Sea Ice

Dirk Notz

Max Planck Institut für Meteorologie

Overview

1. How not to combine observations with models

2. Questions arising from CCI sea ice
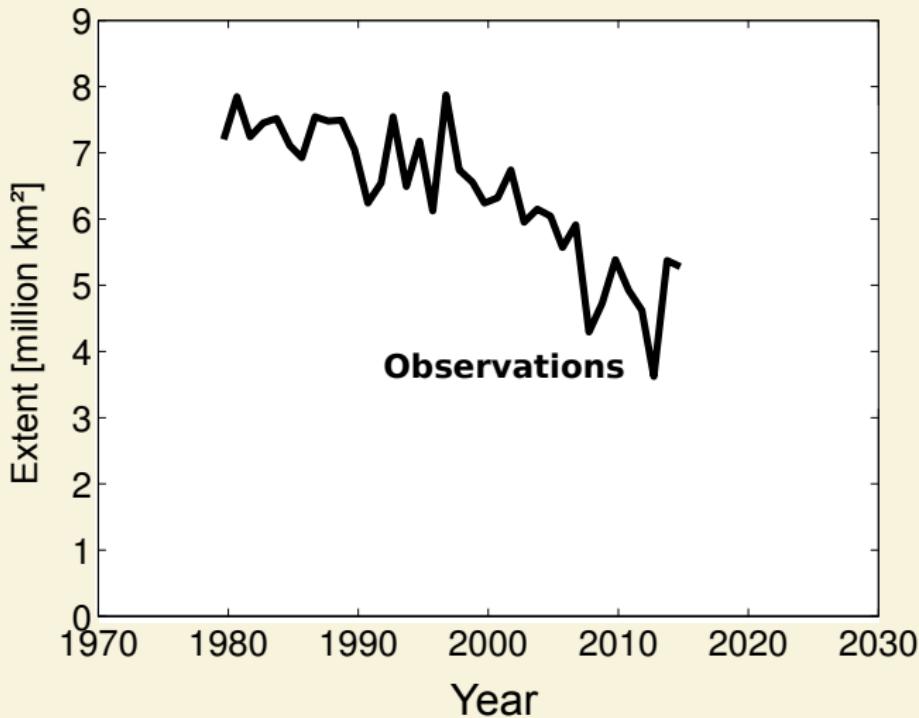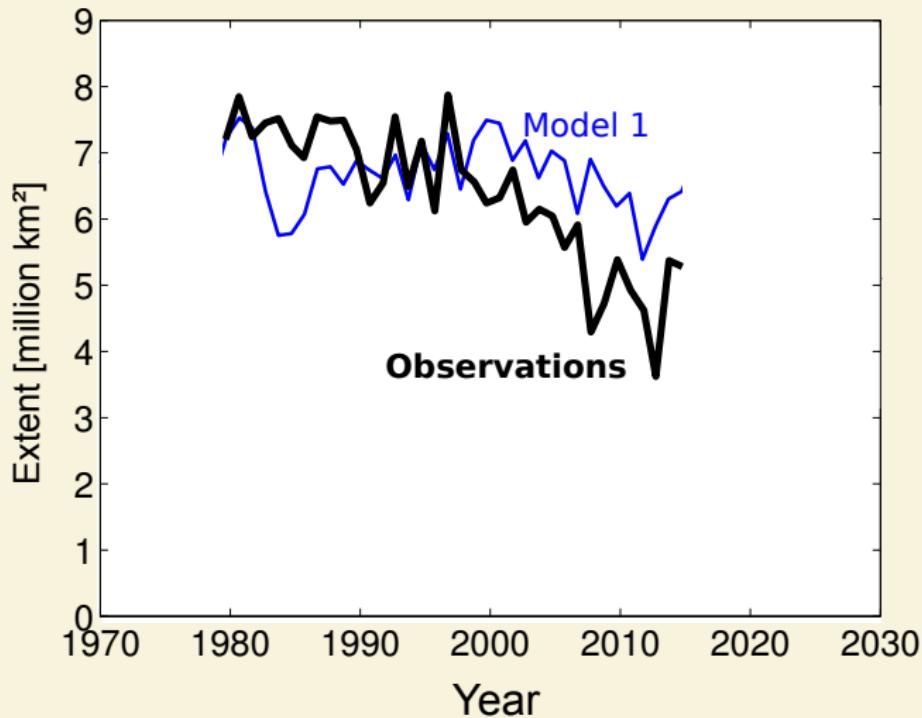
Overview

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# September Arctic sea-ice extent

