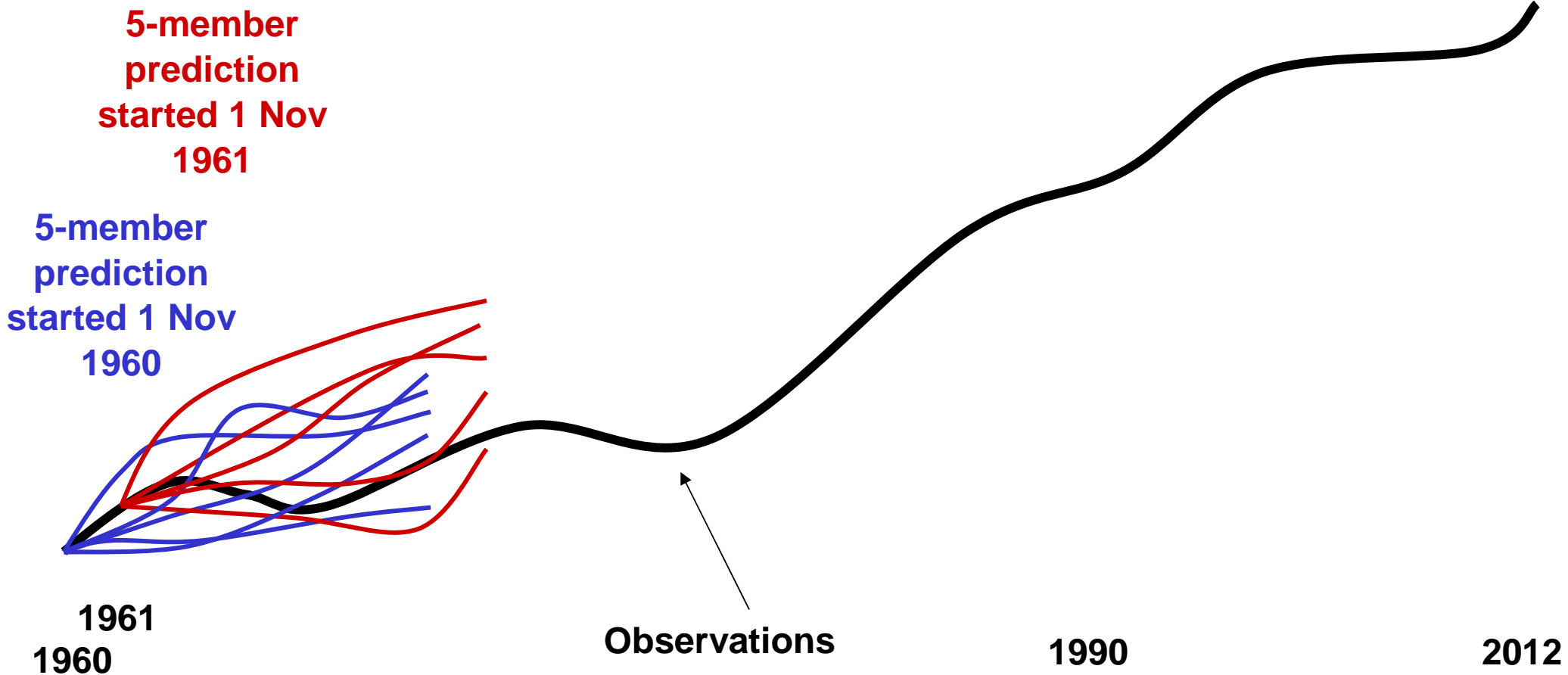
Experimental setup

5-member prediction started 1 Nov 1960



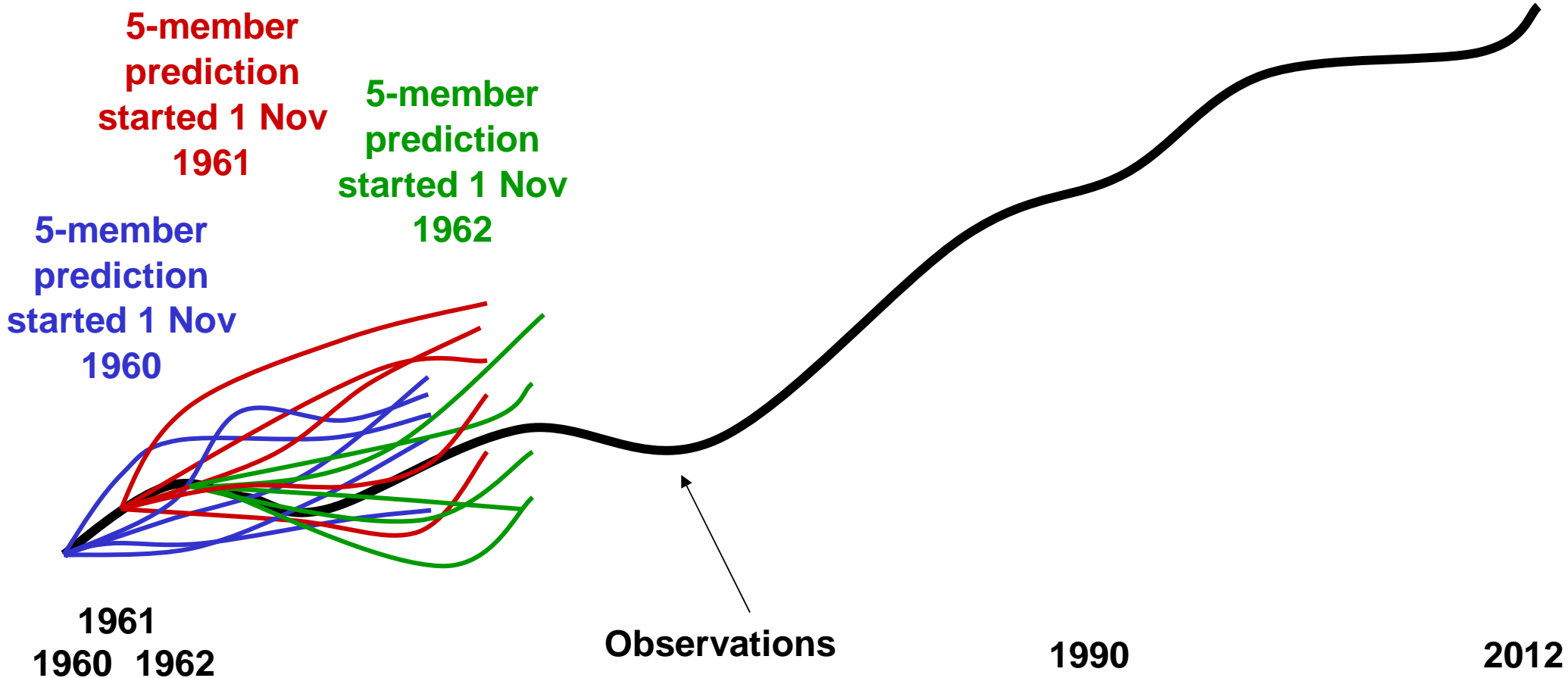
Methodology

Experimental setup



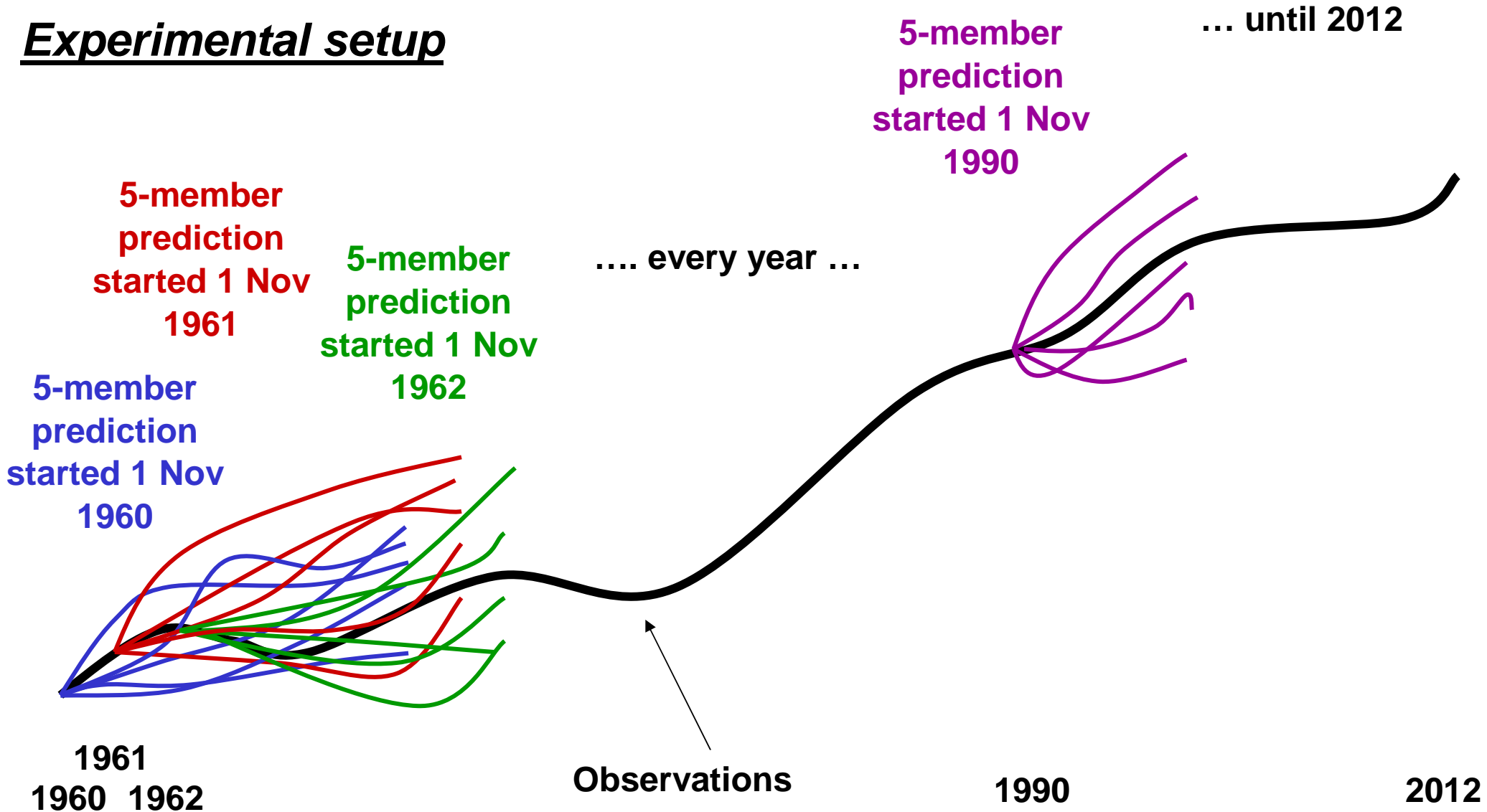
Methodology

Experimental setup



