Netherlands Environmental Assessment Agency

Extreme Climate Change and policy responses

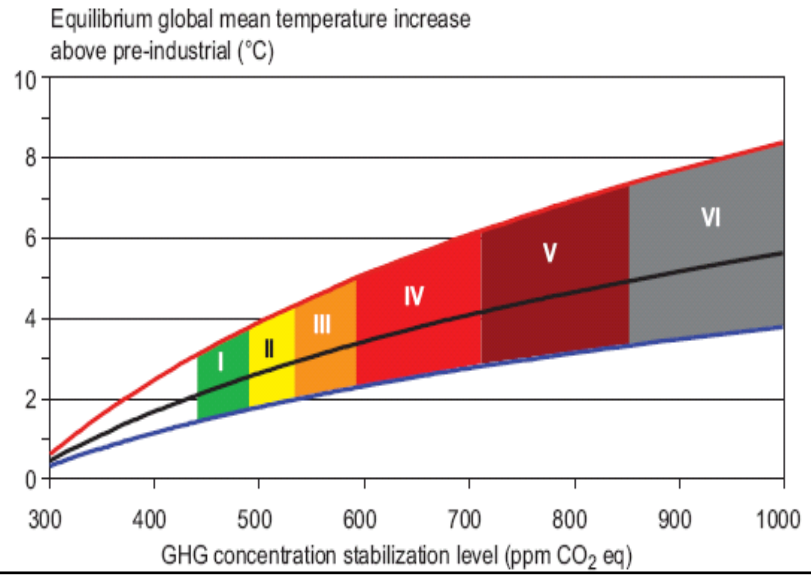
Holland Climate House event
Saturday 12 December , Copenhagen

Leo Meyer

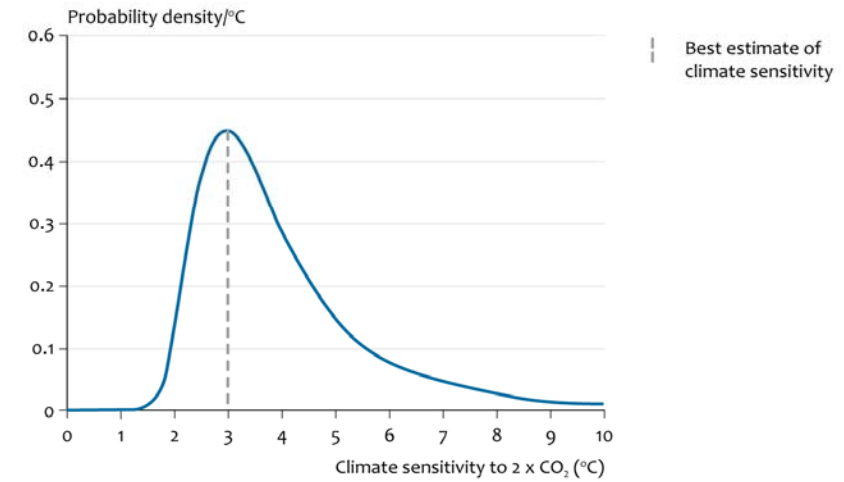
Key message:

- 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



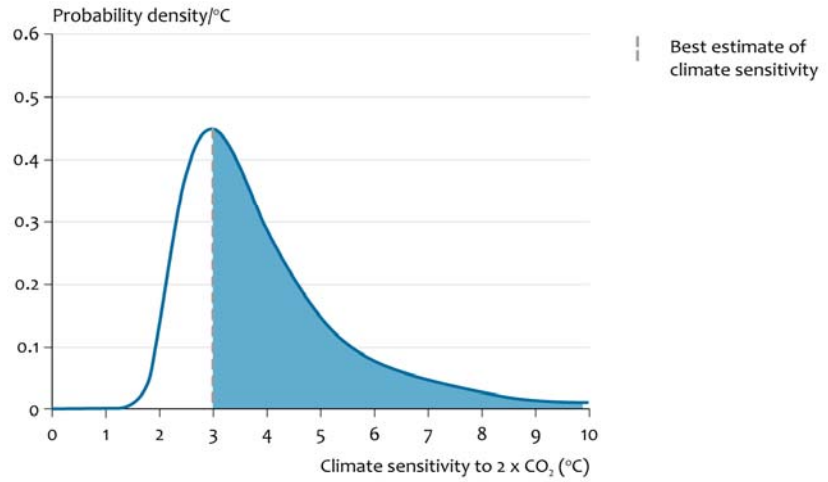
Climate sensitivity pdf is not symmetric, this means…



