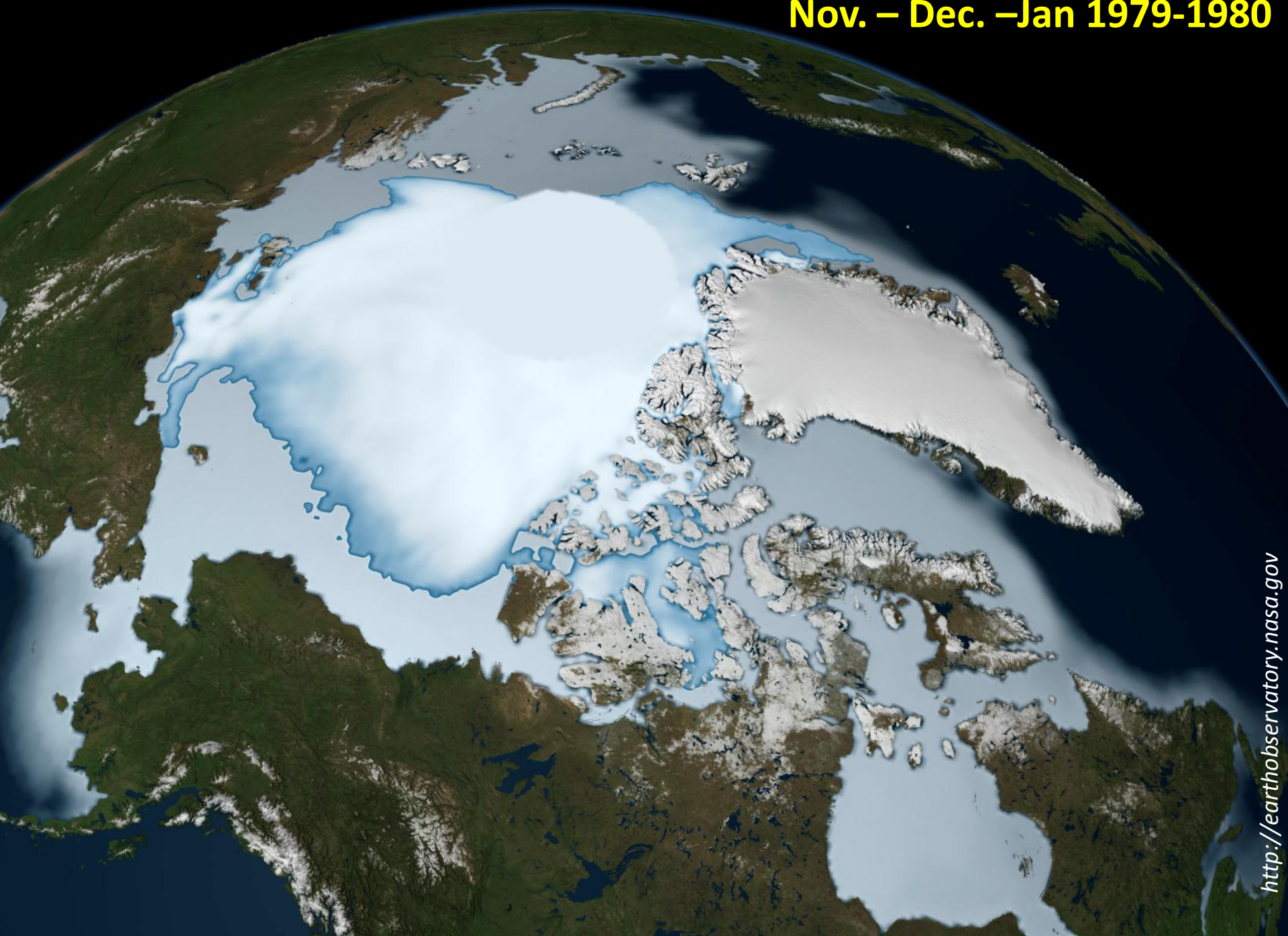


Nov. – Dec. –Jan 1979-1980



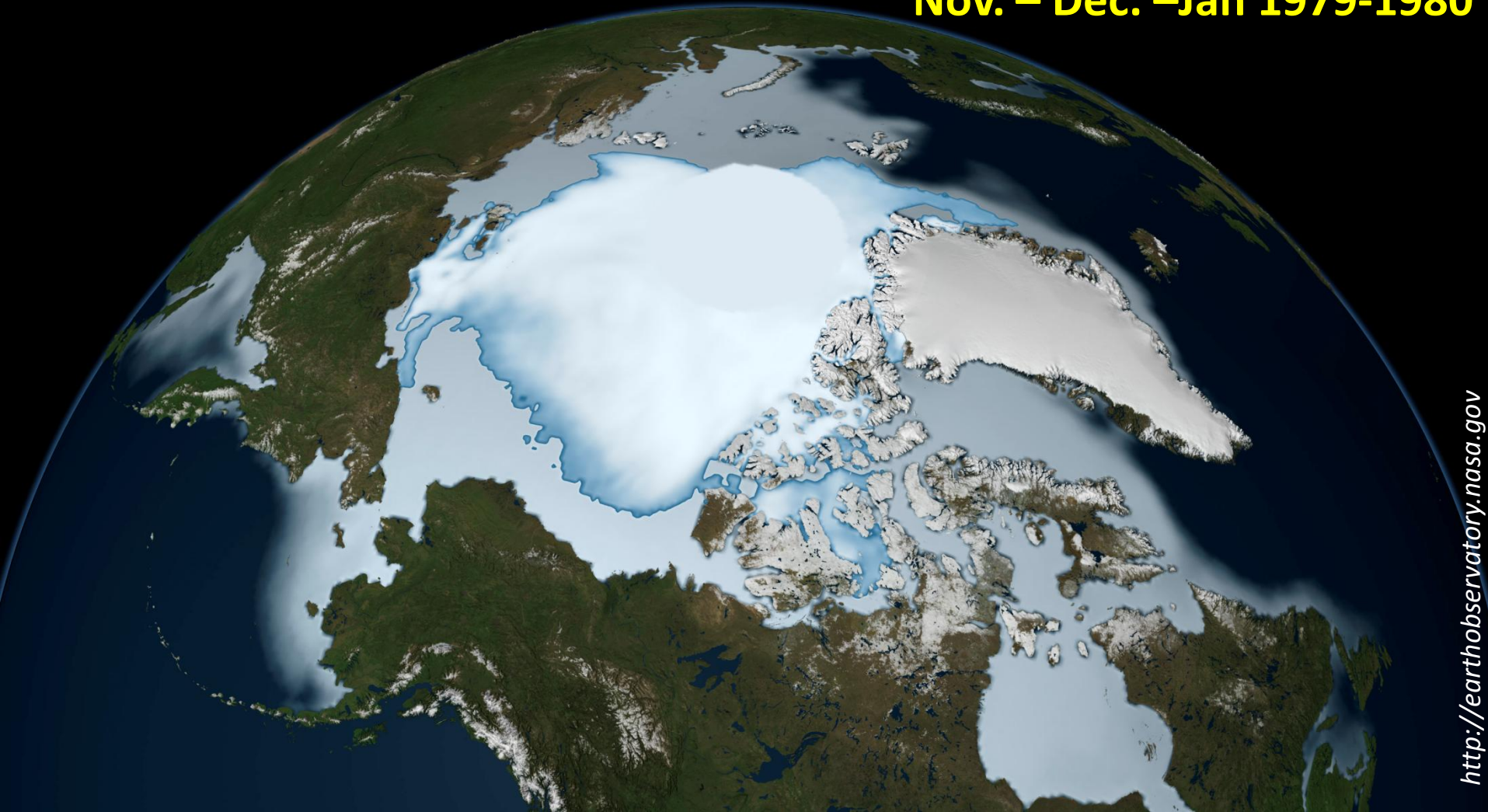
MeteoClim2012 Symposium
Université de Liège, 1st June 2012

Climate projections of Arctic sea ice

What can we learn from global models?