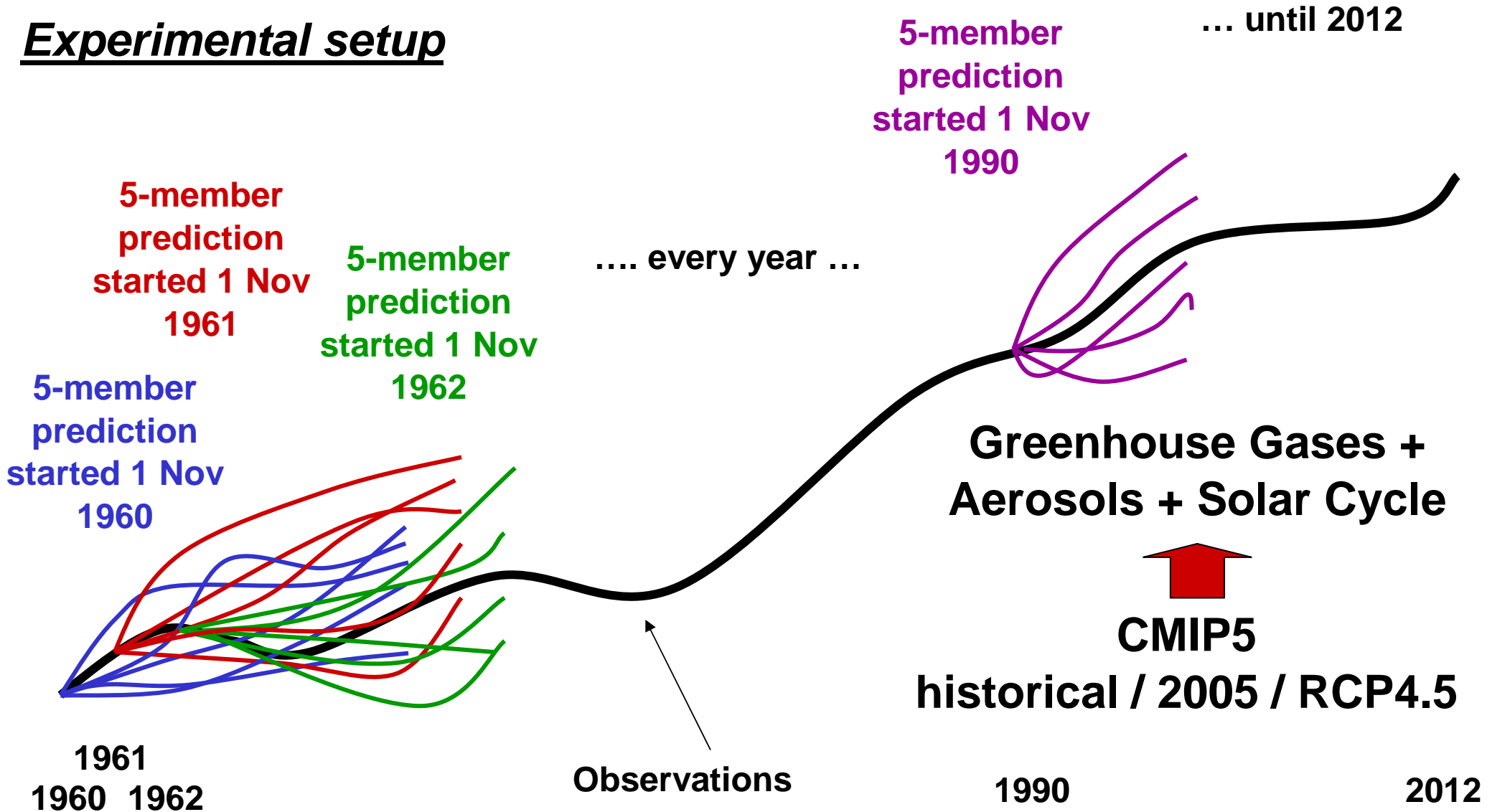
Methodology

Experimental setup



Methodology

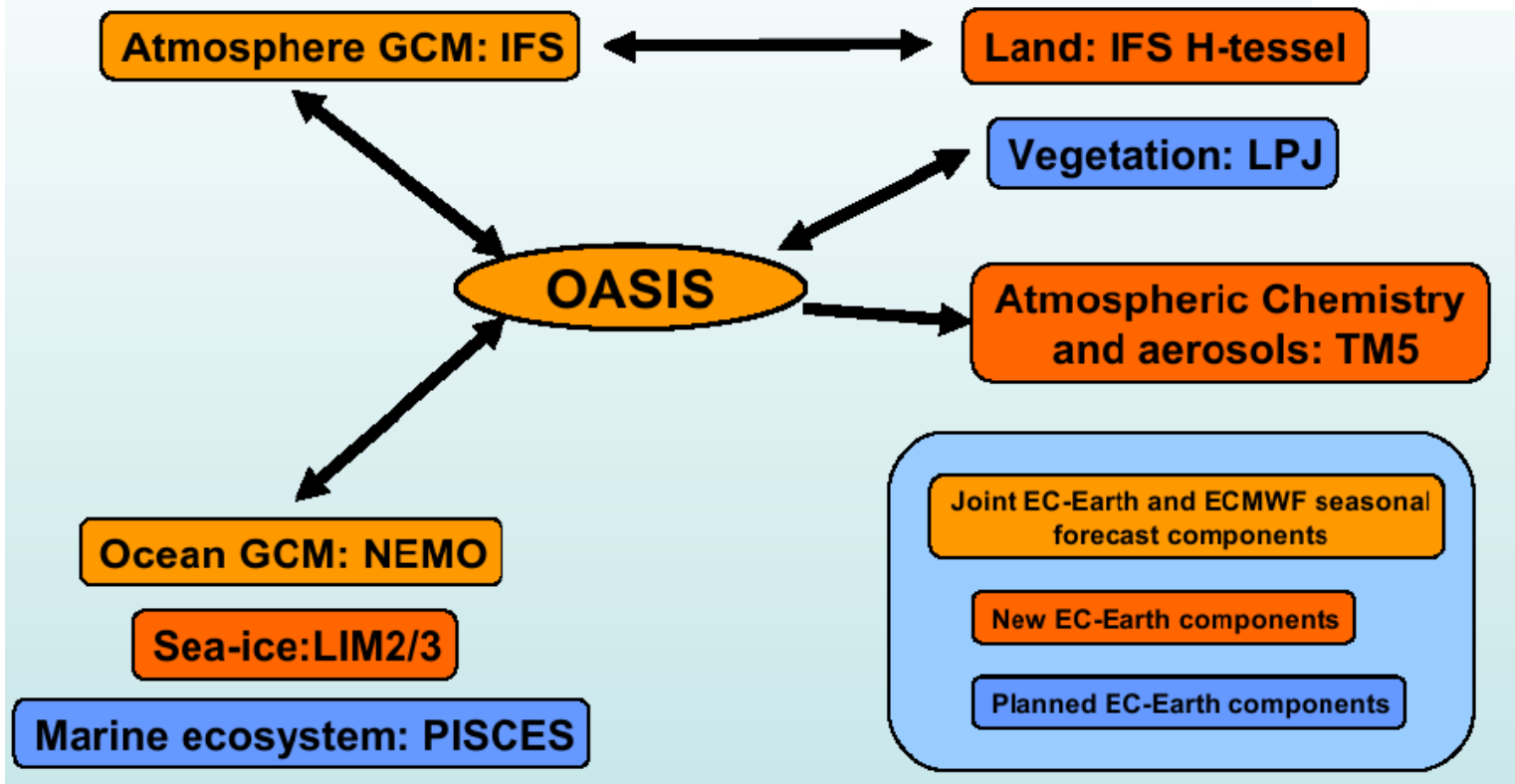
Experimental setup



Methodology

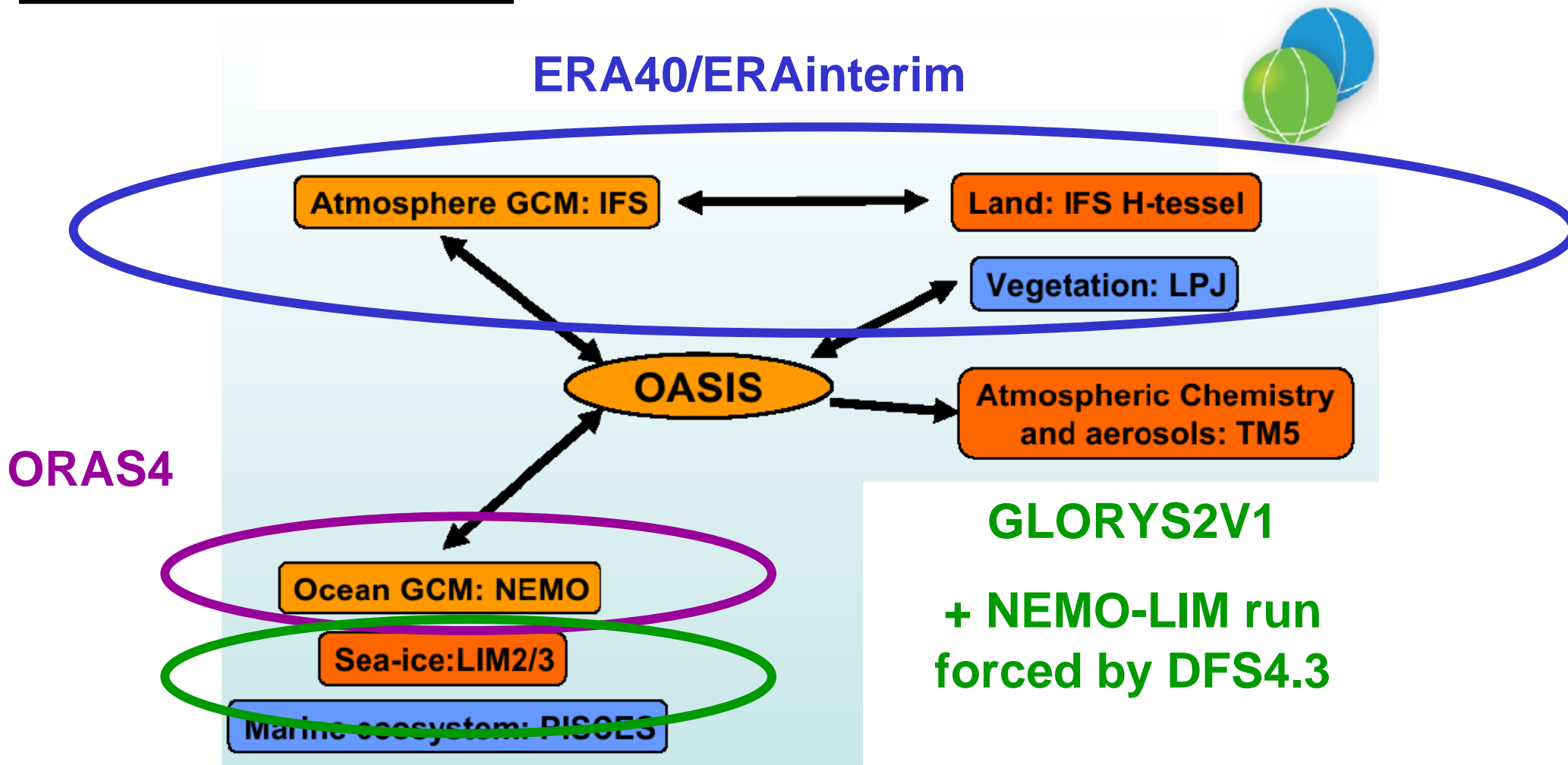
Model

EC-EARTH components



Methodology

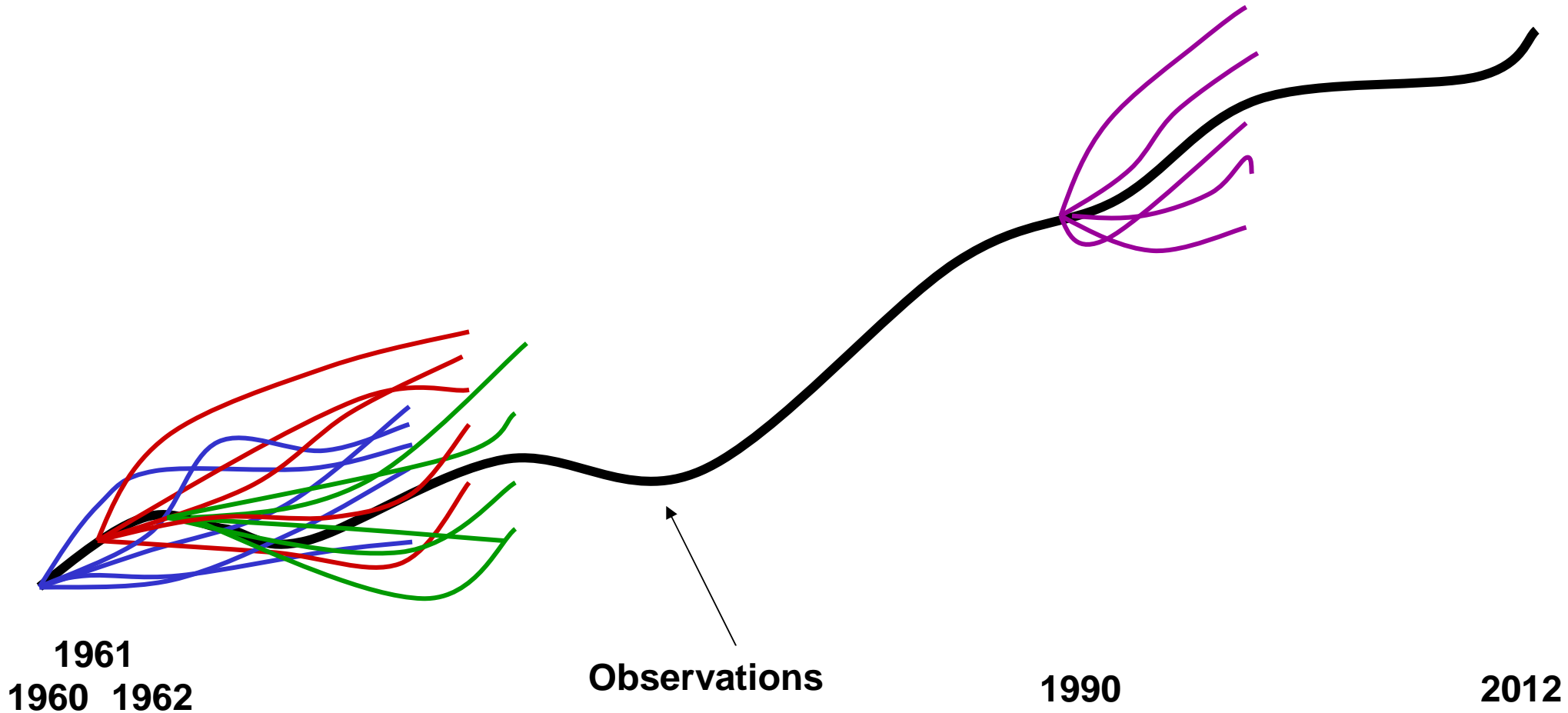
