



Netherlands Environmental Assessment Agency

Extreme Climate Change and policy responses

Holland Climate House event
Saturday 12 December , Copenhagen

Leo Meyer

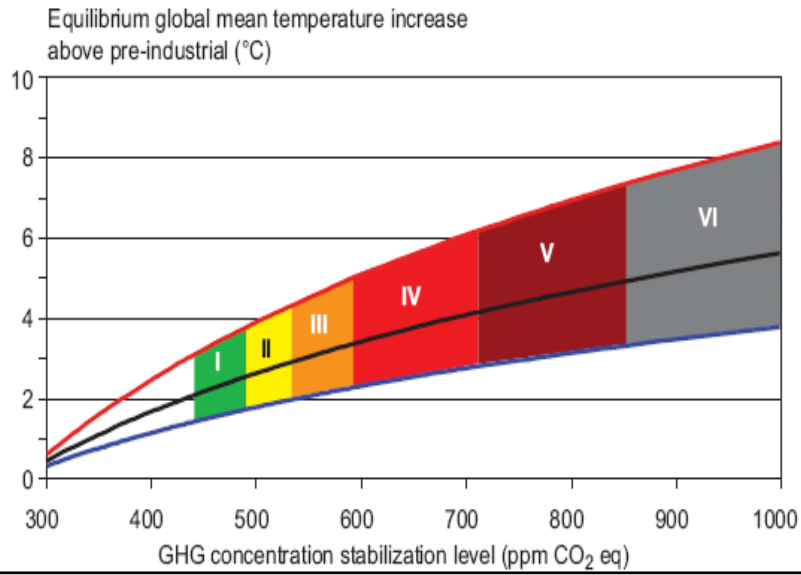


Key message:



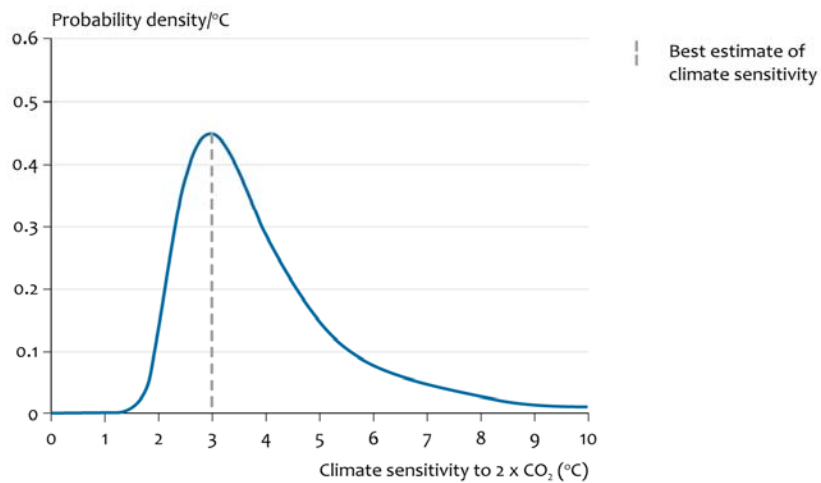
- There are risks that climate change may happen faster – or have more severe impacts – than expected, hence:
- We need to increase monitoring efforts
- We need to investigate policy response options

Temperature range is caused by uncertainty about climate sensitivity



Climate sensitivity pdf is not symmetric, this means...

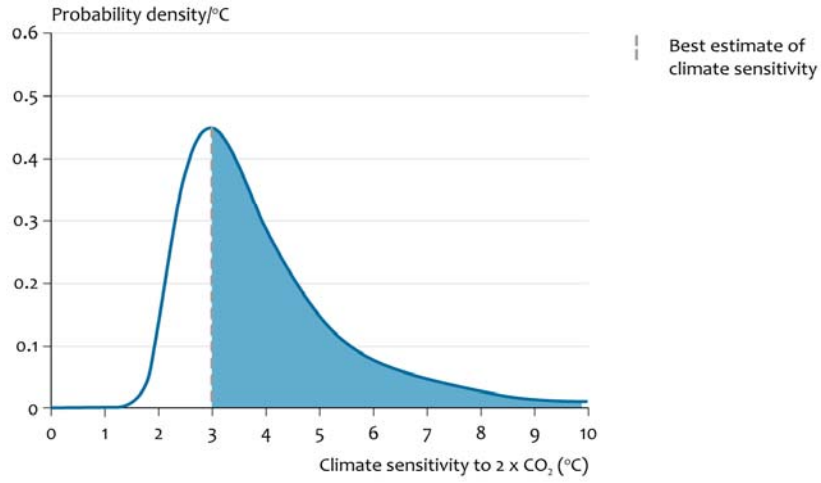
Climate sensitivity



..the chance of under-estimation of future temp. increase is larger...