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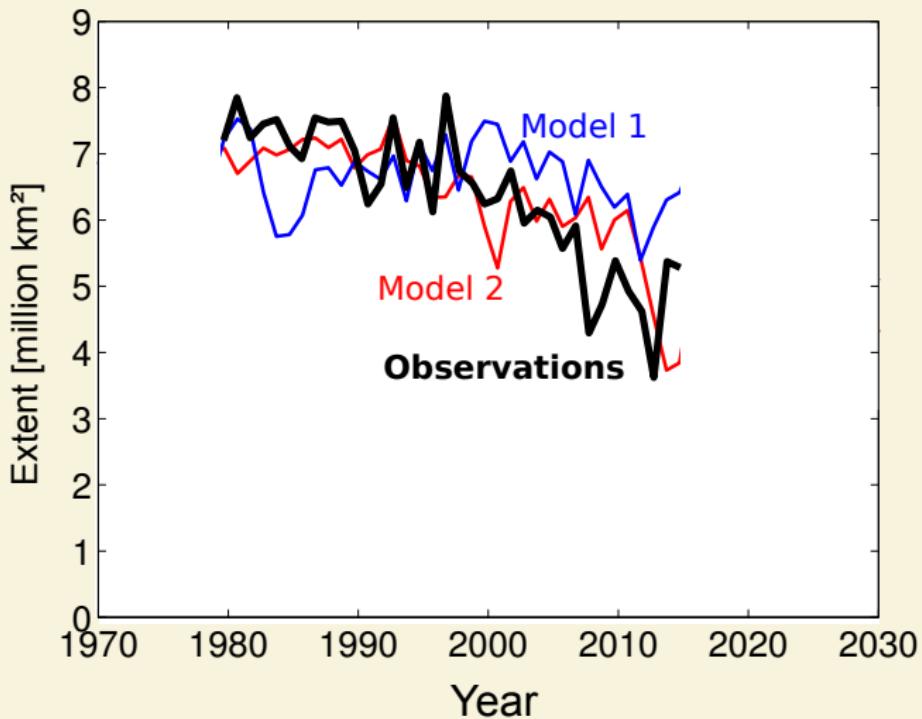
September Arctic sea-ice extent
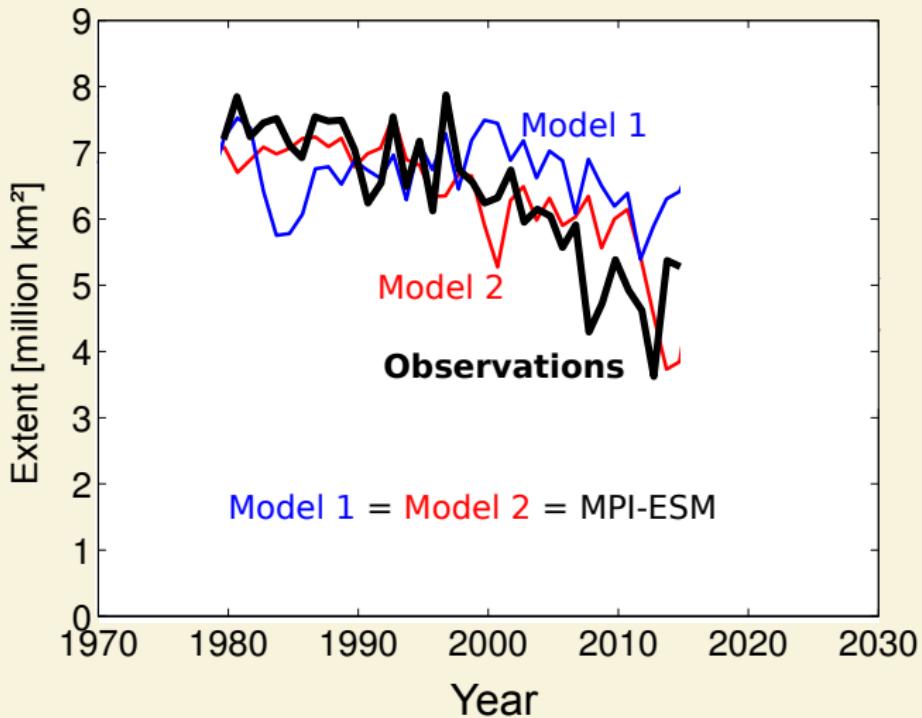
September Arctic sea-ice extent
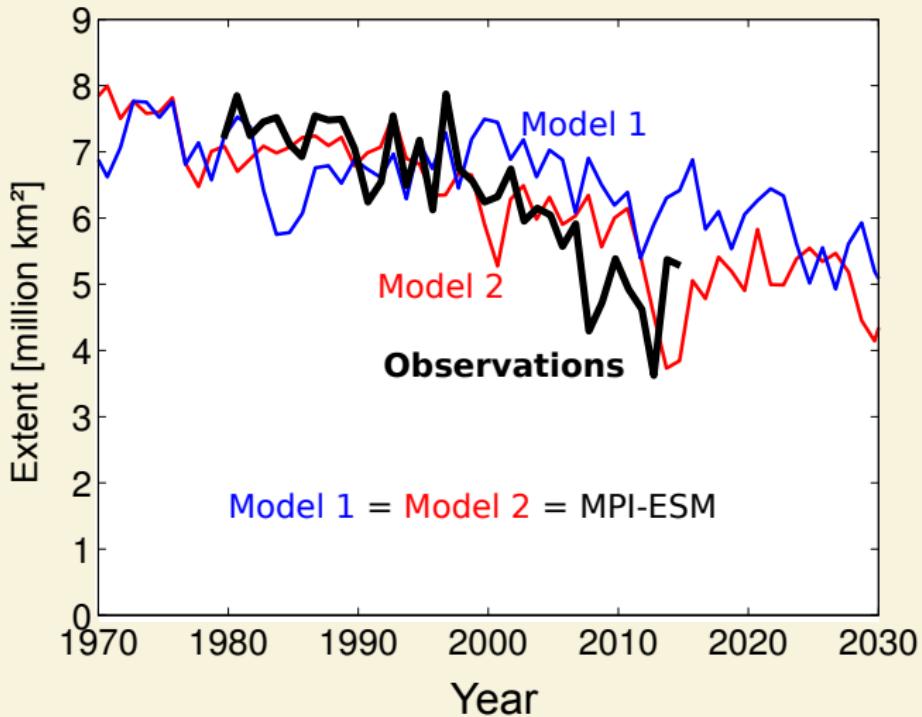
"CMIP5 models underestimate sea-ice retreat"