Full field Initialisation



Methodology

Analyses:

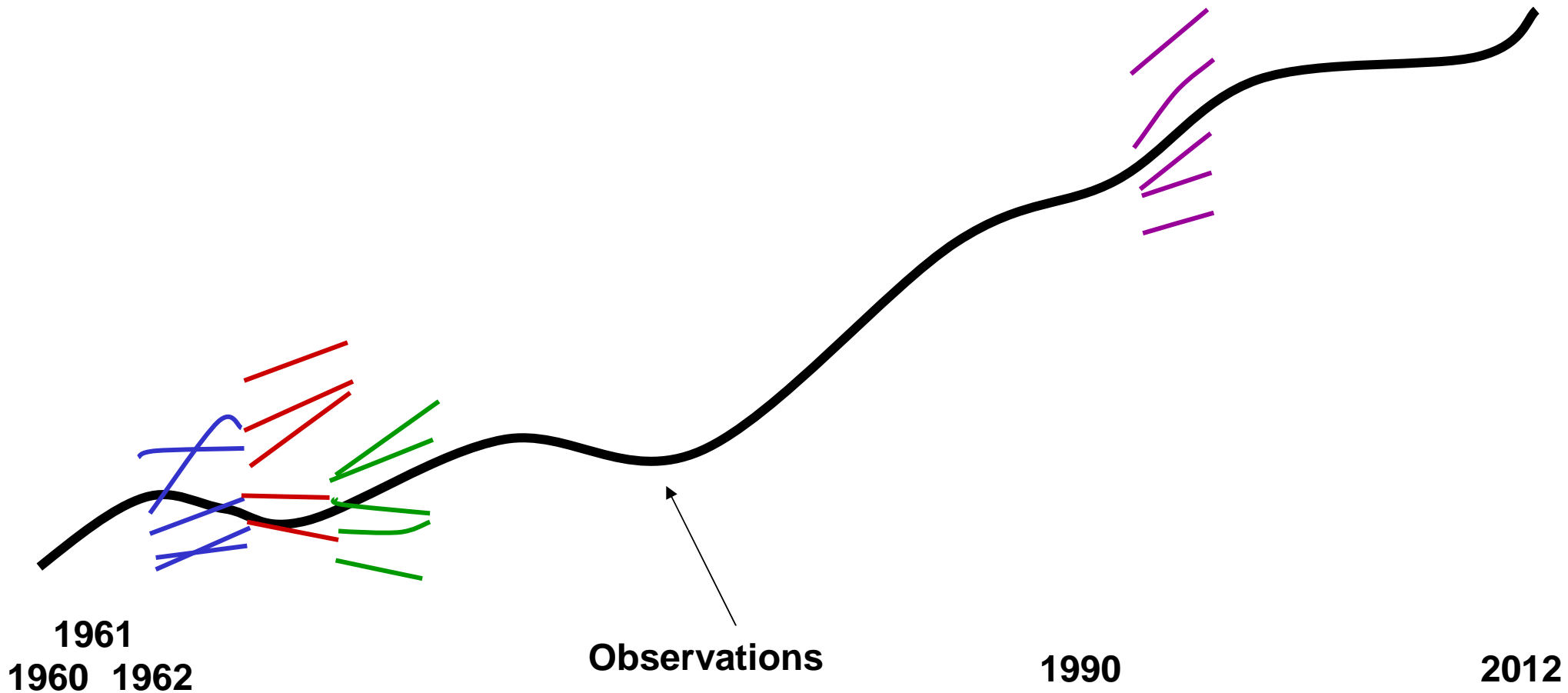
Example : Focus on 3rd forecast year



Methodology

Analyses:

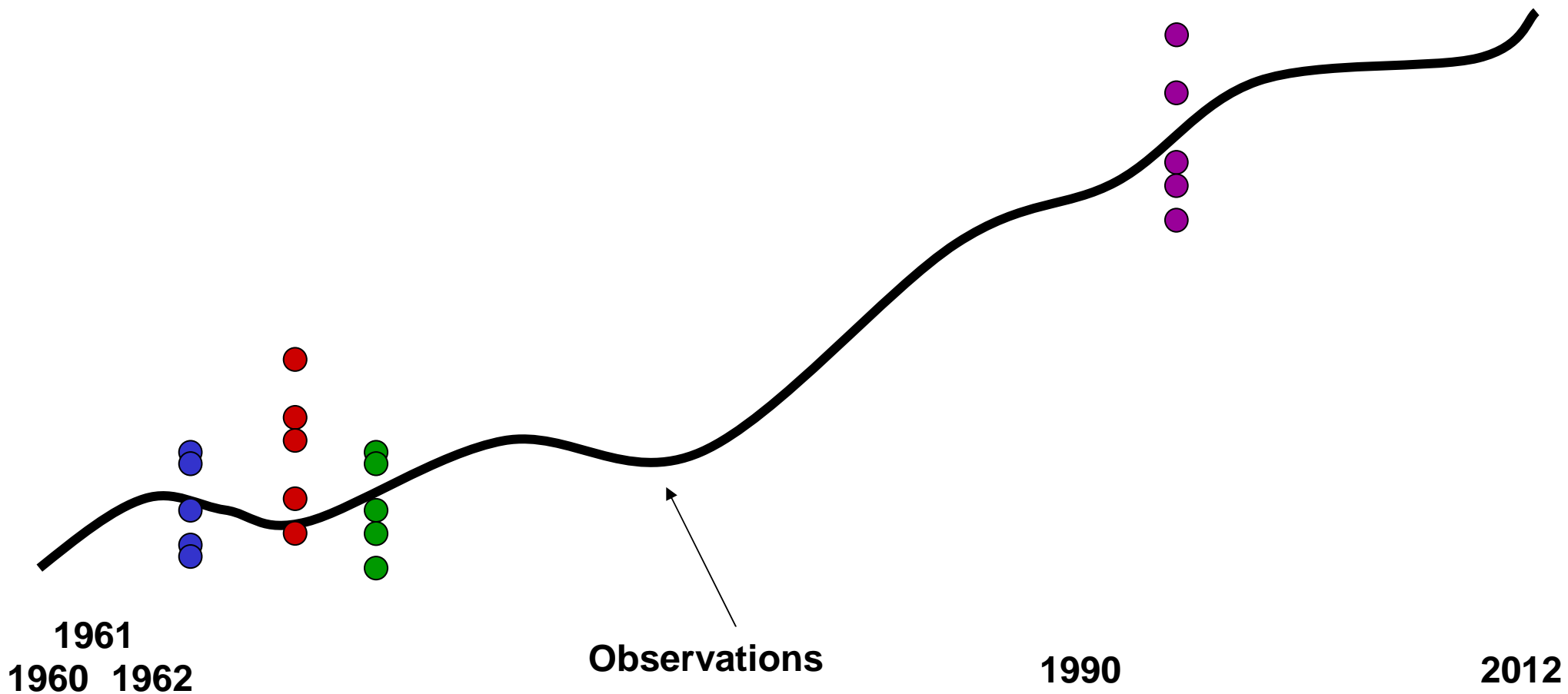
Example : Focus on 3rd forecast year



Methodology

Analyses:

Example : Focus on 3rd forecast year

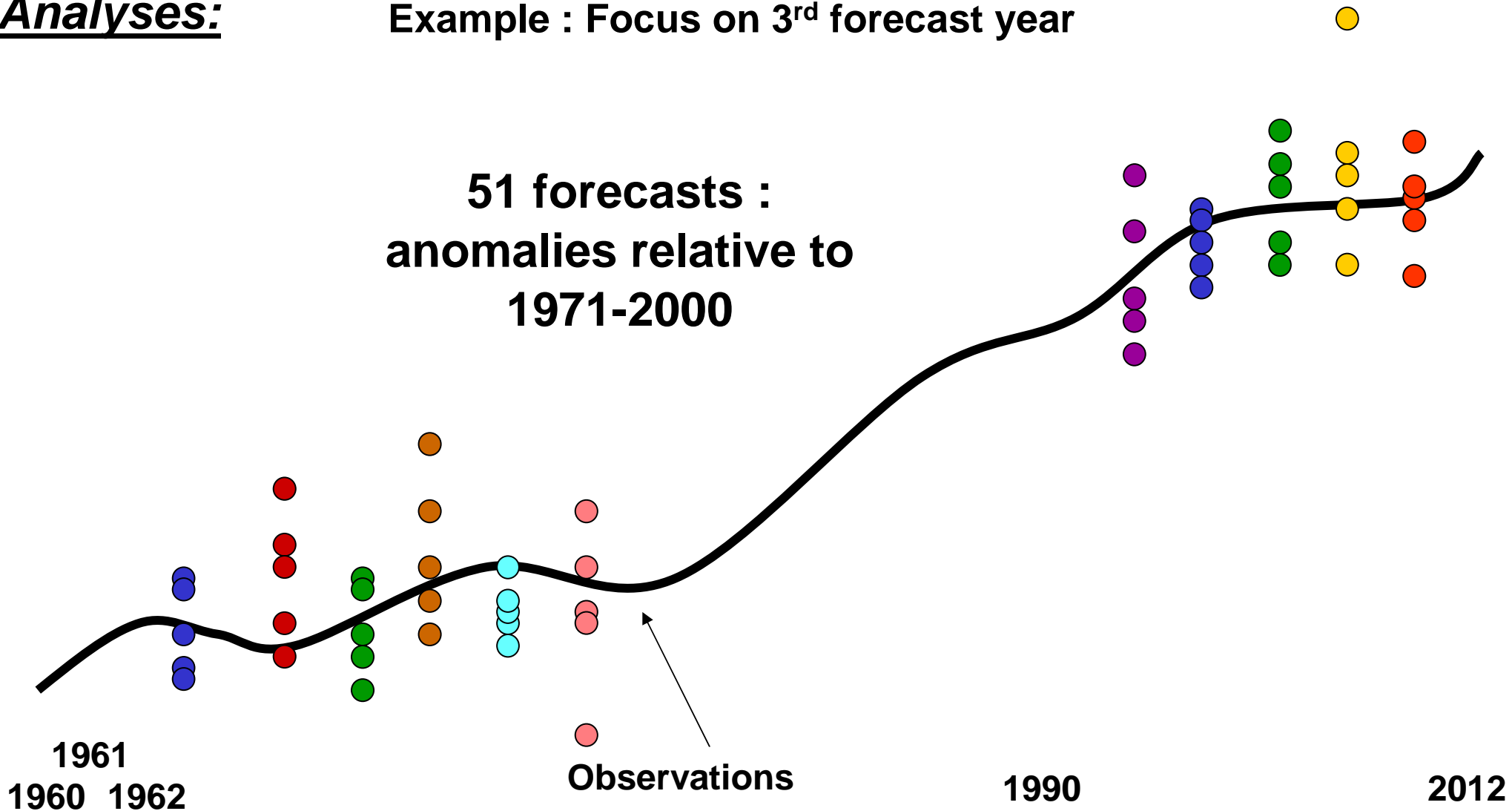


Methodology

Analyses:

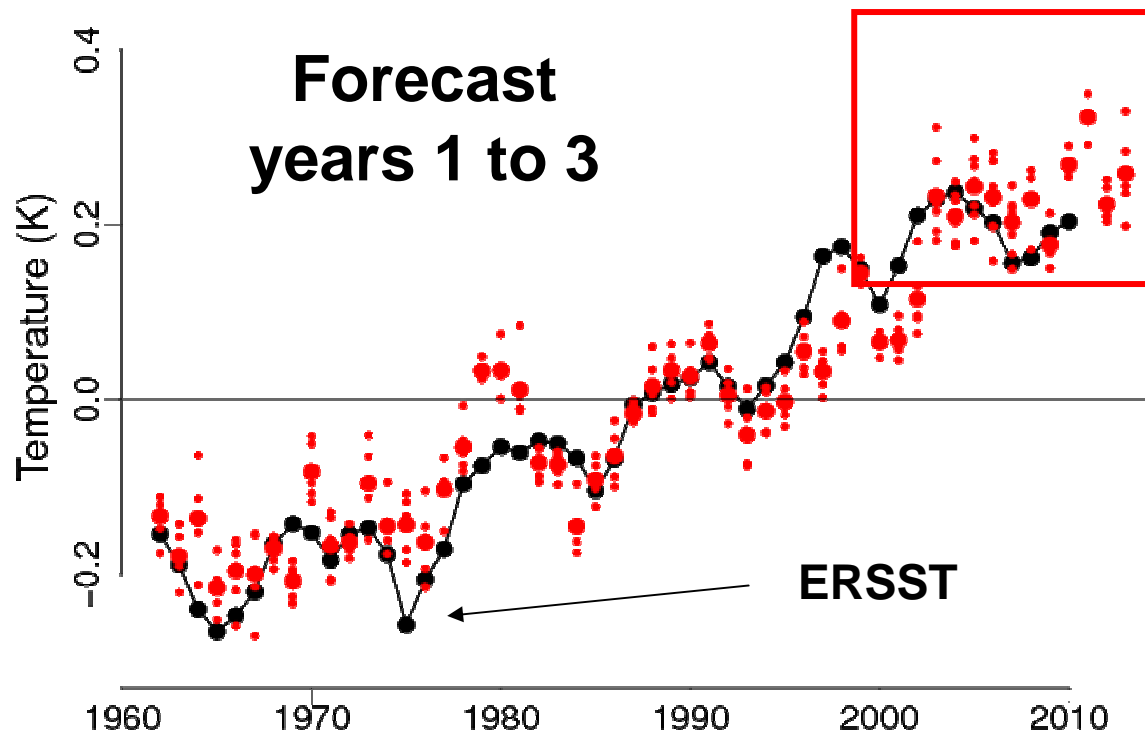
Example : Focus on 3rd forecast year

51 forecasts :
anomalies relative to
1971-2000



Successful climate prediction of the 2000-2010 global temperature plateau

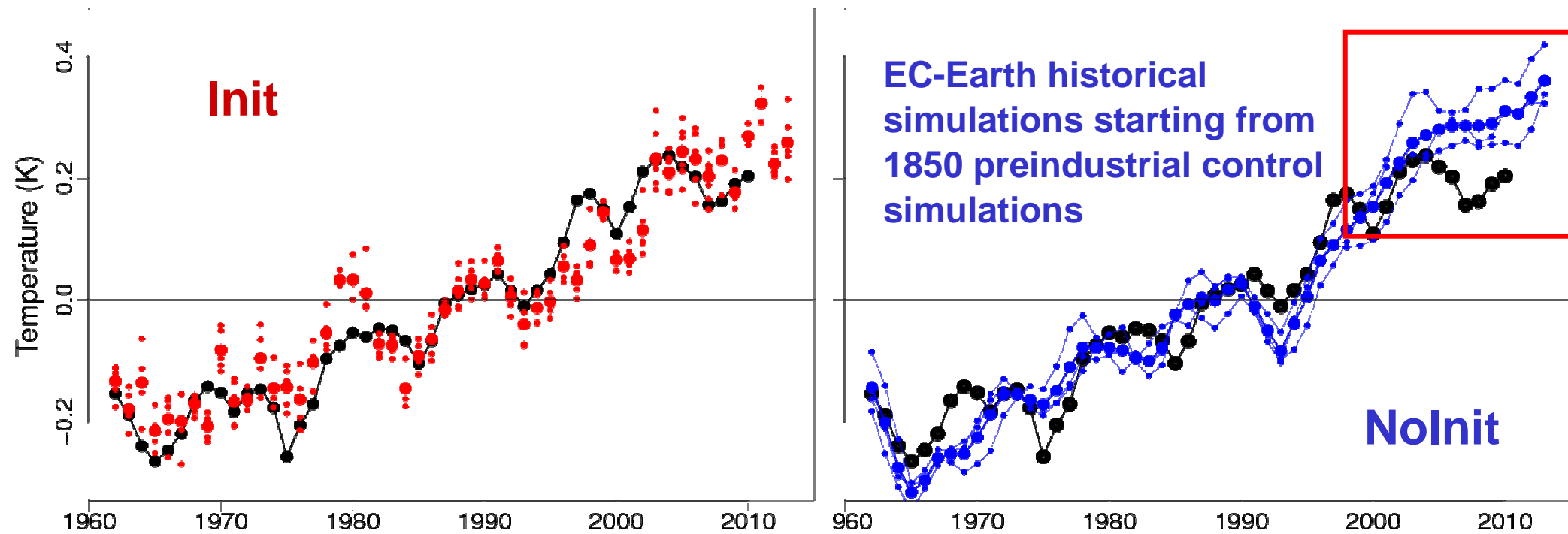
Global mean Sea Surface Temperature (60°S-60°N)



The climate predictions capture the warming slowdown

Successful climate prediction of the 2000-2010 global temperature plateau

Global mean Sea Surface Temperature (60°S-60°N)