Arctic sea ice at a glance

Nov. – Dec. – Jan 1979-1980

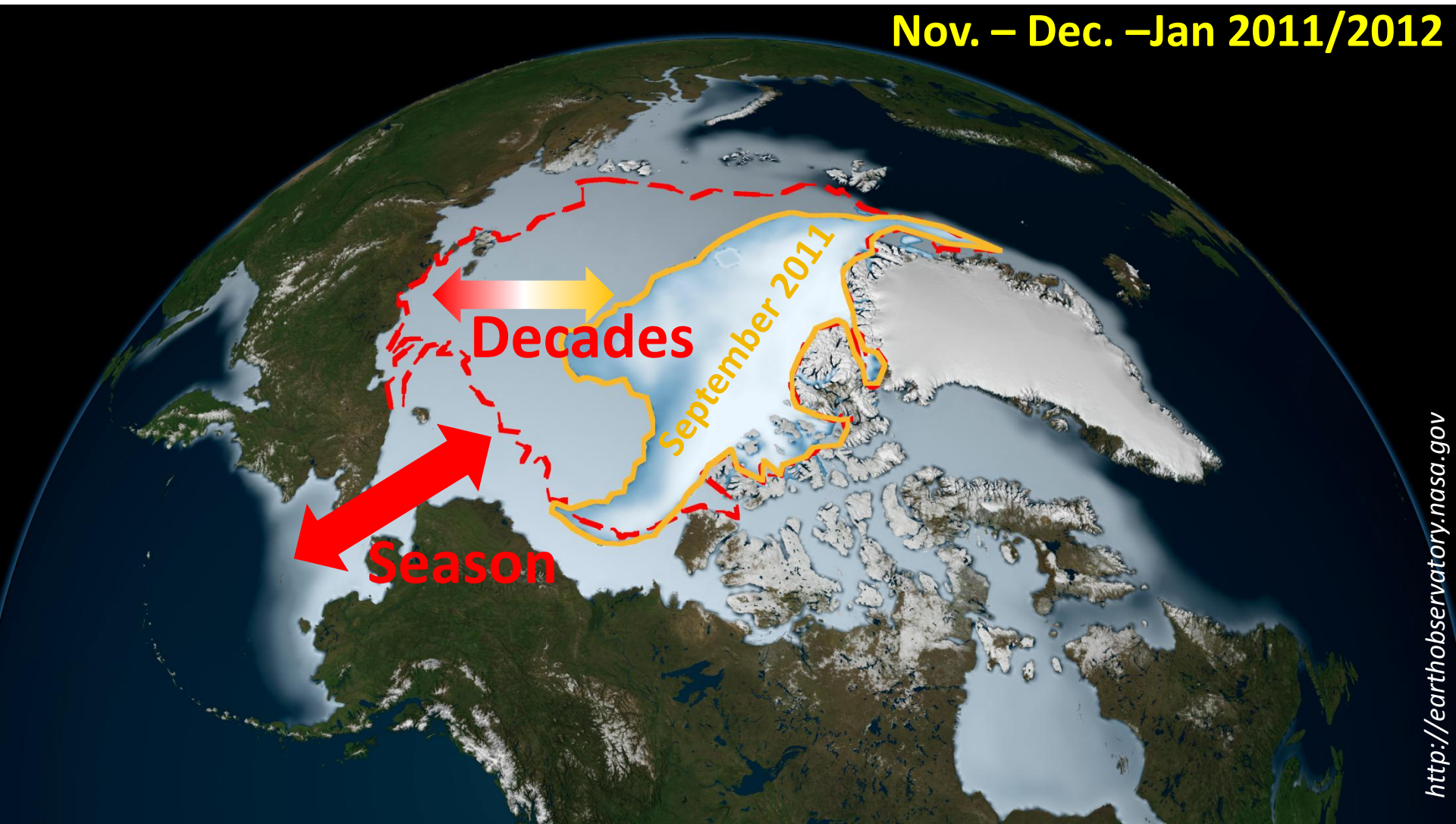


Arctic sea ice at a glance



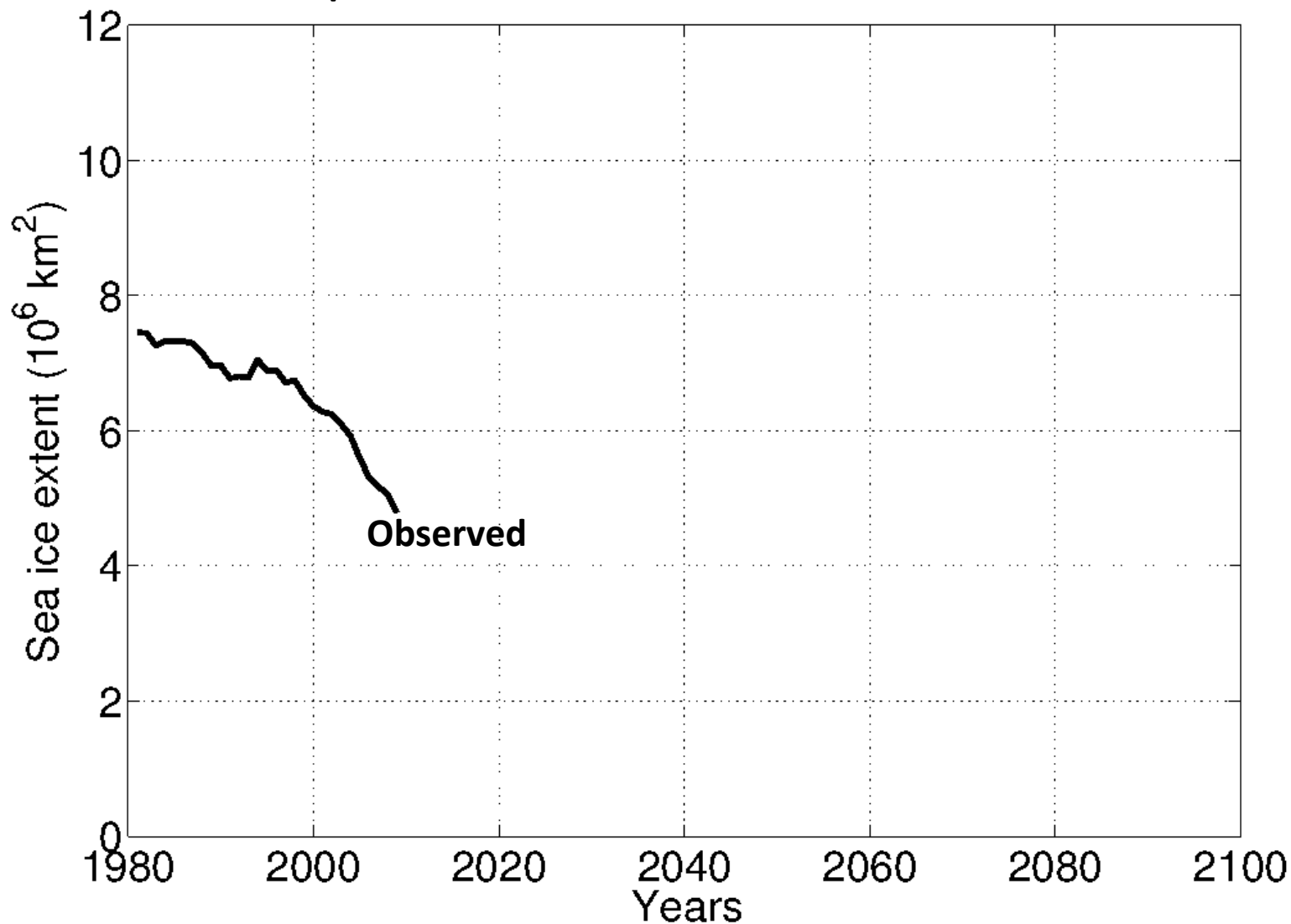
Arctic sea ice at a glance

Nov. – Dec. –Jan 2011/2012



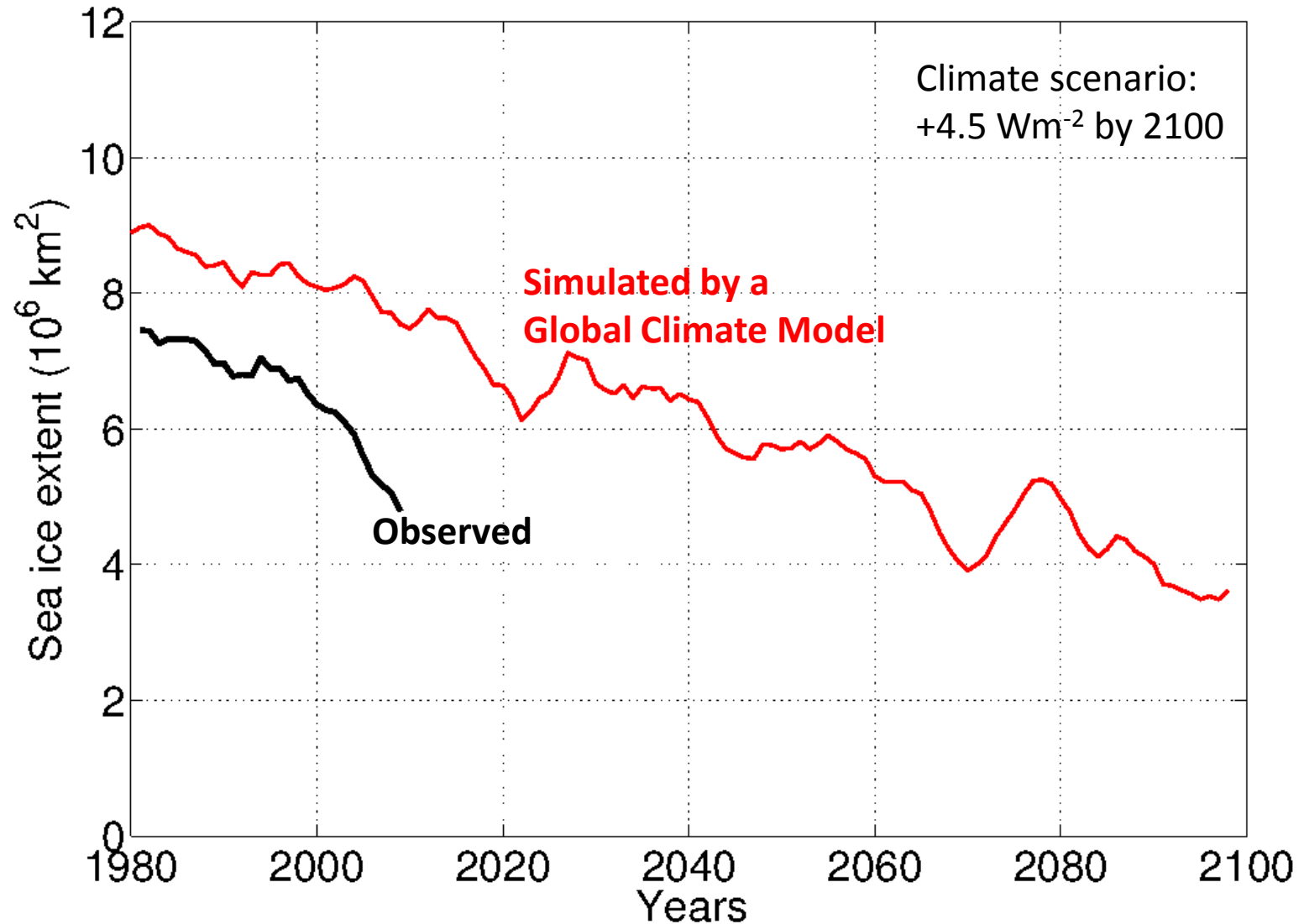