Reality

"CMIP5 models underestimate sea-ice retreat"
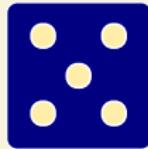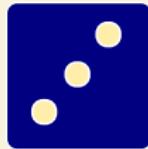
Reality

Model 1

"CMIP5 models underestimate sea-ice retreat"
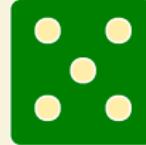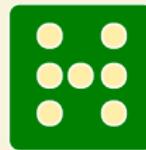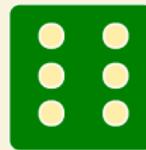
Reality

Model 1

Model 2

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Reality

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Model 2

"CMIP5 models underestimate sea-ice retreat"

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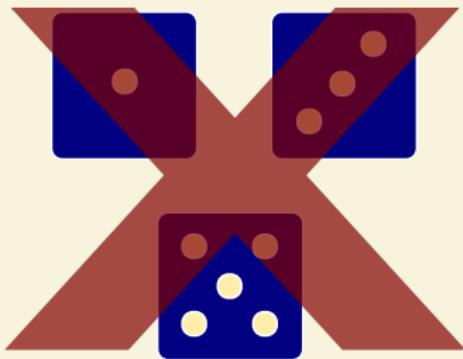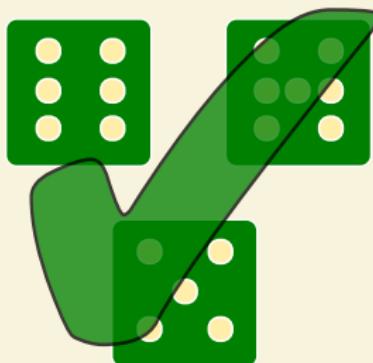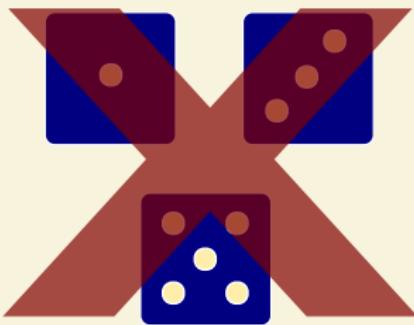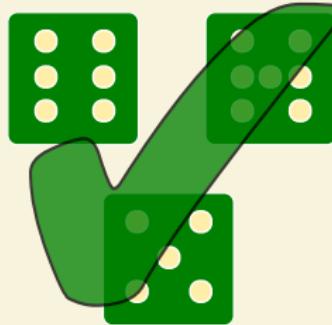
Model 1   Model 2

Model-evaluation tools produce pretty pictures. . .

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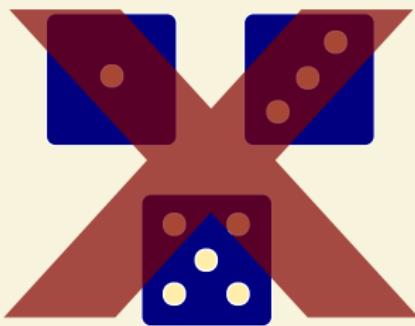
Model 1

Model 2

Model-evaluation tools produce pretty pictures. . .

. . . but not necessarily insights.