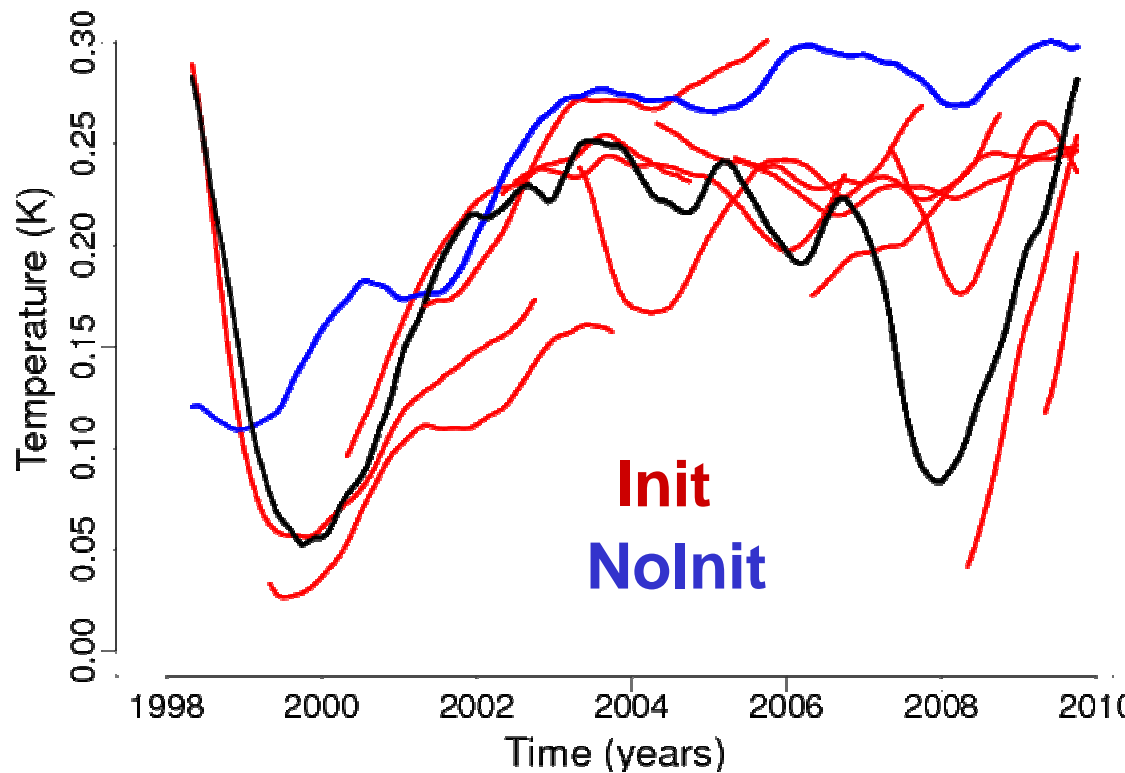


➔ Initializing from observations is crucial to capture the plateau

Successful climate prediction of the 2000-2010 global temperature plateau

Global mean Sea Surface Temperature (60°S-60°N)

Smoothing with 1-year running mean

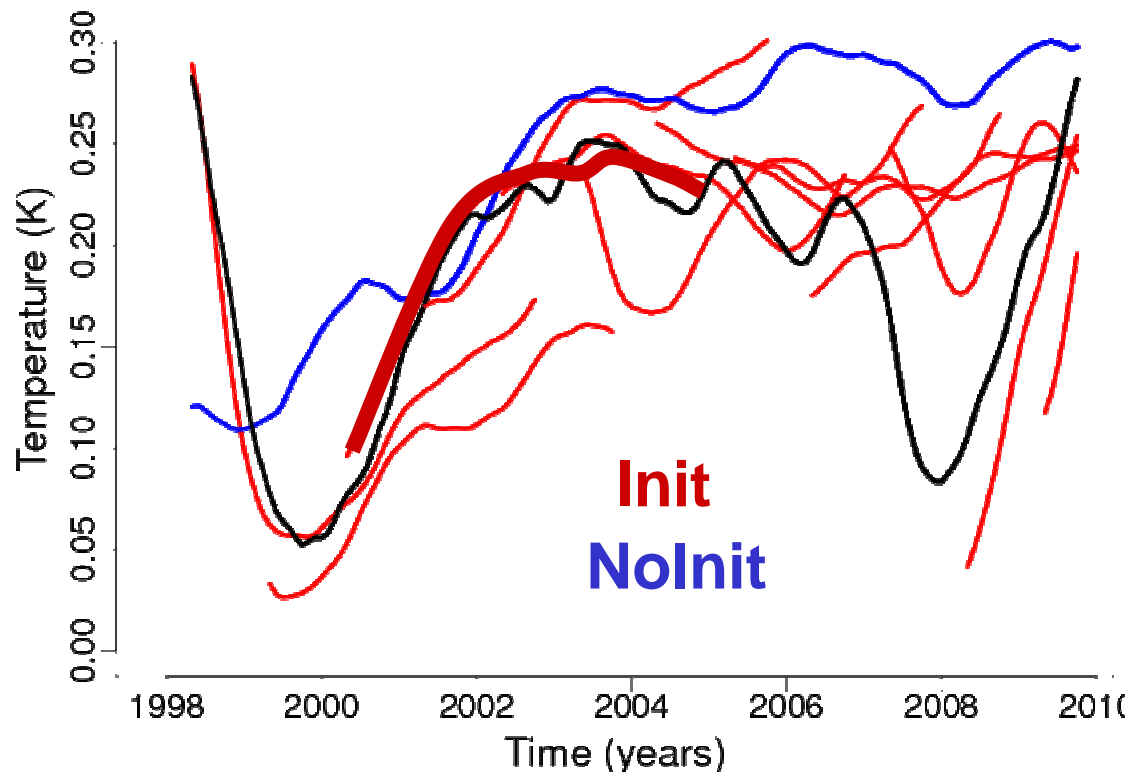


Initializing allows to the SST evolution along the predictions

Successful climate prediction of the 2000-2010 global temperature plateau

Global mean Sea Surface Temperature (60°S-60°N)

Smoothing with 1-year running mean



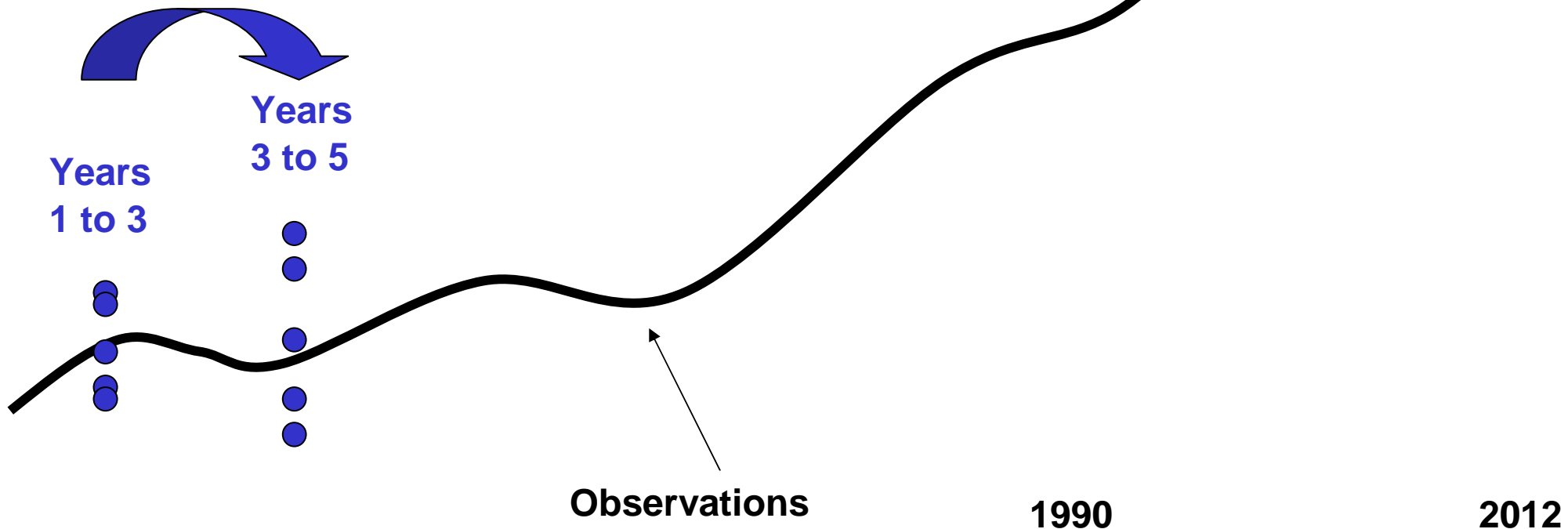
➔ Initializing allows to the SST evolution along the predictions

Methodology

Analyses:

3-year mean changes along the forecast

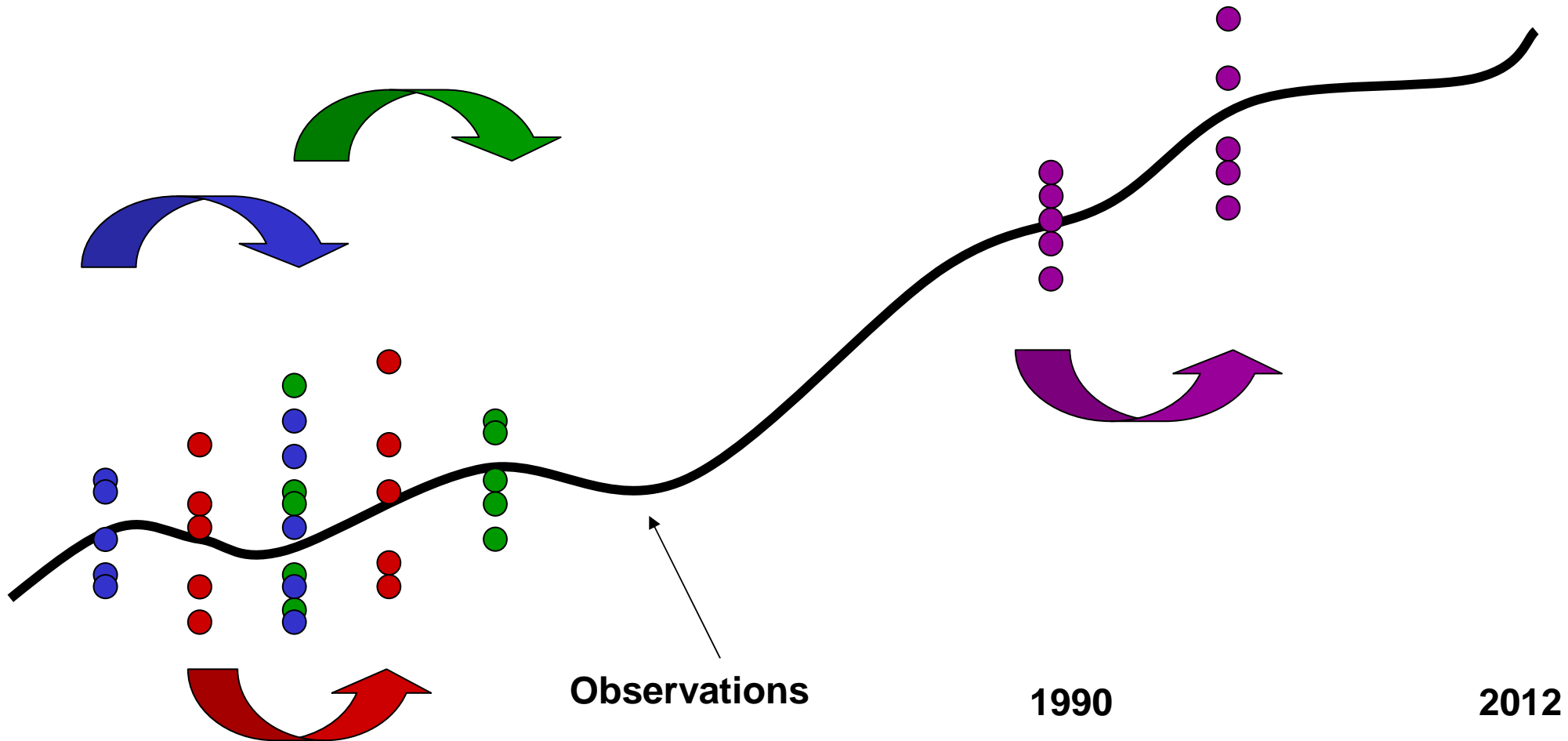
5-member prediction started 1 Nov 1960



Methodology

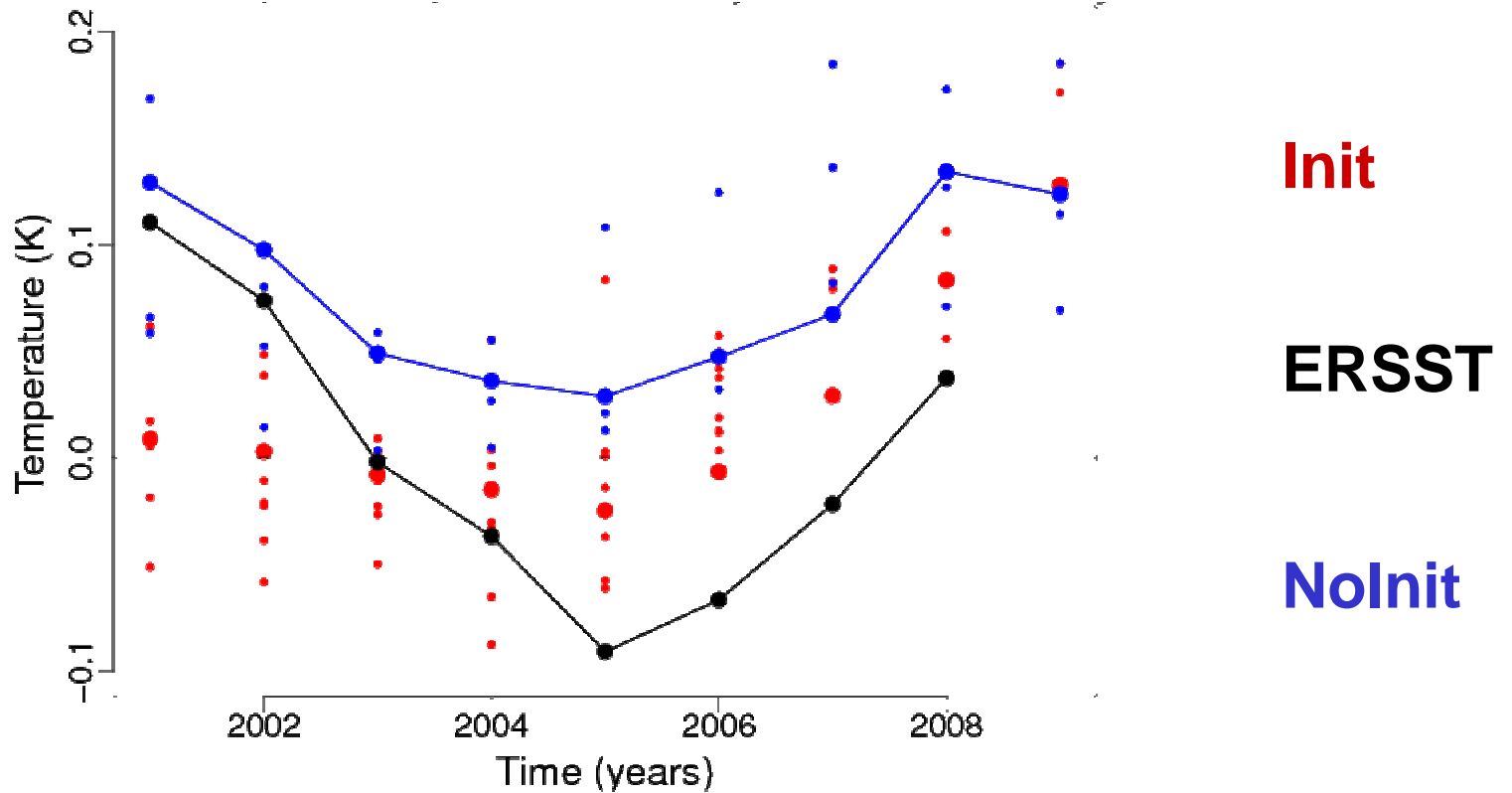
Analyses:

3-year mean changes along the forecast



Successful climate prediction of the 2000-2010 global temperature plateau

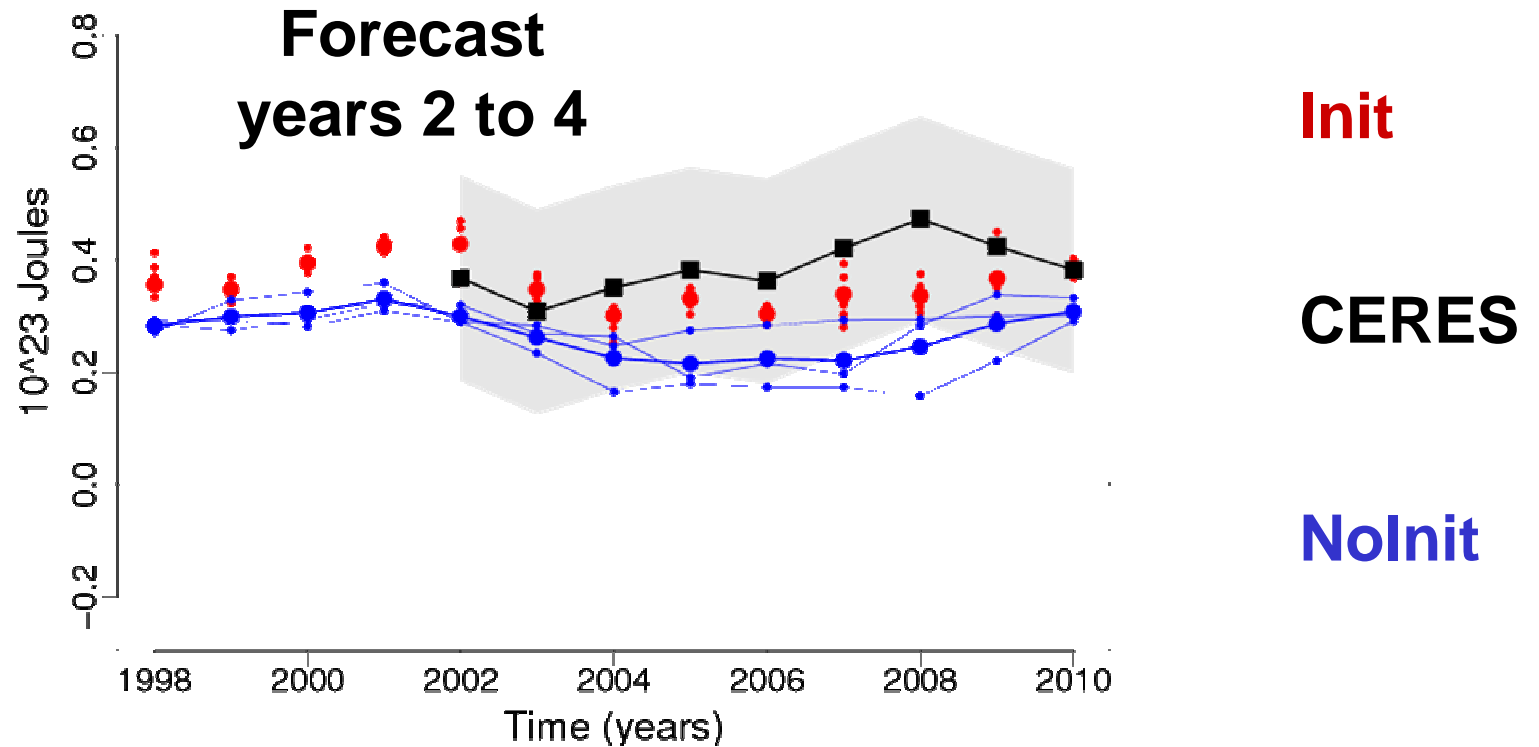
3-year mean change in global SST (60°S-60°N)



Initialization improves the SST trend along the forecast

Analysis of these predictions to attribute the 2000-2010 global temperature plateau