Arctic sea ice has shrunk since decades

September Arctic sea ice extent



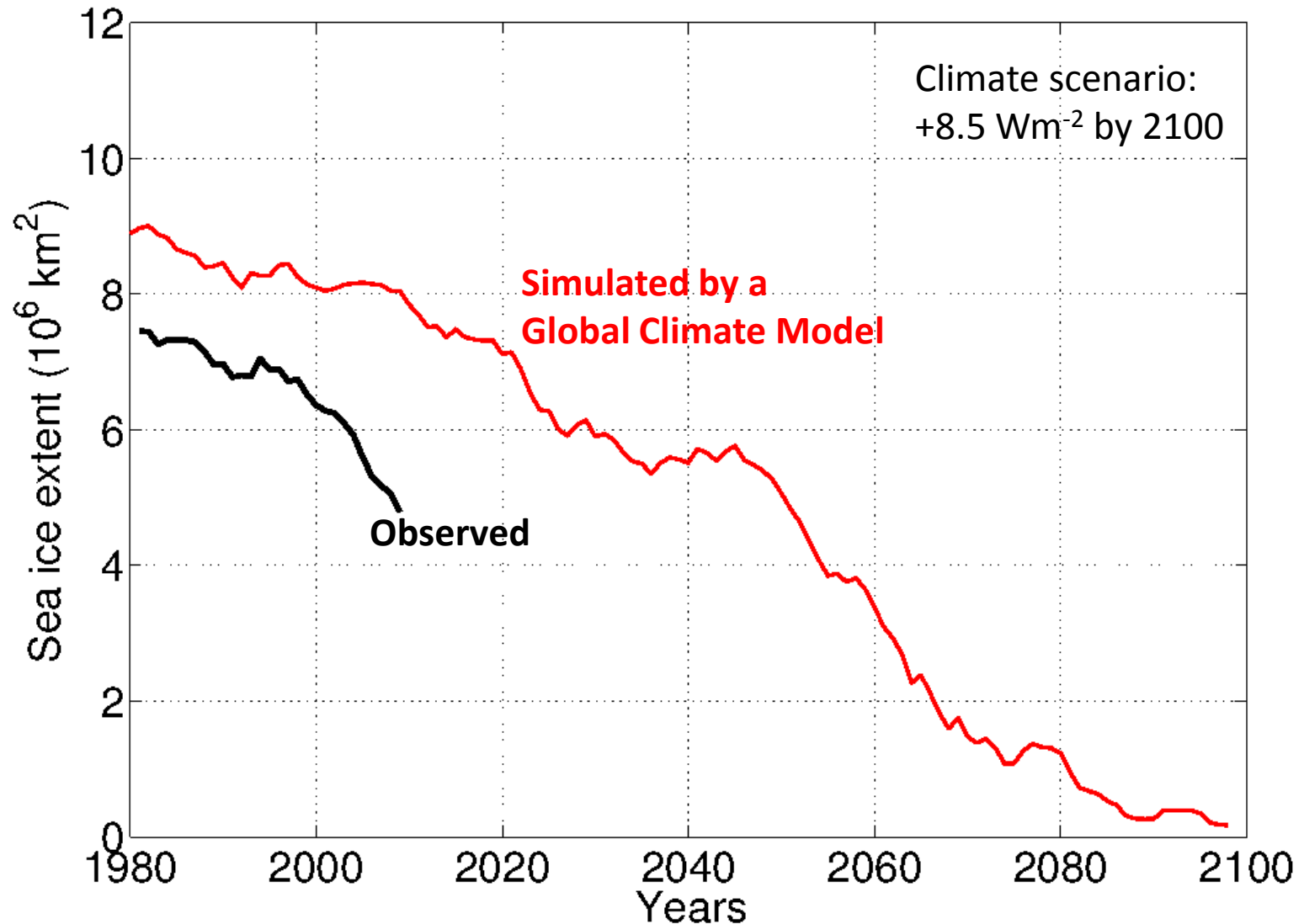
Arctic sea ice expected to shrink even more

September Arctic sea ice extent



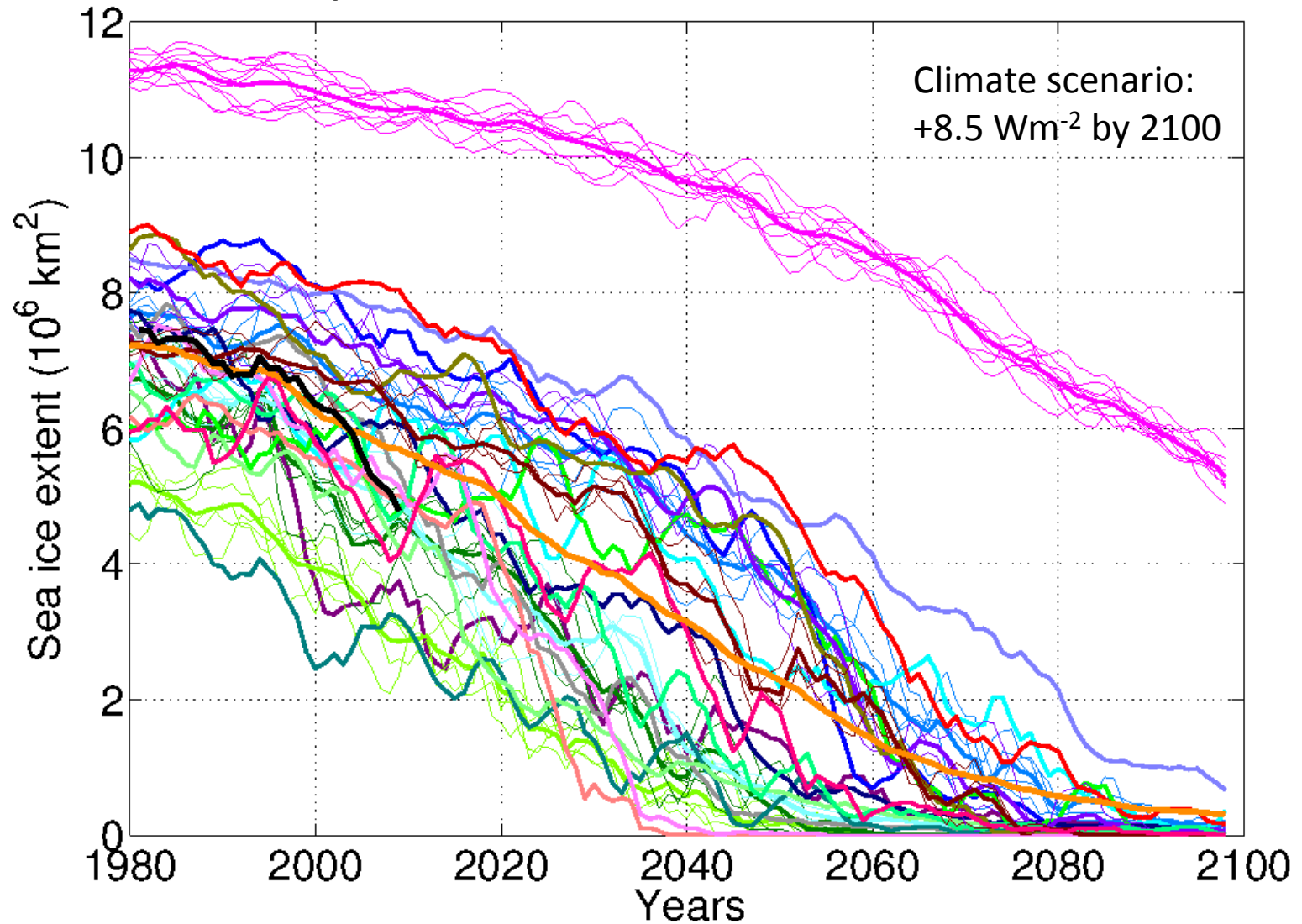
Arctic sea ice expected to shrink even more