Internal variability in CMIP5

Arctic sea ice: 30 year trends, synthetically increased ensemble
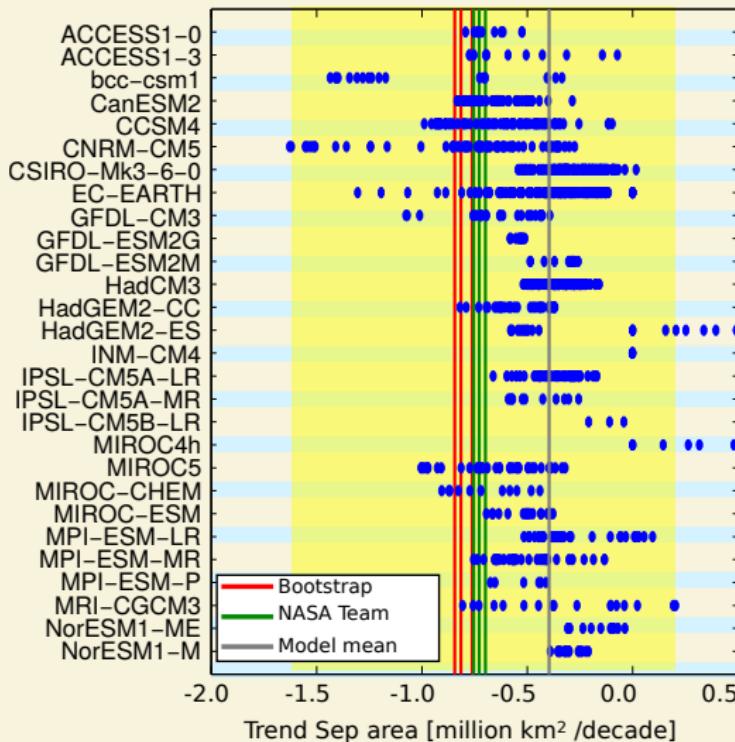
Internal variability in CMIP5

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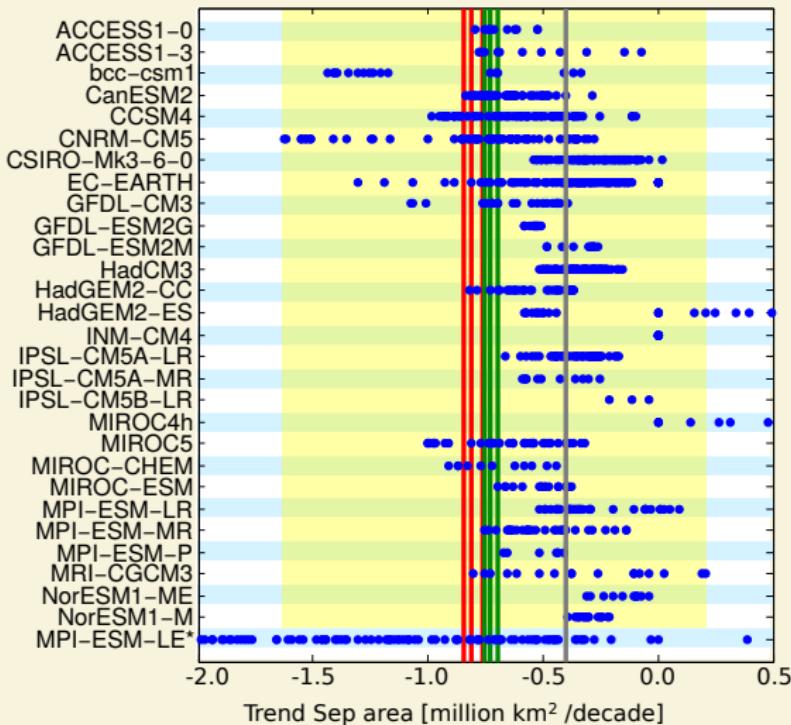
Model convergence is not necessarily desirable
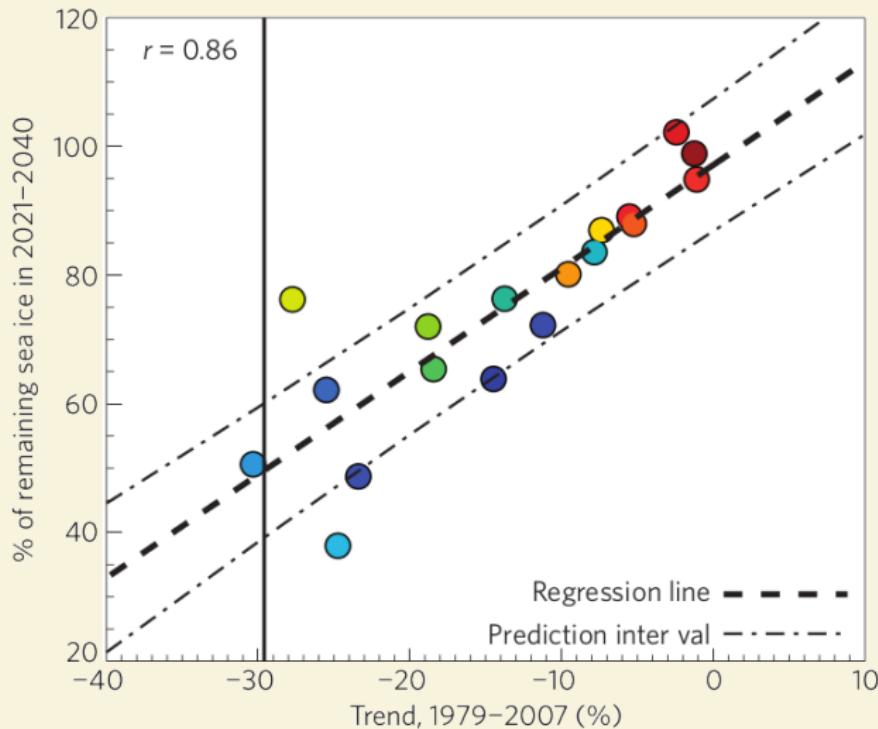
Some (maybe sobering?) facts. . .

