How much global temperature increase can we afford?

Irina Mahlstein
Reto Knutti, Susan Solomon, Robert Portmann and John Daniel
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At what global temperature increase...

1. ... do local temperature changes become perceptible?

2. ... do regional precipitation changes become perceptible?
Detection of **temperature** changes

Does not imply that perceptible to people

When is the **signal** emerging from natural variability?

Modified from Mahlstein et al. (2011)
Method

- **30yr base period (1900-1929)***
- **30yr future period (??-??)***

Year when signal emerges

Temperature above 1900-1929 levels
Method

Modified from Hawkins and Sutton (2012)
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CMIP3 models

Region 1

Model 6
Model 3
Model 5
Model 1
Model 1 Model 7

80% Quantile

Model 8
Model 2
Model 5 Model 6
Model 4

Region 2

Model 4 Model 7
Model 5
Model 6
Model 3
Comparison models and observations

<table>
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<tr>
<th>Models (1900-1999)</th>
<th>GISTEMP (1900-1999)</th>
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<td>Interannual variability ('noise')</td>
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<td>Signal</td>
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<td>Signal to noise</td>
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[°C]

-0.4 -0.2 0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8
Significant changes in low latitude countries
The most affected caused it the least
Issues with precipitation:

1. Large interannual variability

2. Weaker trends

3. Less agreement between models and observations

Dealing with Precipitation
Hulme Dataset
(1900-1998)

CMIP3 multi model mean
(1900-1998)

Natural variability (noise) in wet season
Hulme Dataset
(1970-1998)-(1900-1929)

CMIP3 multi model mean
(1970-1998)-(1900-1929)

Signal in wet season
Signal to noise in wet season
Method

Modified from Hawkins and Sutton (2012)
Method

Modified from Hawkins and Sutton (2012)

CMIP3 models

Region 1
Model 6
Model 3
Model 5
Model 1
Model 2
Model 4
No emergence!
Regions based on cluster analysis

Mahlstein and Knutti (2010)
Changes compared to 1900-1929 precipitation levels

- 66% (likely)
- 90% (very likely)
• Perceptible temperature changes have already occurred in low latitude countries and all land areas are committed to them.

• Perceptible precipitation changes in wet season cannot be expected very soon (1.4°C increase).