September Arctic sea ice extent



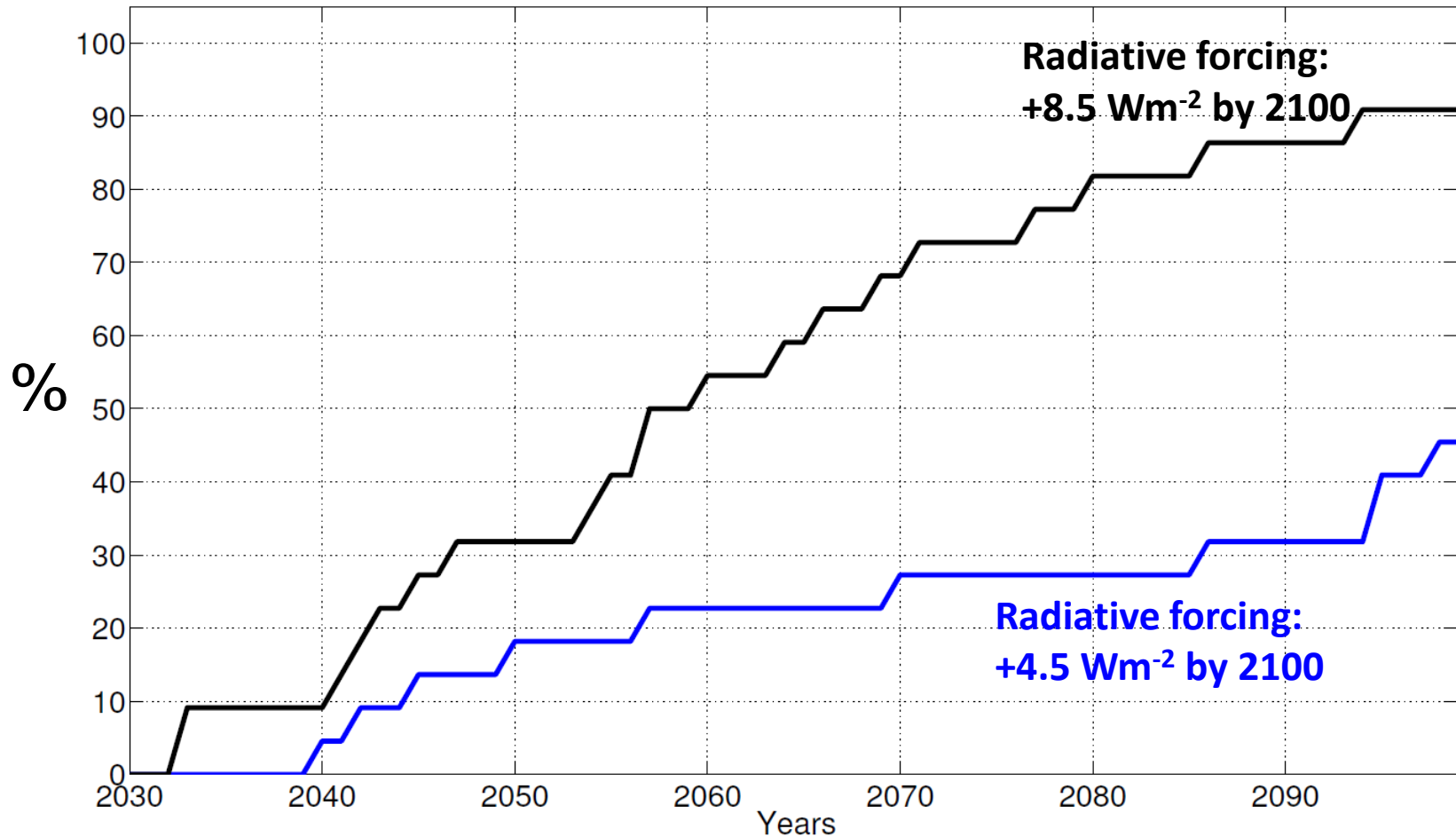
Uncertainties in projected decline

September Arctic sea ice extent



Probabilistic interpretation of uncertainties

Proportion of models with
September sea ice extent ≤ 1 million km^2



We have ½ information



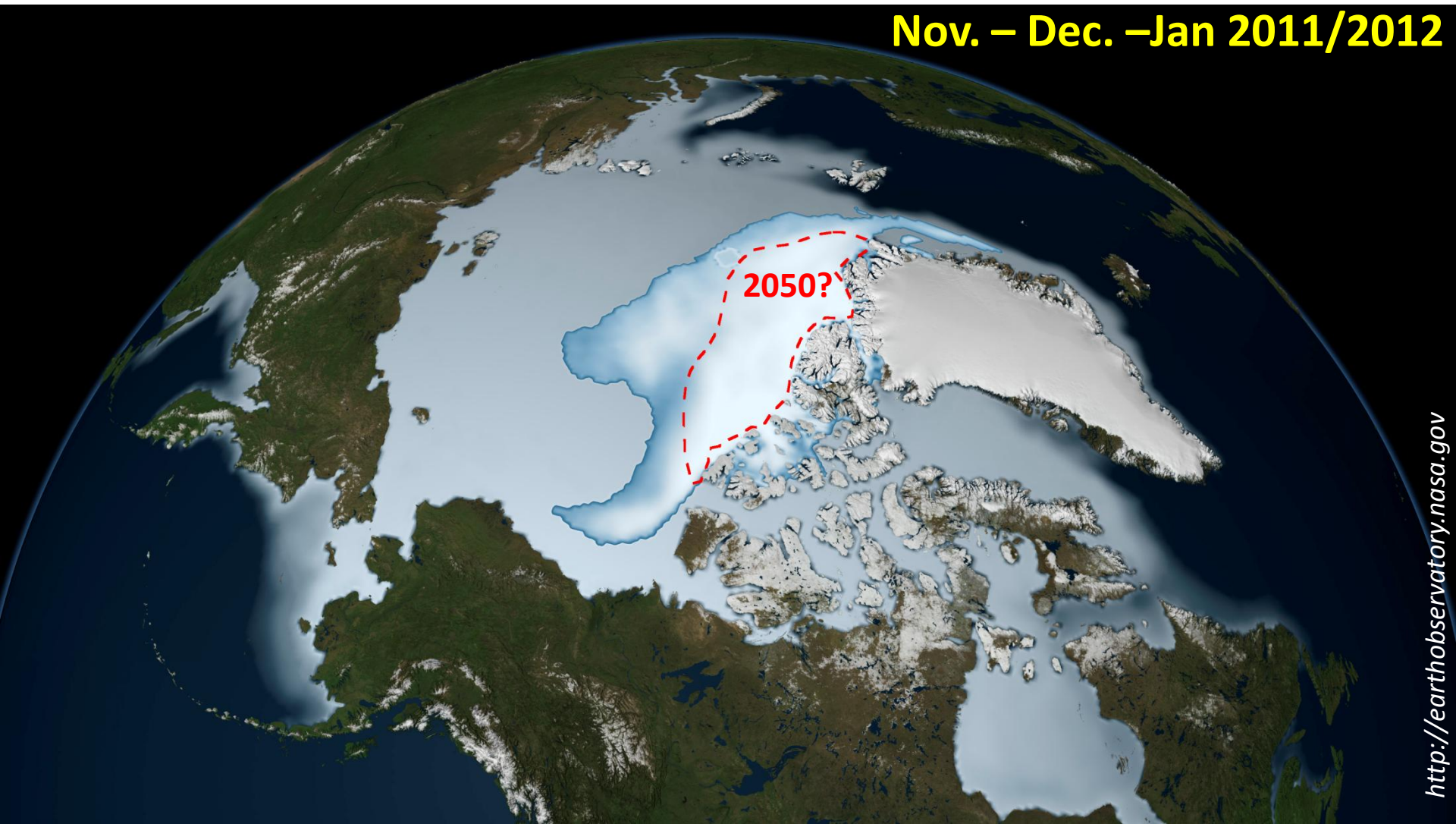