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On model usefulness *(Notz, Proc. R. Soc. A, accepted)*

"The usefulness of a climate model cannot be derived solely based on its degree of agreement with observational data."

Overview

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Observational data I
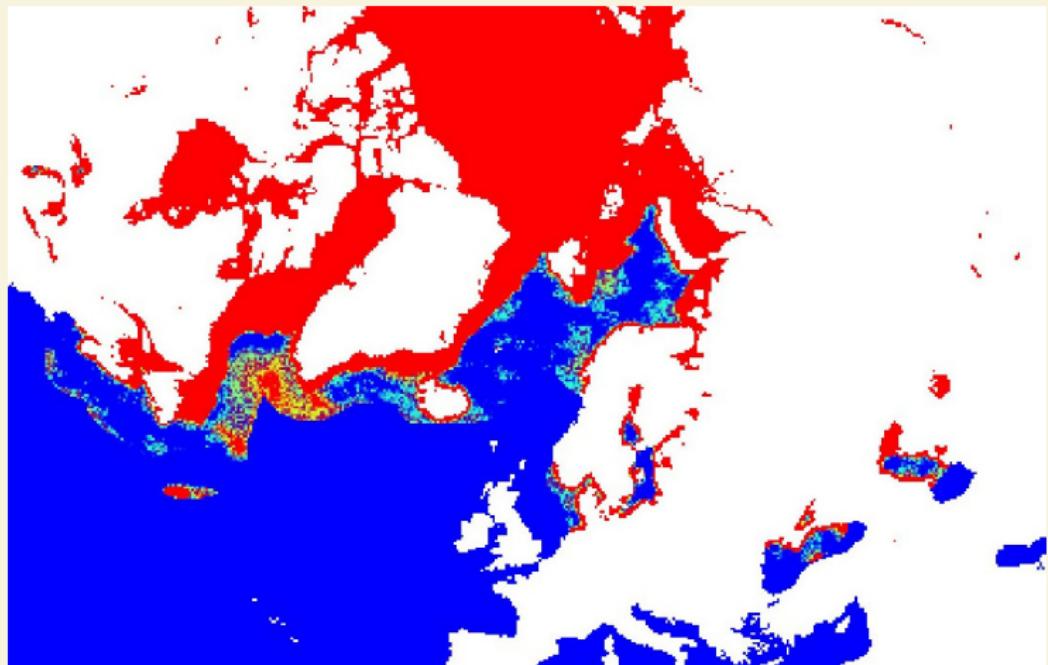
Doesn't look like real sea ice, isn't real sea ice