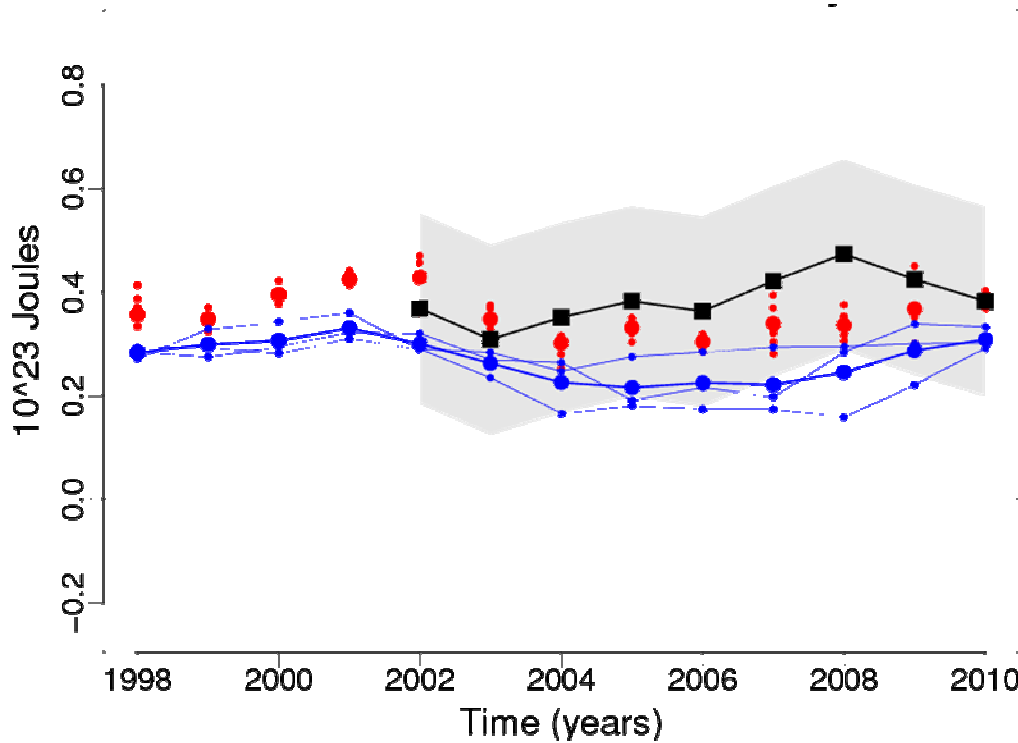
Global Top-of Atmosphere Excess Energy



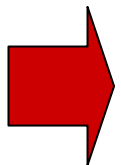
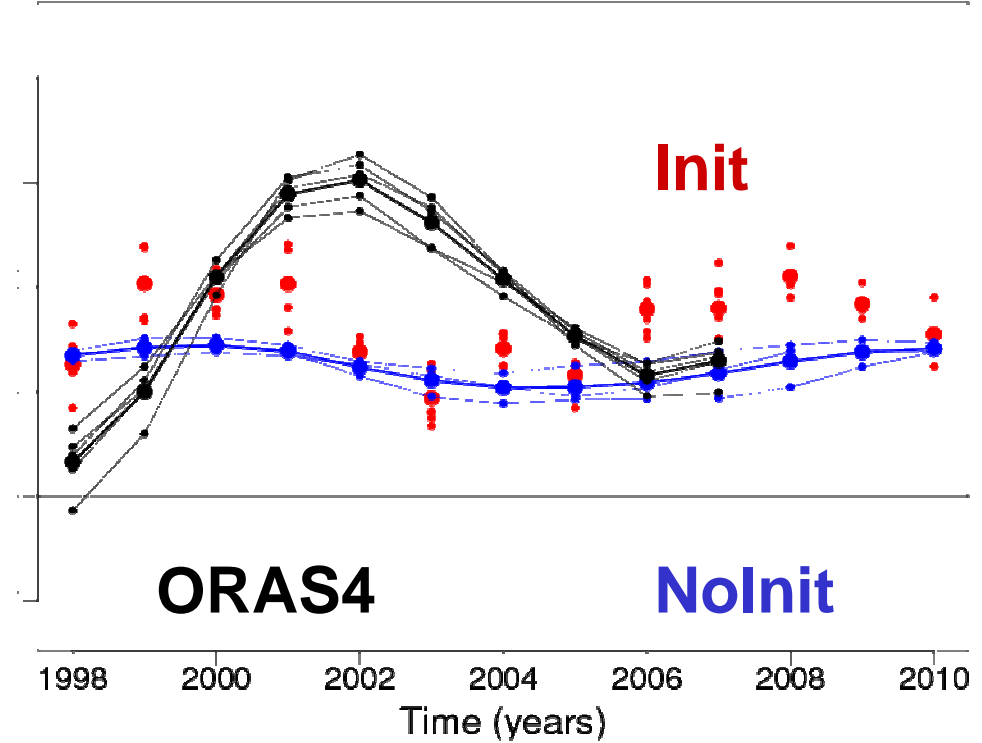
TOA input energy around 0.4 x 10²³ Joules captured

Analysis of these predictions to attribute the 2000-2010 global temperature plateau

Global TOA Excess Energy



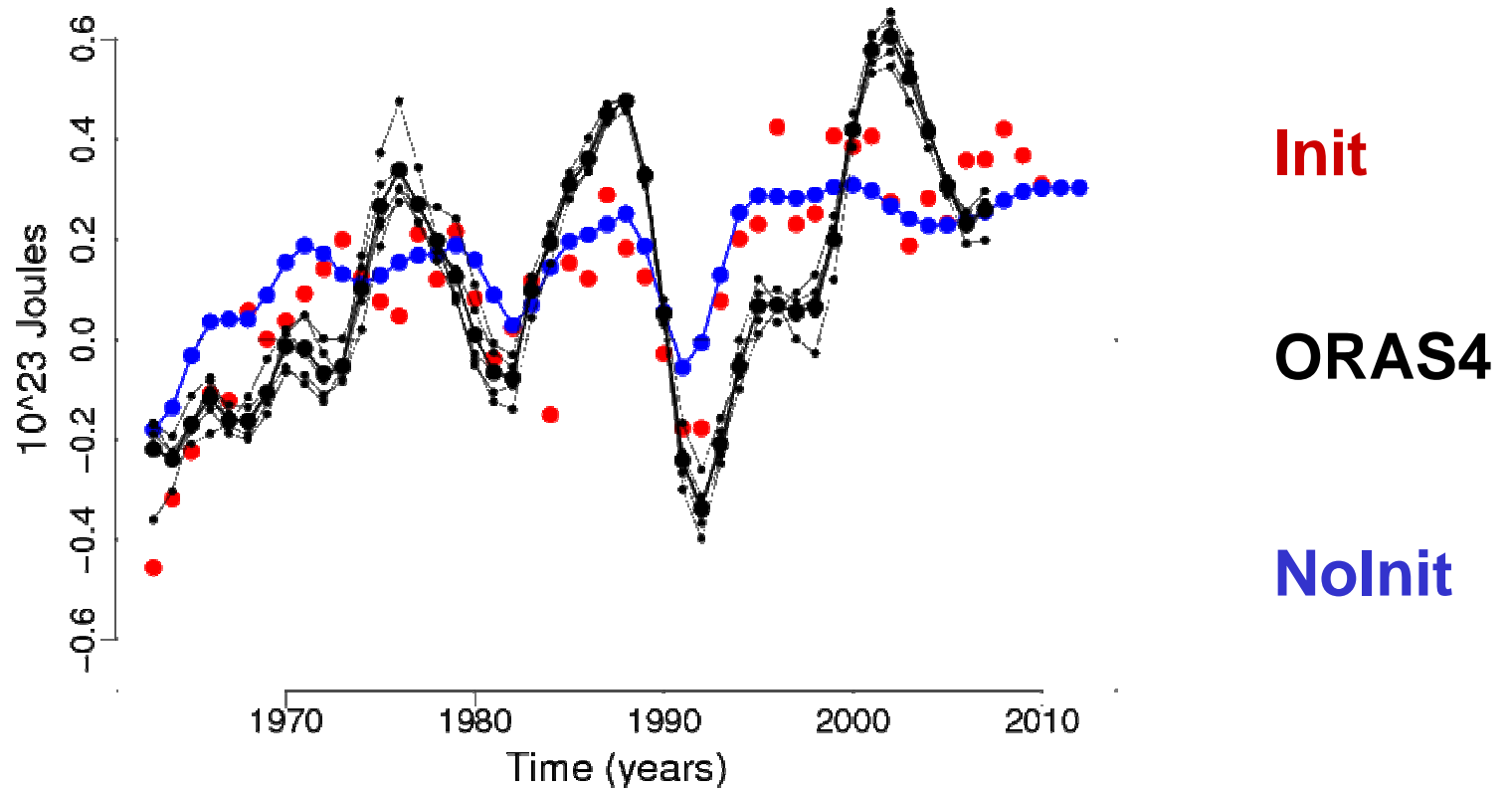
Global Ocean Heat Uptake



Increased Ocean Heat Uptake compensates for TOA inflow

Analysis of these predictions to attribute the 2000-2010 global temperature plateau

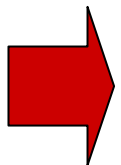
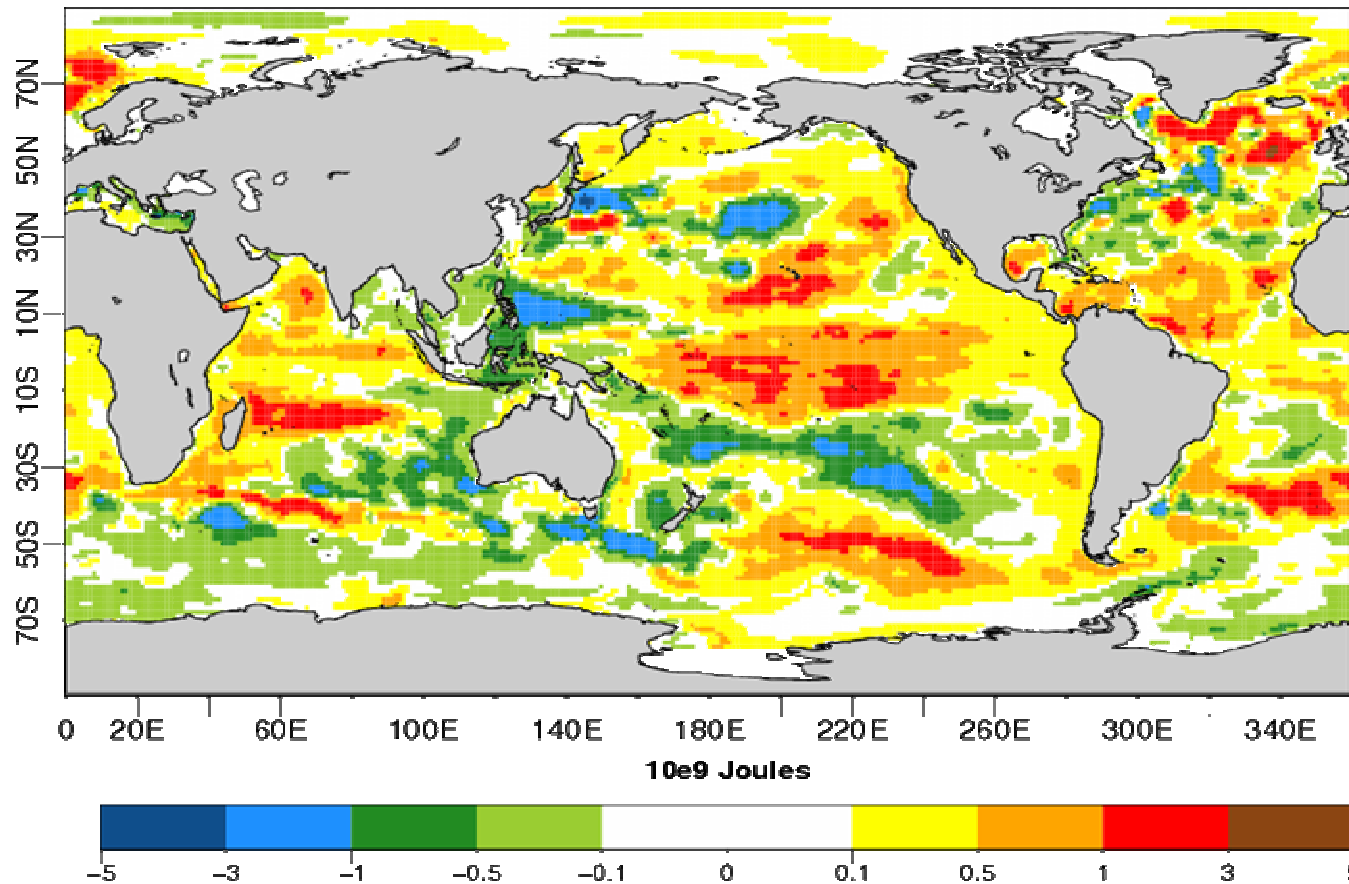
Global Ocean Heat Uptake