We have ½ information

Nov. – Dec. – Jan 2011/2012



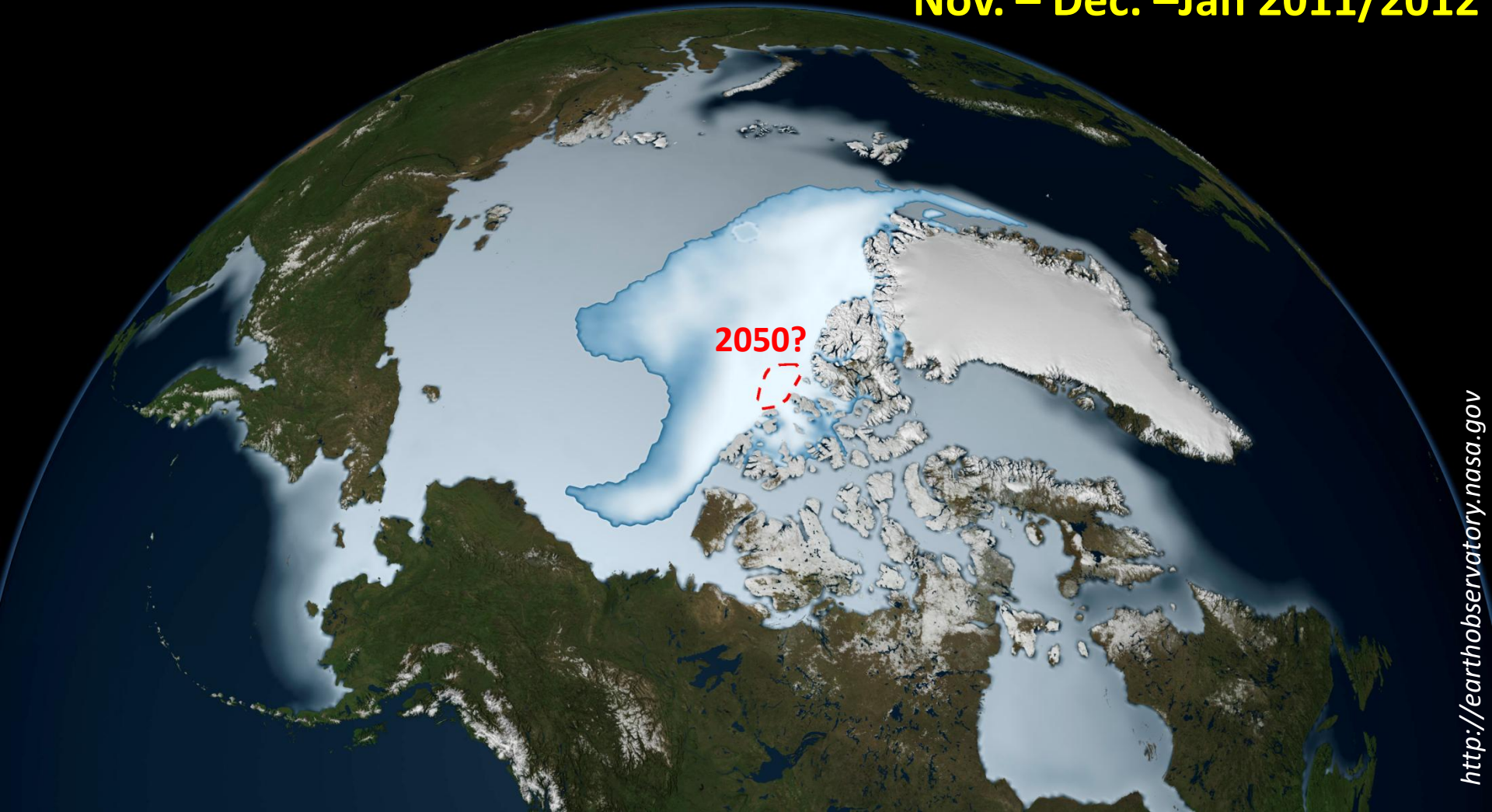
We have ½ information

Nov. – Dec. – Jan 2011/2012



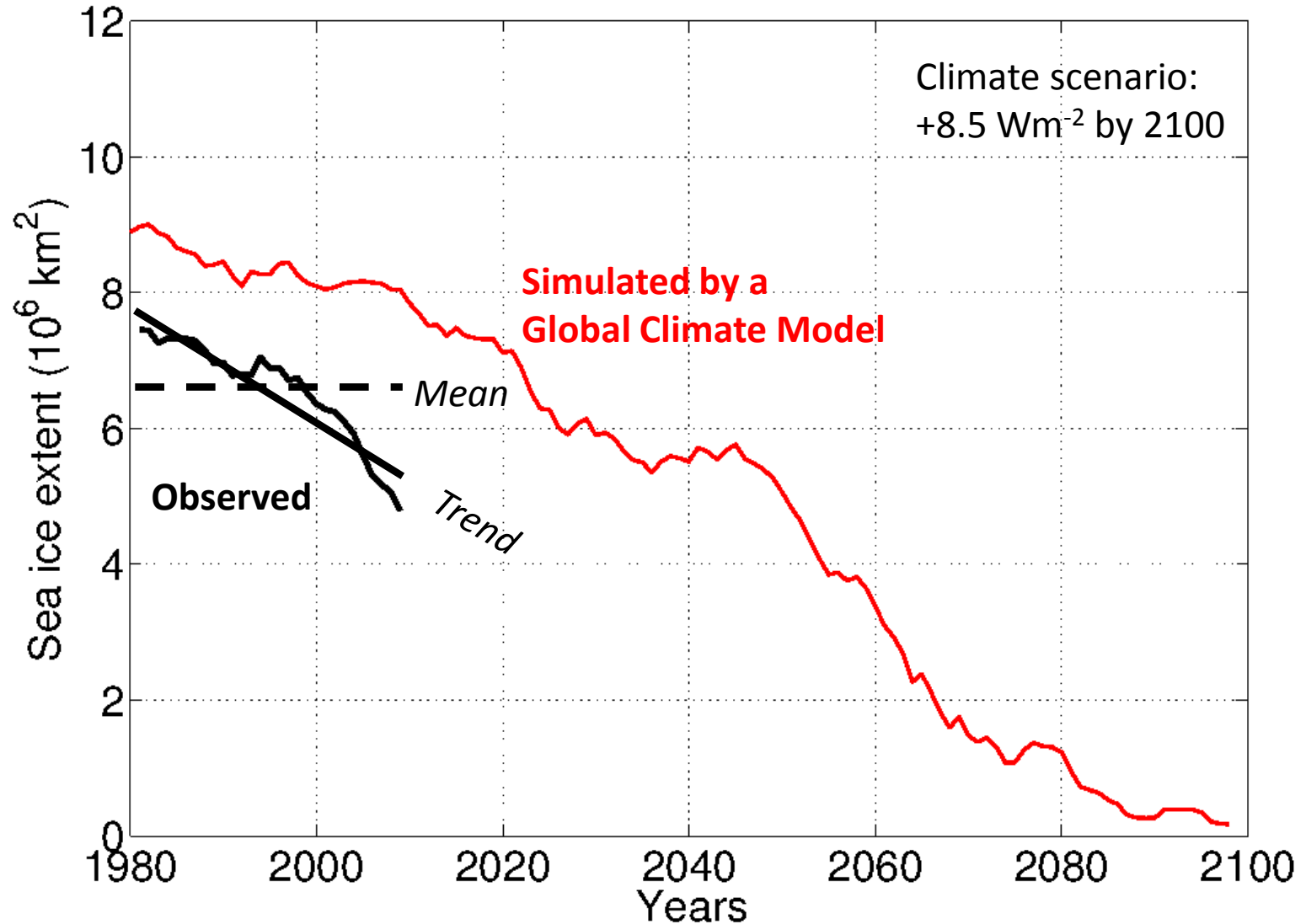
We have ½ information

Nov. – Dec. – Jan 2011/2012



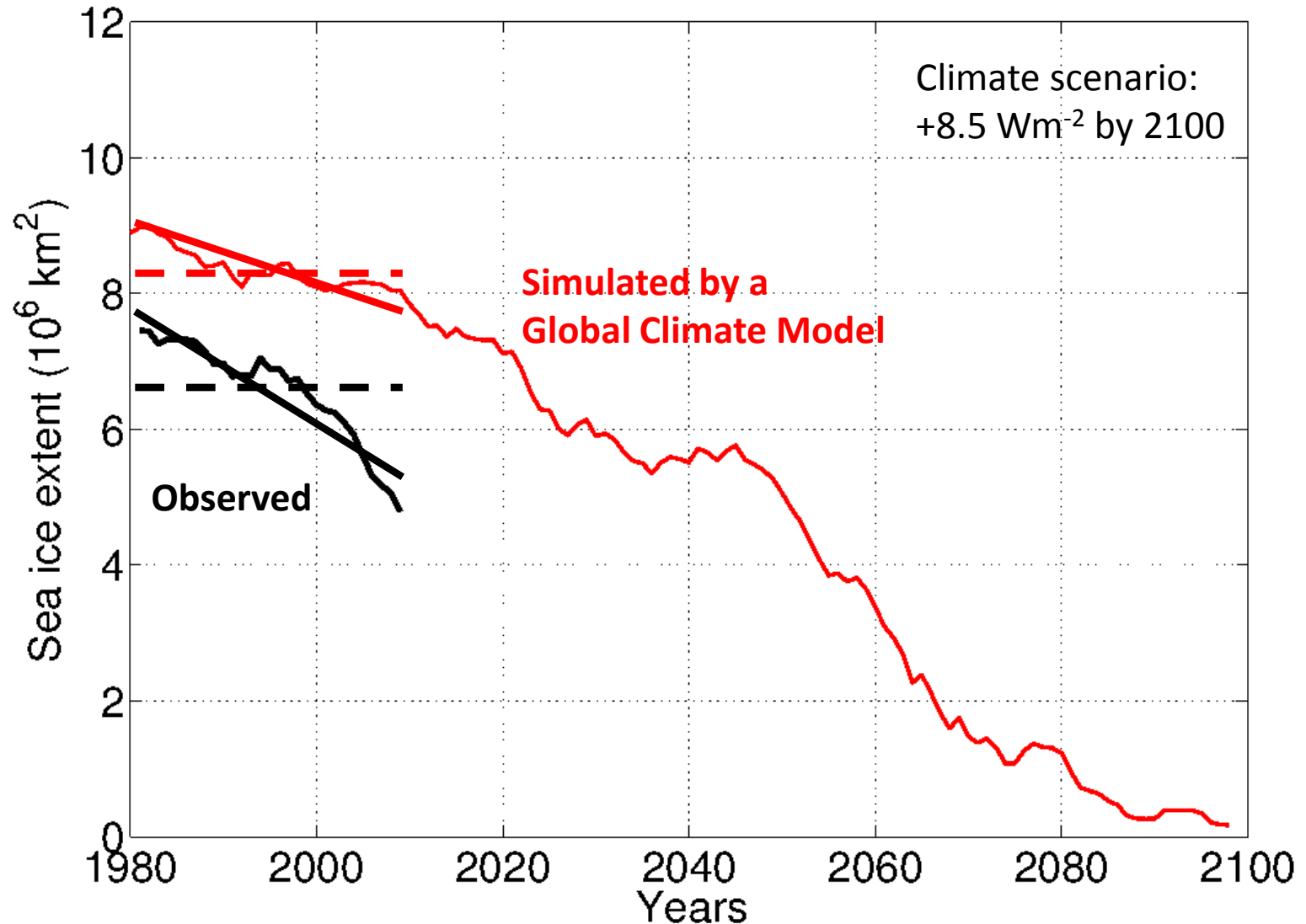
Constrain 100 yr simulations with 30 yr of data