Reality
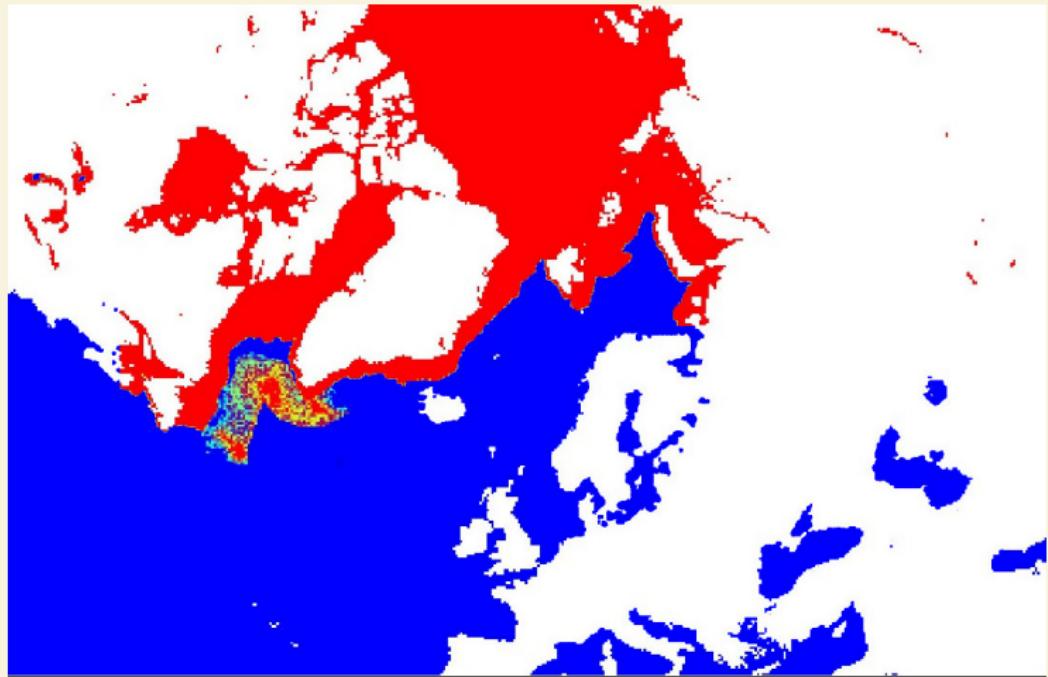
Let's assume this is reality

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Observational data II
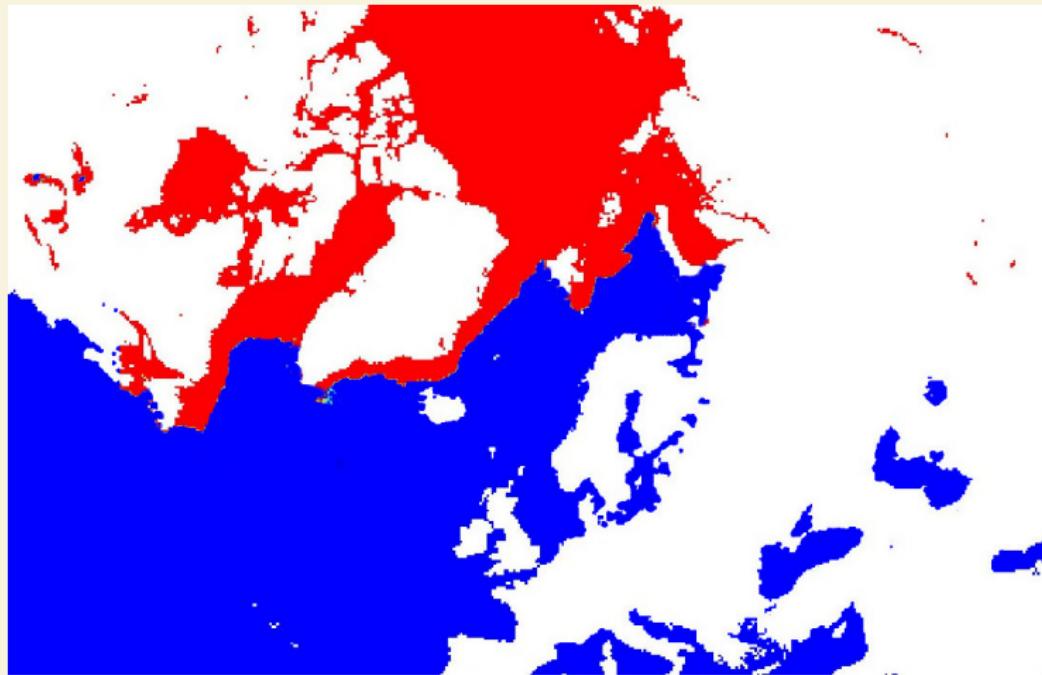
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Annual mean I
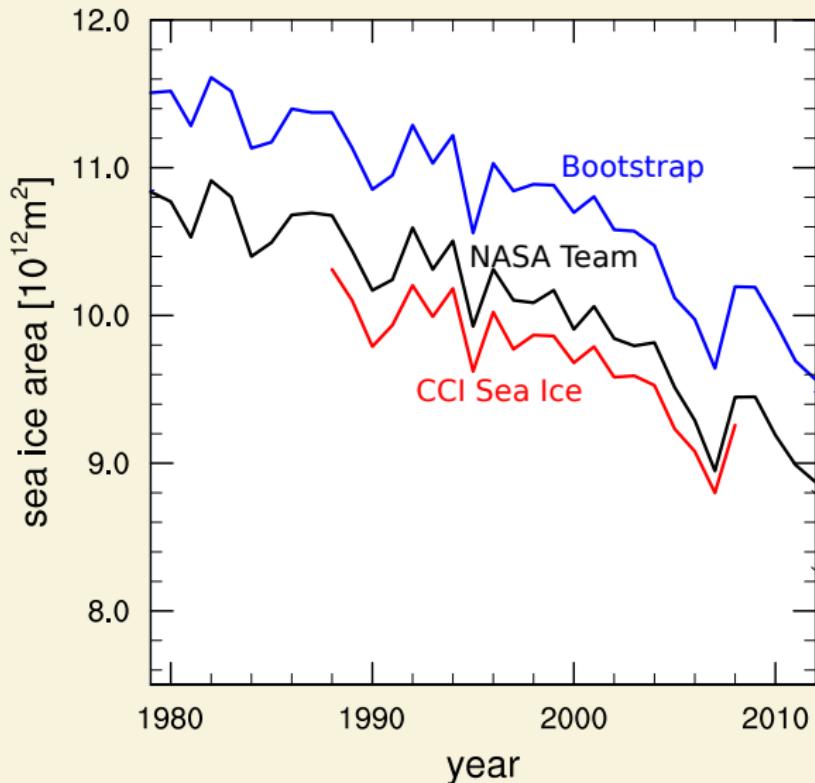
Annual mean II
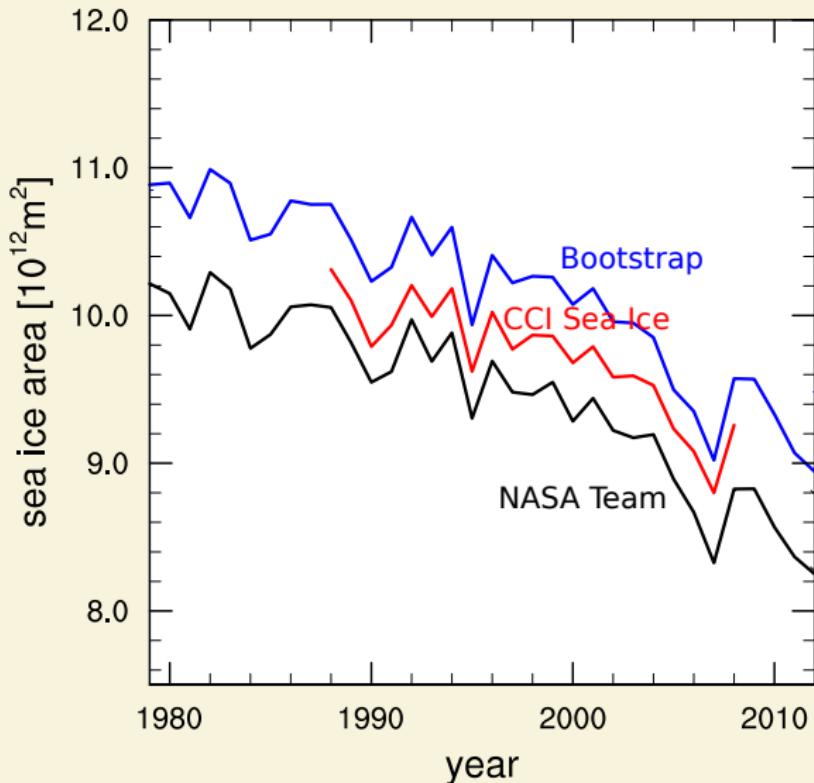
Consistency with model physics