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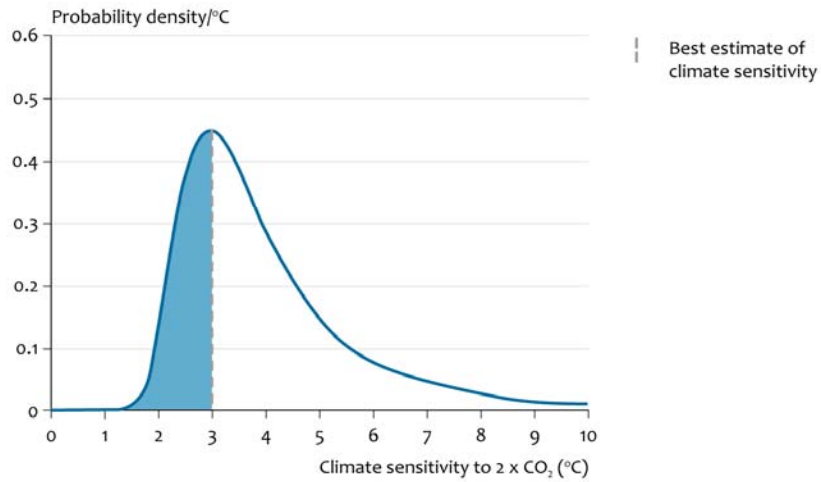
Climate sensitivity

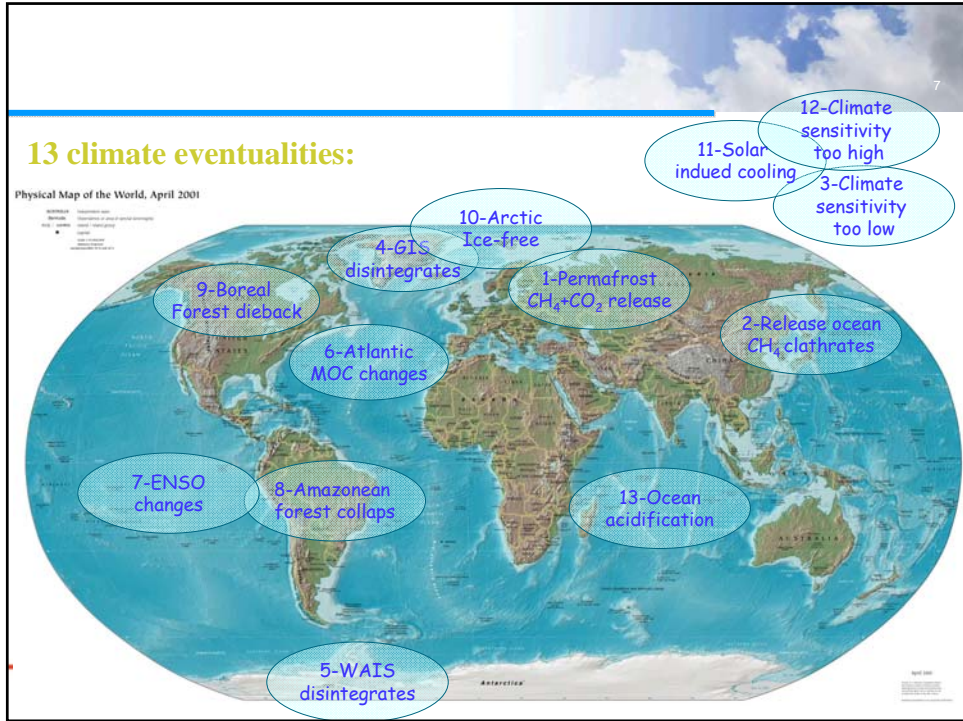


...than of the chance of over - estimation ...

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Climate sensitivity





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Disintegration West-Antartc ice sheet

- Positive feedback through sea-level rise

Possibly tipping point at $3^\circ - 5^\circ\text{C}$ global warming

5-7 m sea-level rise on a timescale of centuries to millenia

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Disintegration of the Greenland Ice Sheet (GIS)

Possibly tipping point
at 1°- 2°C

No reliable information
Collaps unlikely before 2050

5-7 m sea-level rise
timescale of centuries
to millenia



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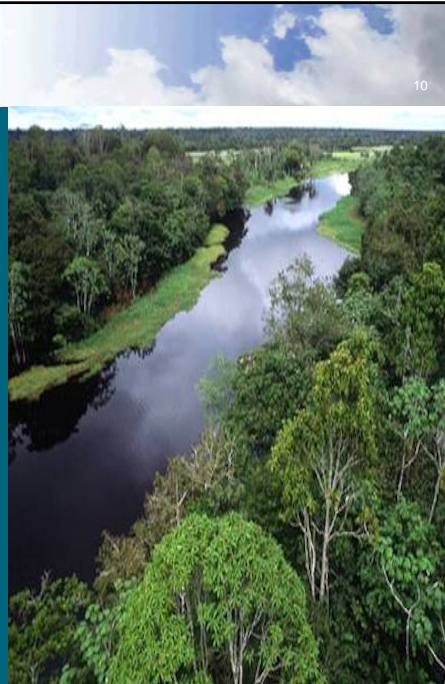
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Amazon Forest Collaps