September Arctic sea ice extent



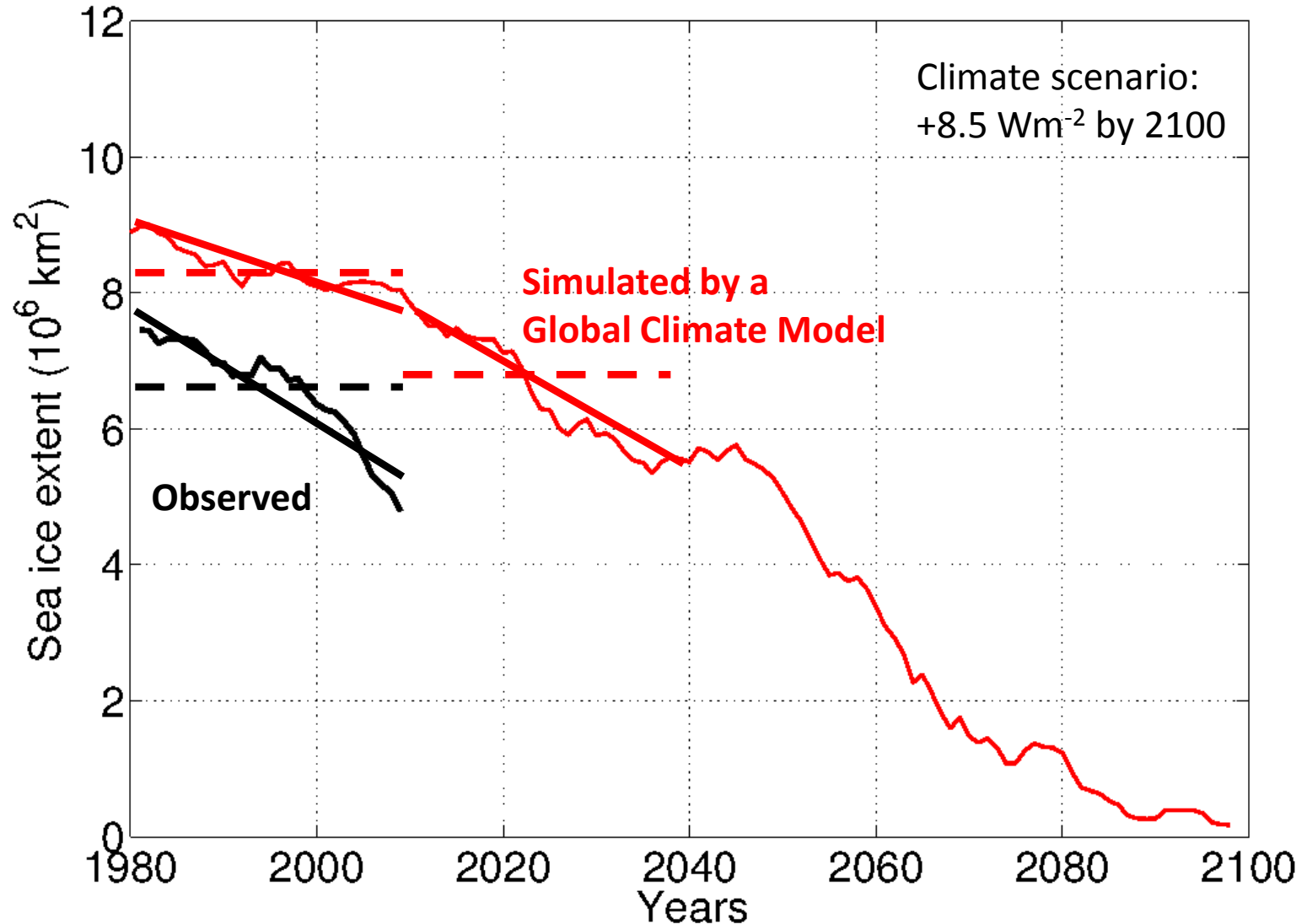
Constrain 100 yr simulations with 30 yr of data

September Arctic sea ice extent



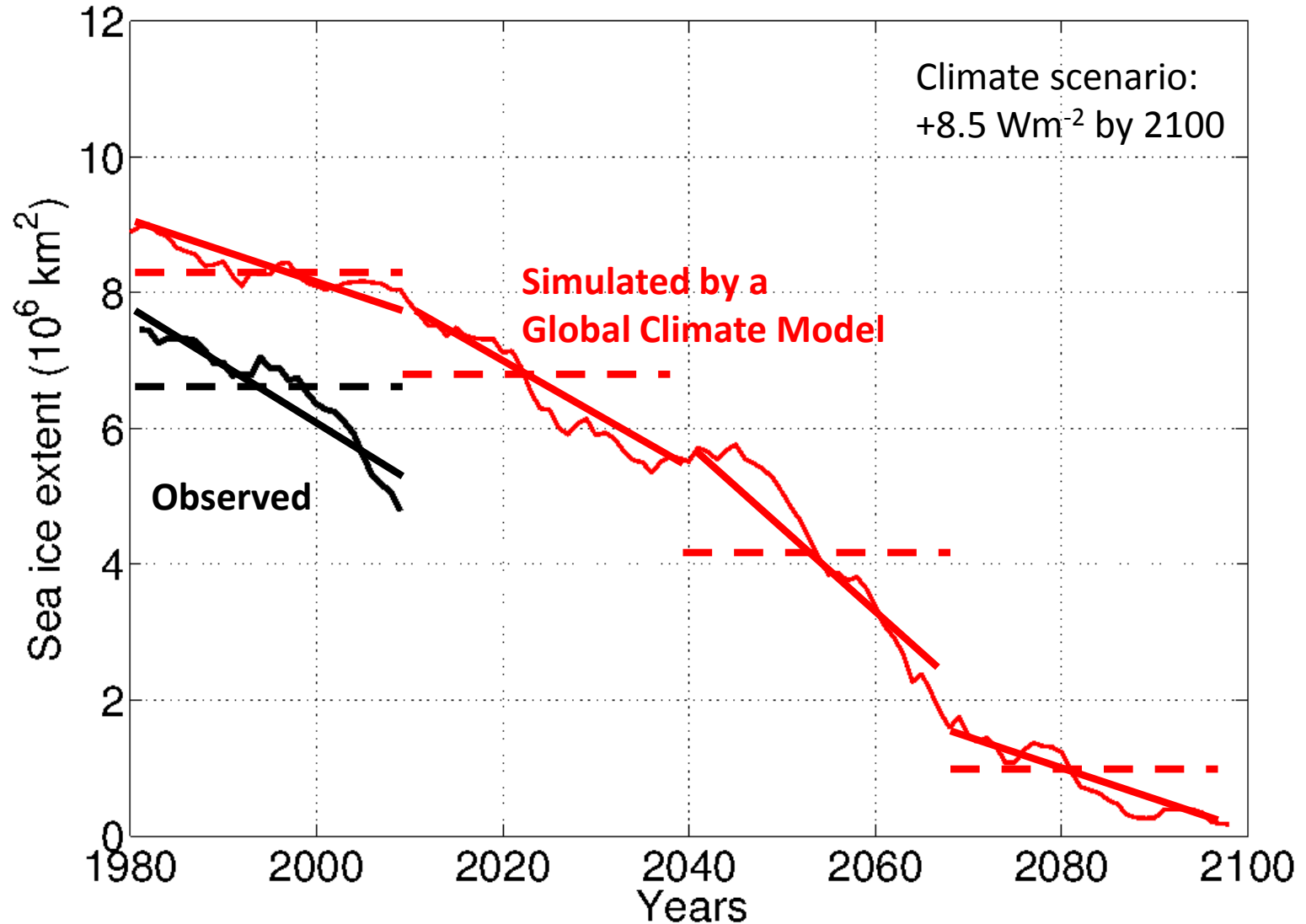
Constrain 100 yr simulations with 30 yr of data