Largest ever recorded peak in ocean heat uptake

Analysis of these predictions to attribute the 2000-2010 global temperature plateau

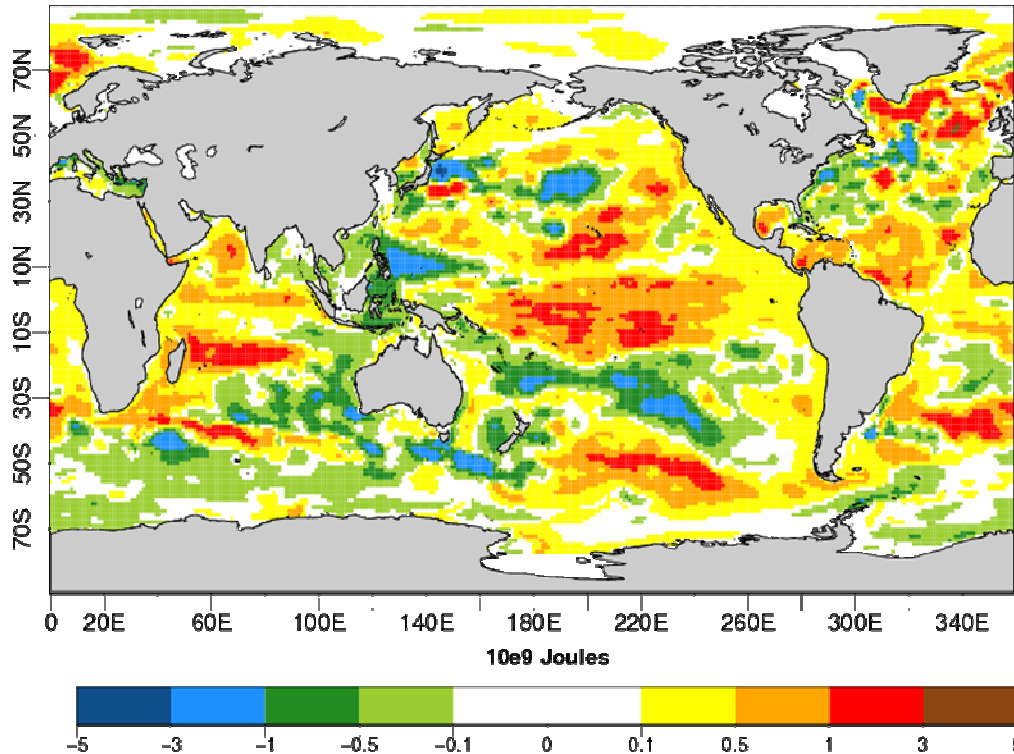
ORAS4 Ocean heat uptake (0-800m excluding the mixed layer) at the onset of the plateau



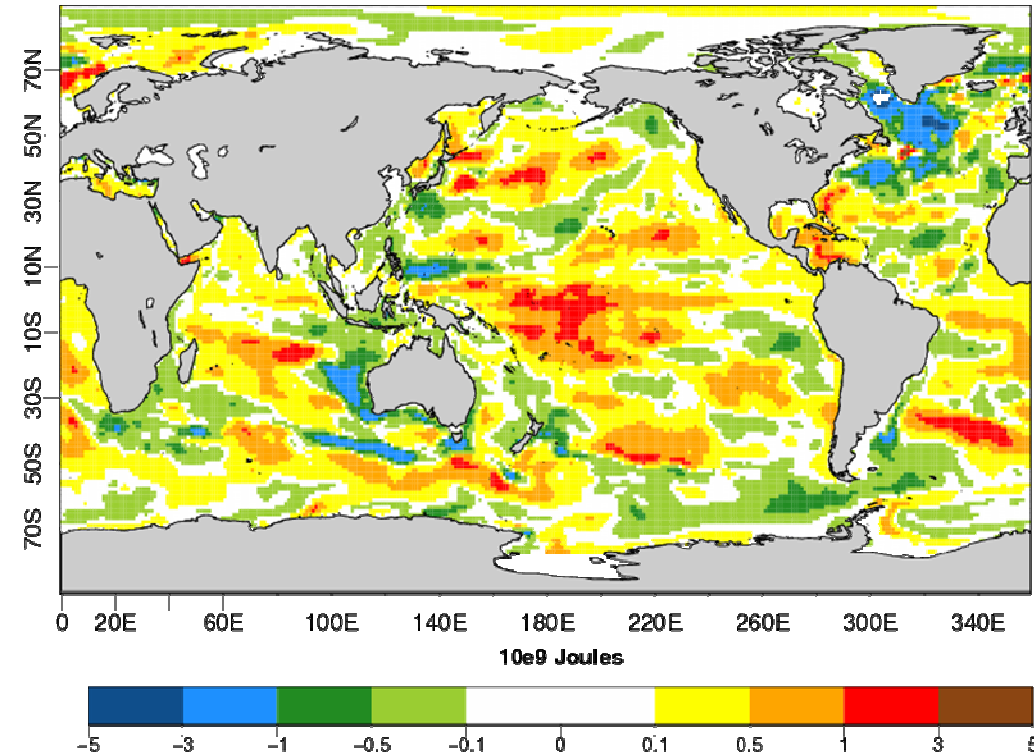
The plateau seems due to increased ocean heat absorption

Analysis of these predictions to attribute the 2000-2010 global temperature plateau

ORAS4



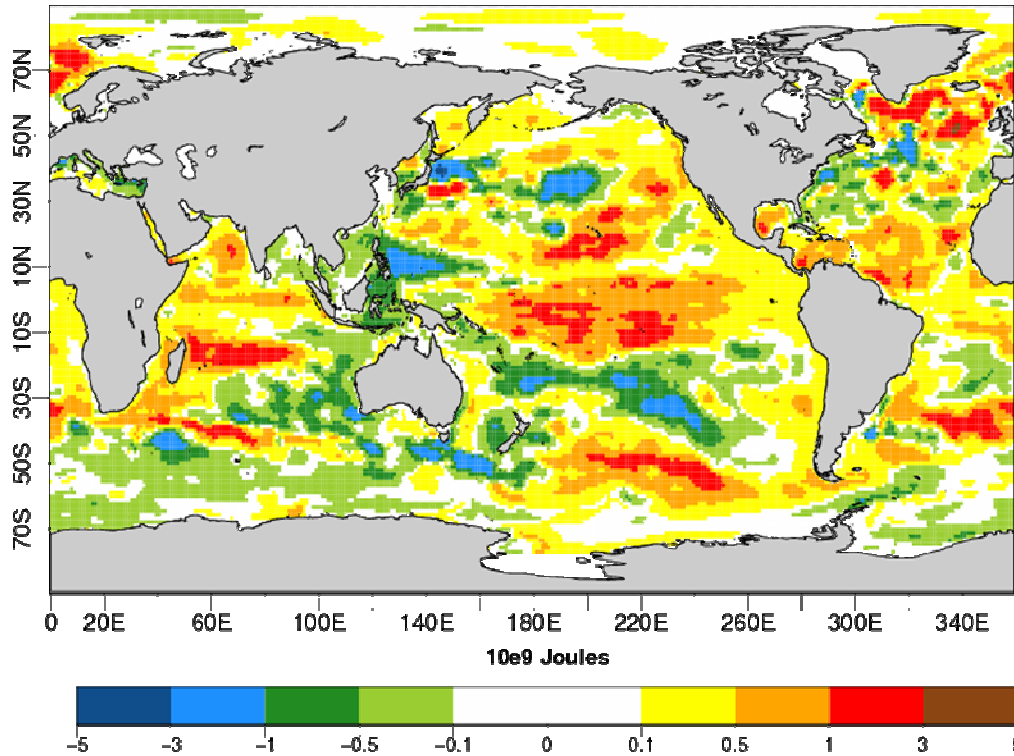
Init



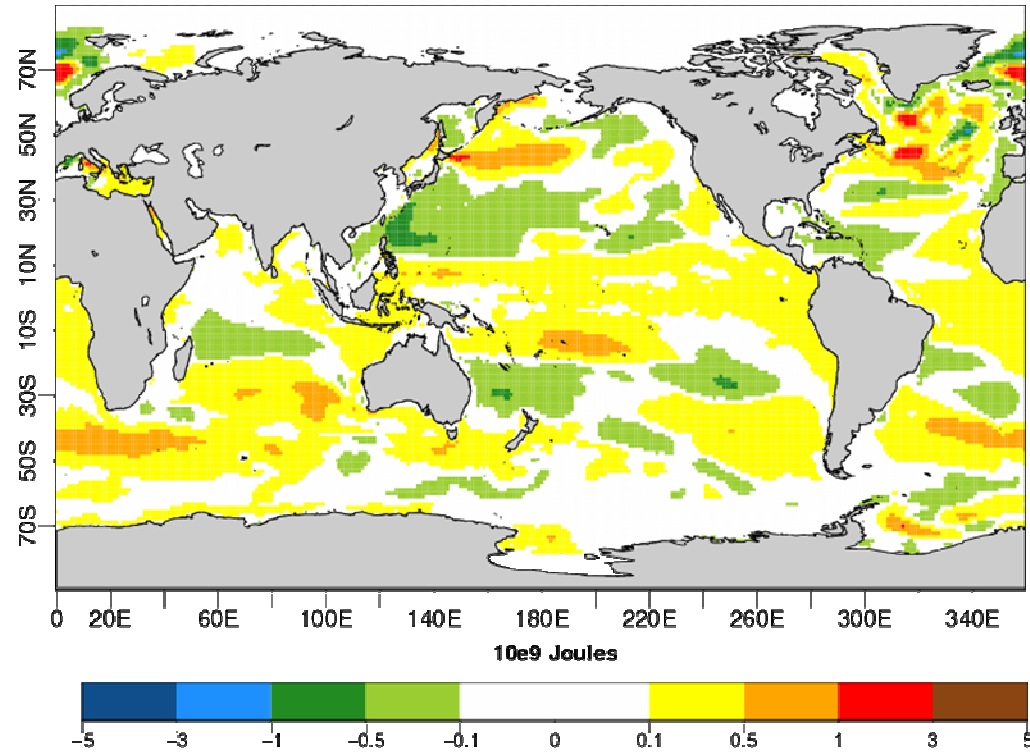
Increased ocean heat uptake in the Pacific captured by Init

Analysis of these predictions to attribute the 2000-2010 global temperature plateau

ORAS4



NoInIt



Weak signals after ensemble-mean operator on NoInIt

Conclusions

- **Ec-Earth climate predictions capture the temperature plateau until 5 years ahead. The realism of the SST trend along the forecast is improved with initialization**
- **The Earth's heat budget shows that the TOA excess energy has been mainly absorbed in the ocean below the mixed layer at the onset of the plateau**



**Thank you very much for
your attention**

virginie.guemas@ic3.cat