Tipping points possibly by
global warming > 3-4°C

Transition to savanna
in decades

Irreversible loss of biodiversity
and fresh water resources,
increase atmospheric CO₂



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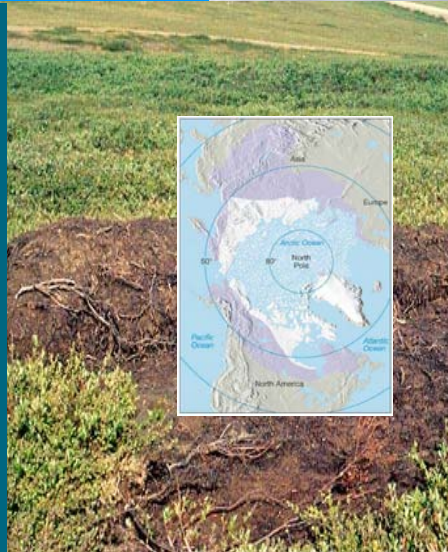
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Release of CH₄ from permafrost and Ocean clathrates

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Rapid release would lead to extra warming on global scale

Unlikely but huge impacts (+10 °C)



Need for early warning signals

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- Unpredictable natural variability on decadal and centennial timescales)
- Possible presence of tipping points may be hidden in natural variability
- More monitoring needed (ice dynamics, ocean currents)
- Search for early warning signals of tipping points

Four categories of response options: Option 1: Drastic emissions reductions

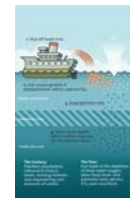
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- Old studies: maximum 2-4%/yr global emissions reductions
- New assessment: >4 % possible in emergency situation
- Strong societal opposition to be expected to many of these options, even in emergency situations
- *Long lead times, slow effect*

Four categories of response options: Option 2: Carbon dioxide removal

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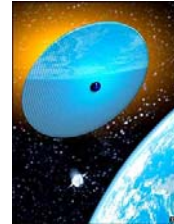
- REDD/reforestation (deserts)
- Ocean fertilization (Fe, nutrients)
- Aquatic C-capture (algae in situ or reactors)
- Biochar
- Air capture (CO₂-scrubbing & disposal, artificial trees)
- Mineral sequestration (olivine)
- *Risks diverse, energy and space requirements, delays*



Four categories of response options: Option 3: Solar Radiation Management

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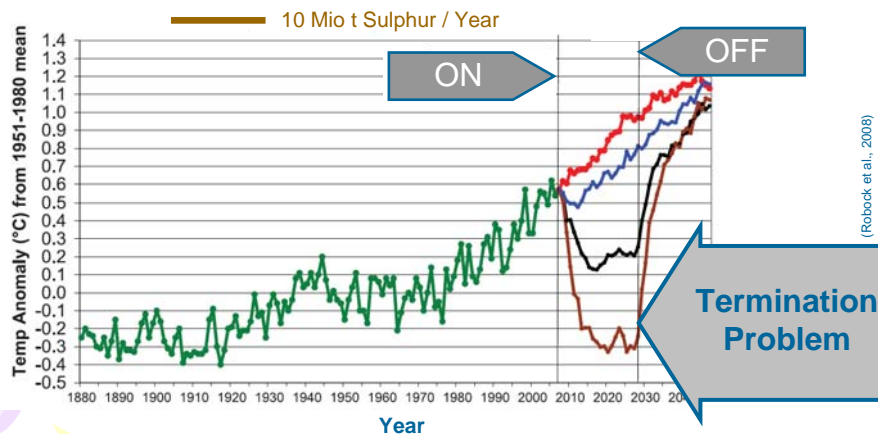
- (Sulphur-)aerosols in stratosphere
- Reflecting space screens (one large/many small)
- Creating light surfaces (desert, crops, urban, ocean)
- Cloud modification (e.g. sea water injection)
- *Quick response time but RD&D needed, risks, ethical questions*



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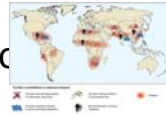
Abrupt climate changes caused by geoengineering



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Four categories of response options: Option 4: Adaptation: from local to a global issue

- Climate change and trade policy
 - Energy, food, timber
- Disaster prevention and development collaboration
 - Focus on vulnerable hotspots
- Management/protection “climate refugees”
 - International regimes, national integration programmes
- Avoid or control security risks/conflicts
 - Triggered by impacts or by solutions
- Radical rather than incremental adaptation
 - Migration, novel infrastructure designs, ocean liming



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Extreme 09

The puzzle: How to choose from four options to respond to extreme climate change



THANK YOU!

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- report **NEWS IN CLIMATE SCIENCE AND EXPLORING BOUNDARIES** on WWW.PBL.NL
- TUESDAY 15 DEC 1030 -1230 h EU PAVILION ROOM SCHUMAN
 - Full presentation of report by PBL, KNMI, WUR
 - Chaired by *Jean-Pascal van Ypersele*, vice chair IPCC
 - Discussants:
 - *Stephen Schneider, Stanford University*
 - *Jo Alcamo, chief scientist UNEP (TBC)*