September Arctic sea ice extent



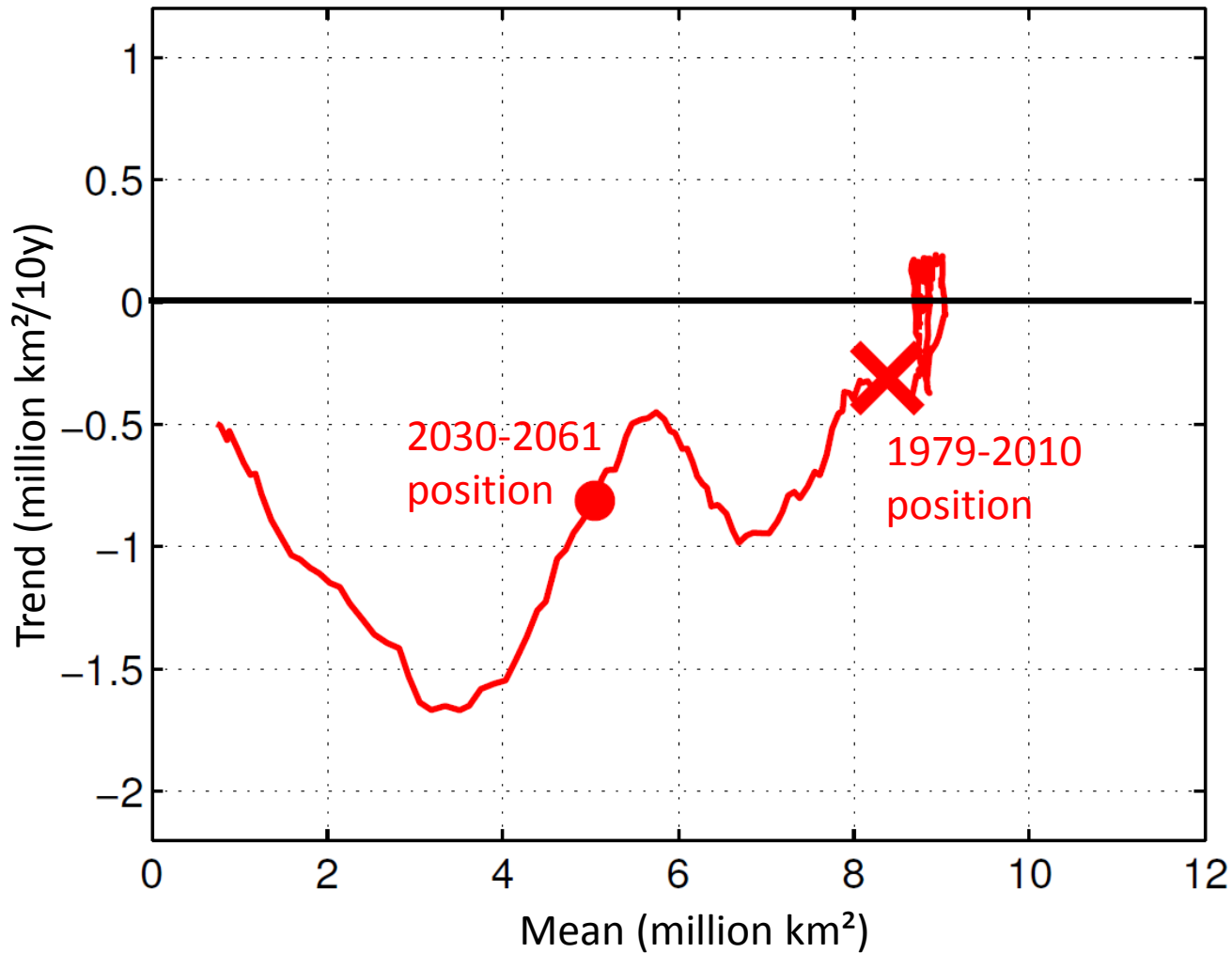
Constrain 100 yr simulations with 30 yr of data