Sea ice concentration difference, 2003-2008, MAR mean
SICCI observations minus concentration-only nudging run

sea ice concentration difference

Data Min = -0.11, Max = 0.36

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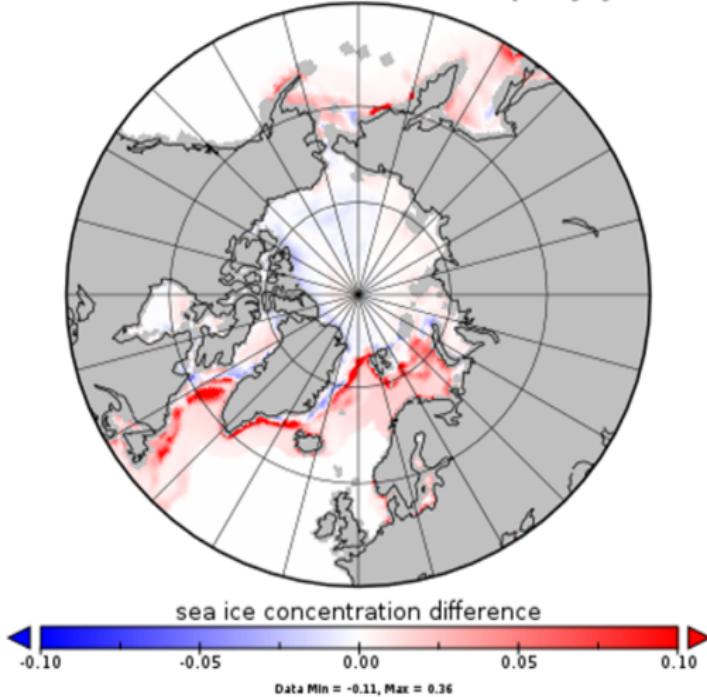
Note: any model will eventually surrender to data

Sea ice concentration difference, 2003-2008, MAR mean
SICCI observations minus thickness/concentration nudging run