September Arctic sea ice extent

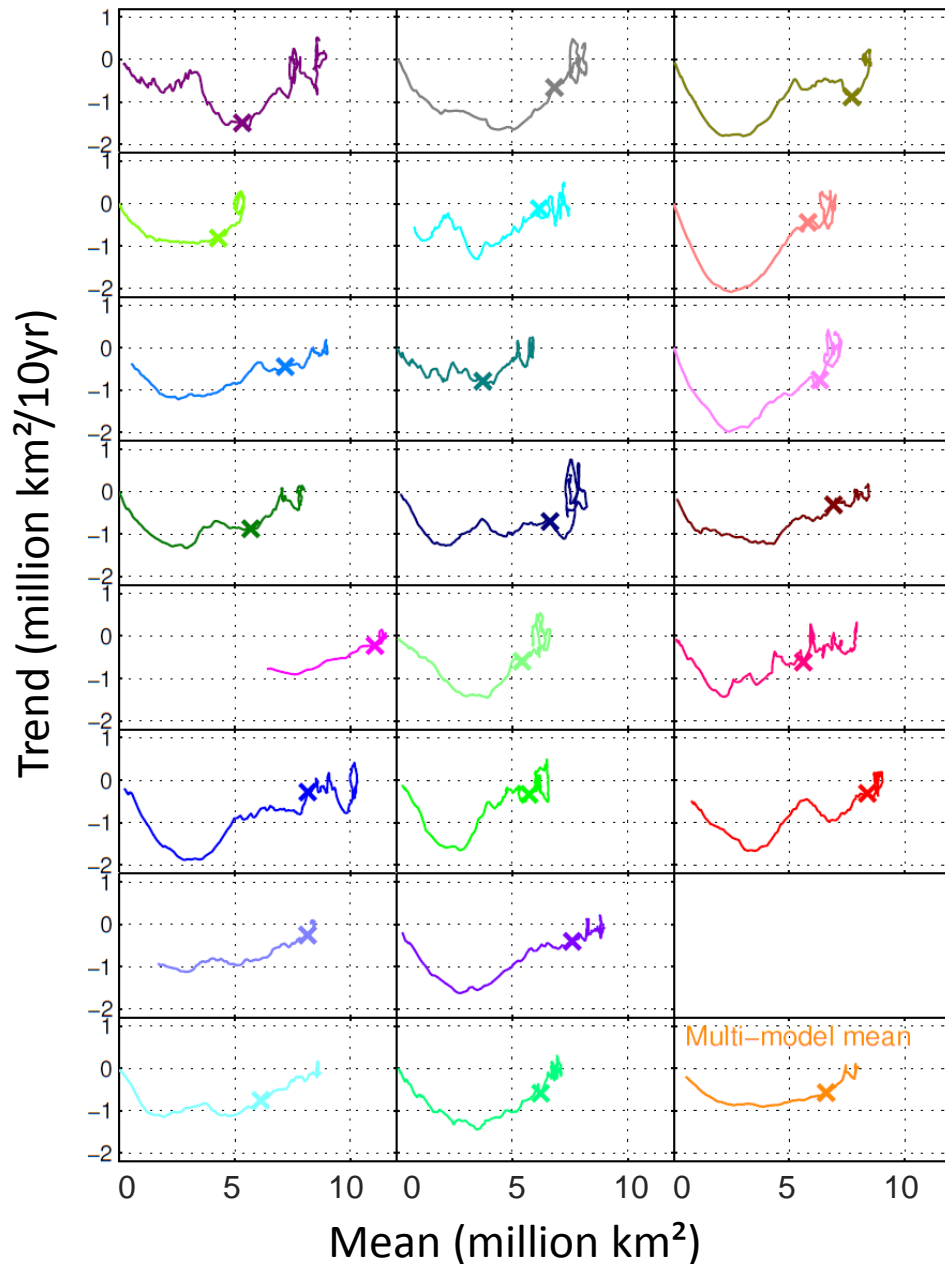


A phase-space diagram for sea ice extent

September Arctic sea ice extent evolution



Global models share similarities



September Arctic sea ice extent evolution

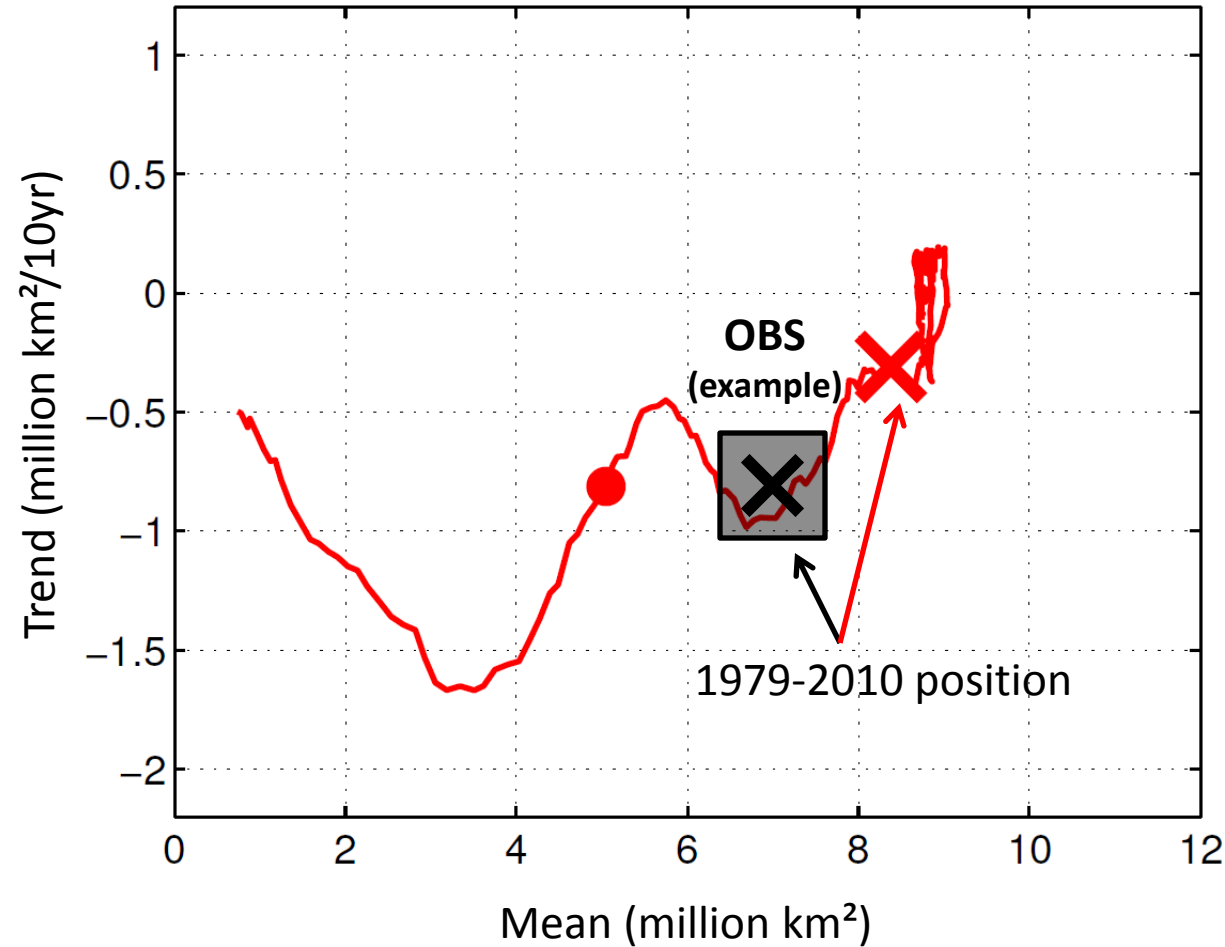
↙
x = 1979-2010 model position

1. Similar trajectories towards ice-free conditions
2. Different current positions



Global models share similarities

September Arctic sea ice extent evolution



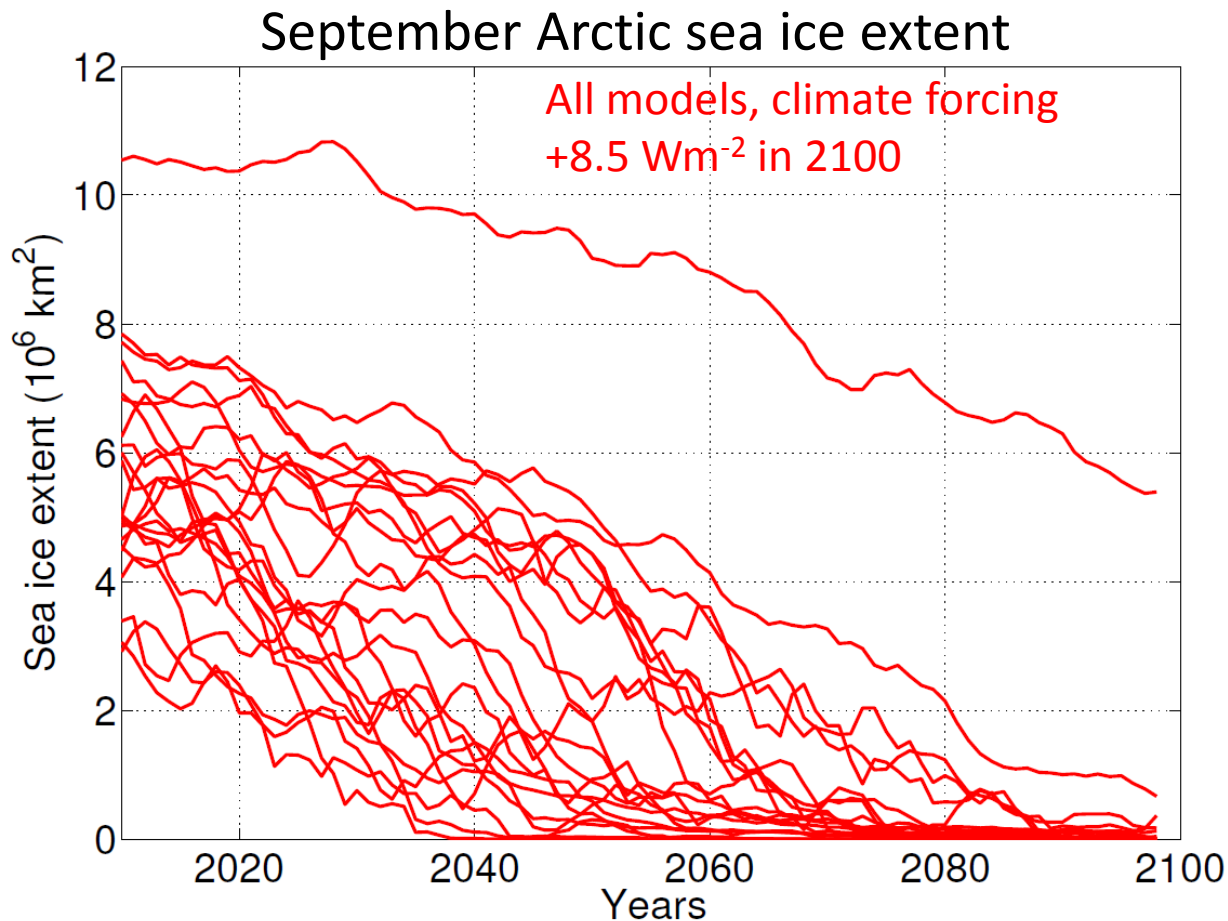
Only one snapshot is available from observations, with uncertainties.

Would you trust this model?

Why?

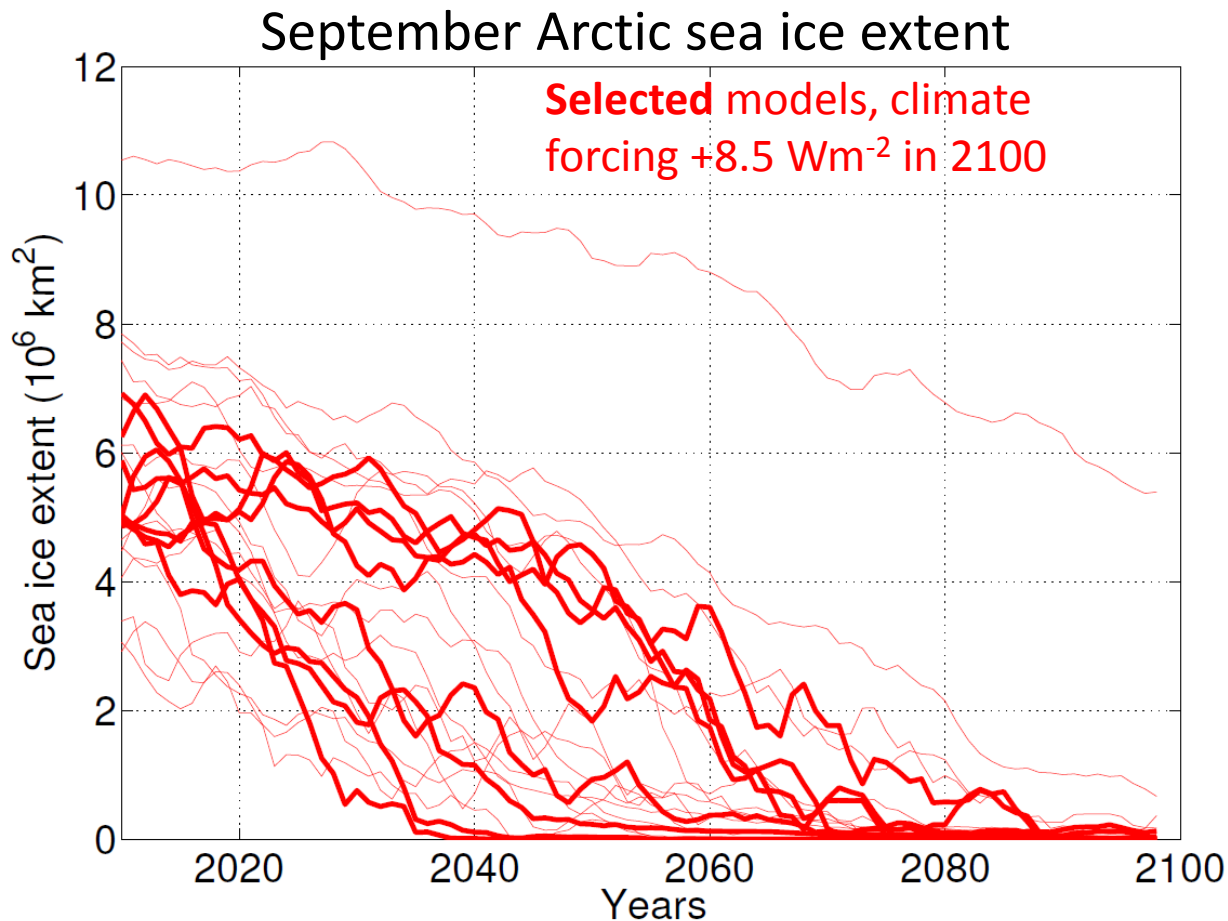
A (very simple) selection

- We have a better idea on the *nature* of selection
- For all that, setting up a numerical rule is by nature *arbitrary*



A (very simple) selection

- We have a better idea on the *nature* of selection
- For all that, setting up a numerical rule is by nature *arbitrary*



Retain models with mean September sea ice extent and amplitude of the seasonal cycle within **20%** of the observations

Take home messages

- Making climate projections is the art of driving by looking in the rear-view mirror
- Illustration with the « popular » Arctic summer sea ice extent
- Climate models population
 - Independence?
 - Complementarity?
 - Sample structural uncertainty?
 - Selection?
 - Suggested reading: R. Knutti, *The end of model democracy*, Climatic Change (2010)



This presentation will be available on
www.climate.be/u/fmasson or on demand
at francois.massonnet@uclouvain.be