sea ice concentration difference

Data Min = -0.18, Max = 0.19

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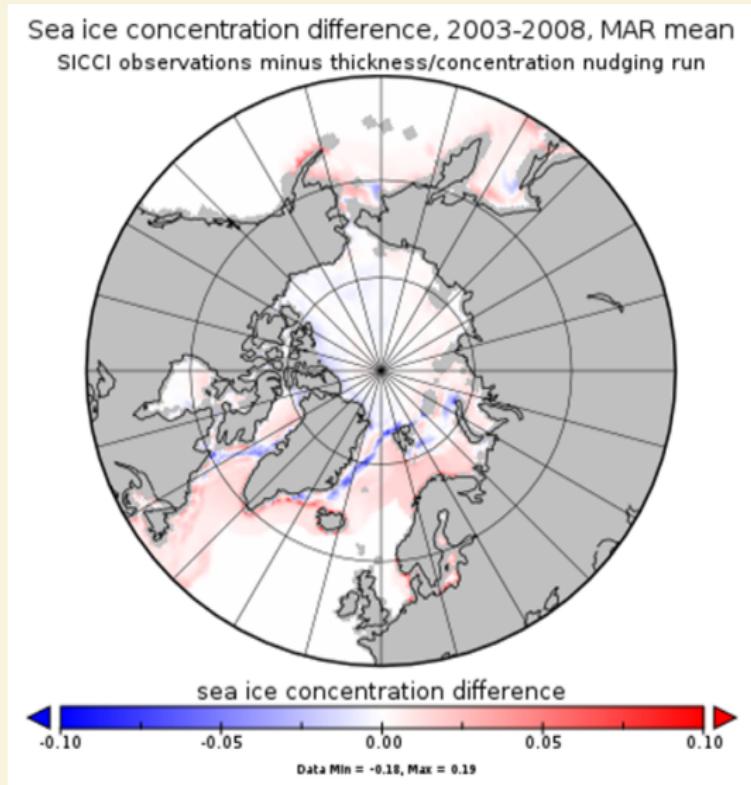
Impact of model initialisation
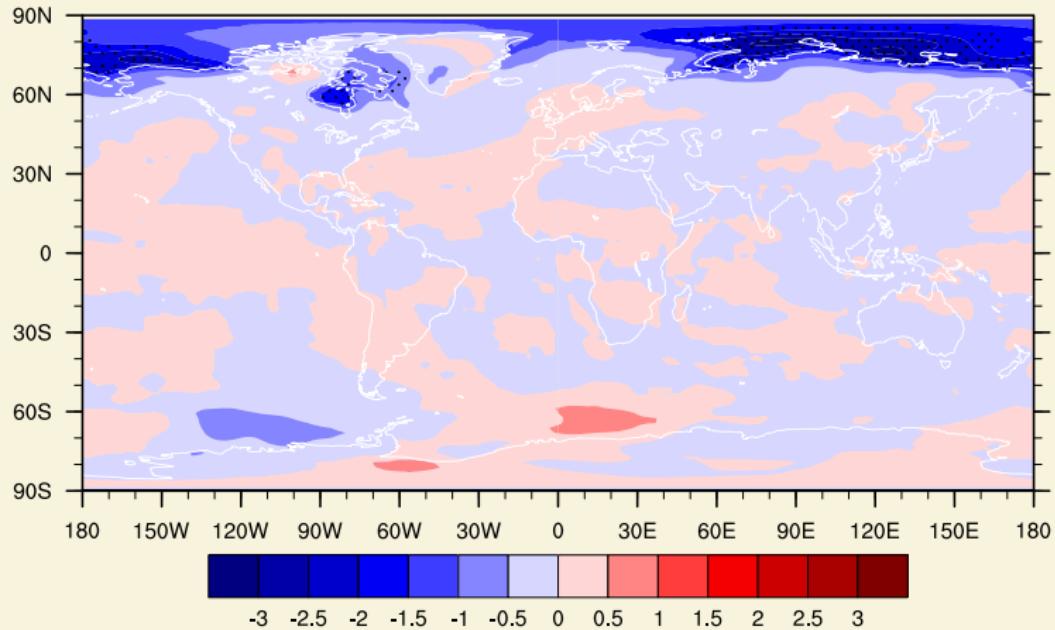
Temperature difference in September after initialisation in May
(Bootstrap - NASA Team)

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You will never (?) see this much CCI-SI data again...
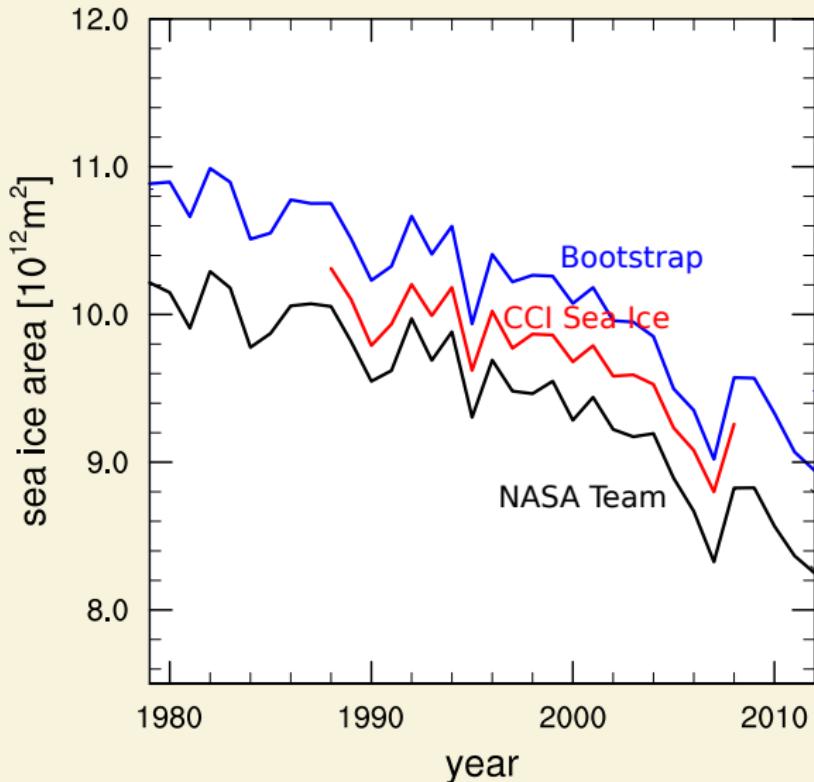
Summary

- Models are not developed to agree with observations, but to answer questions

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- Sometimes, observations can assist the models in answering questions (and vice versa)
- How much independent thinking can we expect of users of our data?
- How useful will be a timeseries of sea-ice concentration starting in 2002 if other time series start in 1978?

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