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

5

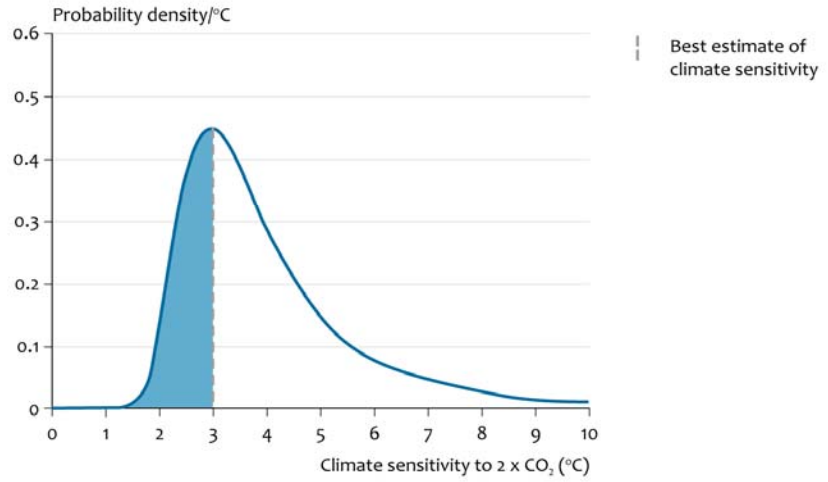
Climate sensitivity



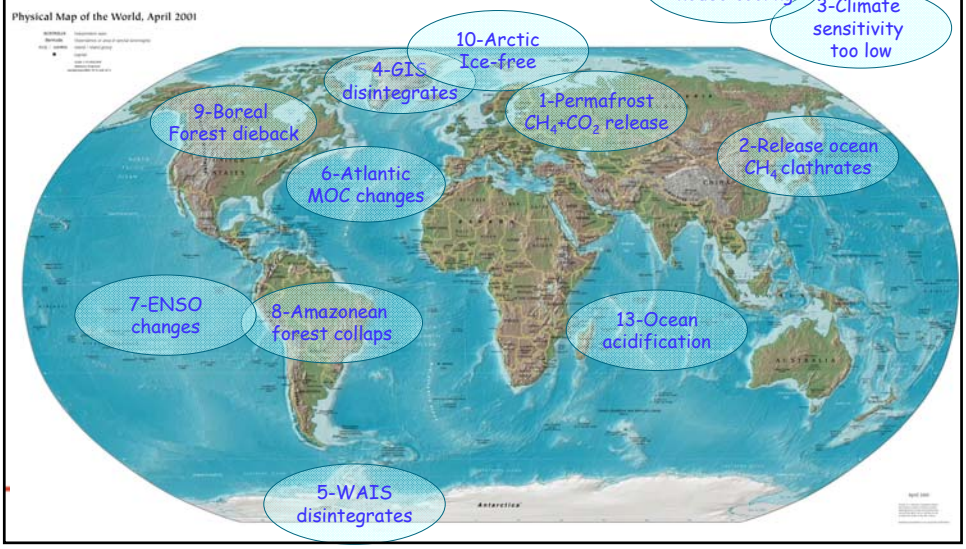
…than of the chance of over - estimation …

6

Climate sensitivity



13 climate eventualities:

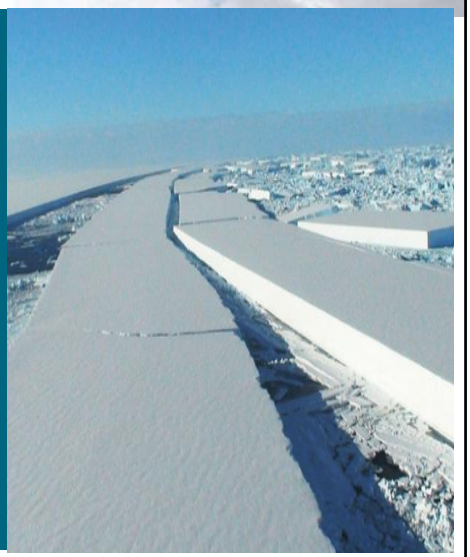


Disintegration West-Antartic ice sheet

- **Positive feedback through sea-level rise**

Possibly tipping point at 3°- 5°C global warming

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



Disintegration of the Greenland Ice Sheet (GIS)

9

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

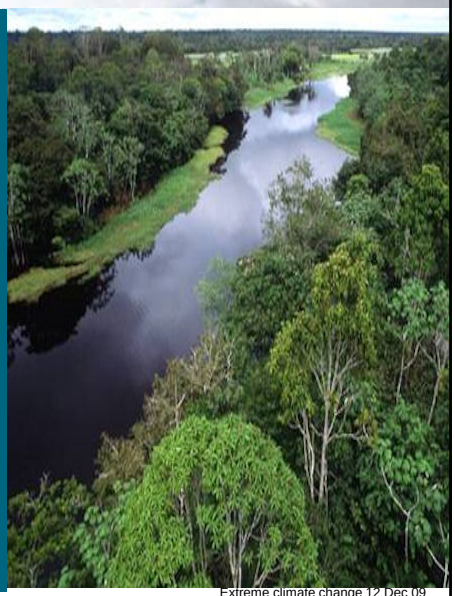
Amazon Forest Collaps

10

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

Transition to savanna
in decades

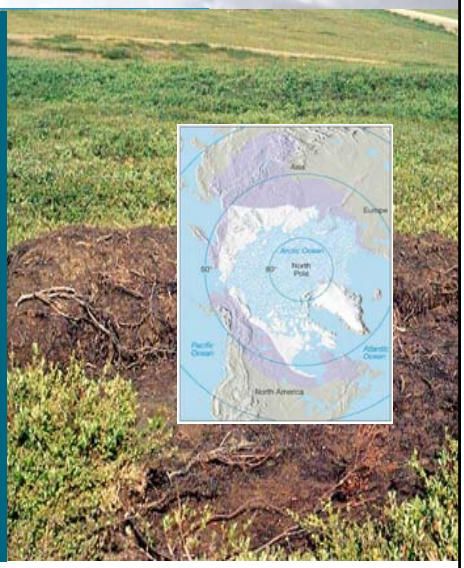
Irreversible loss of biodiversity
and fresh water resources,
increase atmospheric CO_2



Release of CH_4 from permafrost and Ocean clathrates

Rapid release would lead to extra warming on global scale

Unlikely but huge impacts (+10 ^{0}C)



Need for early warning signals

- 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

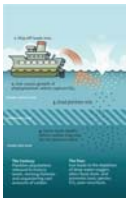
13

- 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

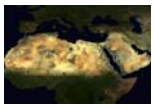
14

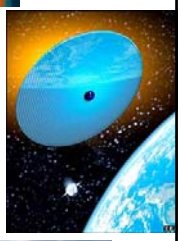
- REDD/reforestation (deserts)
- Ocean fertilization (Fe, nutrients)
- Aquatic C-capture (algae in situ or reactors)
- Biochar
- Air capture (CO_2-scrubbing & disposal, artificial trees)
- Mineral sequestration (olivine)
- *Risks diverse, energy and space requirements, delays*

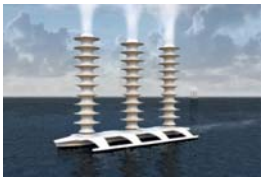


Four categories of response options: Option 3: Solar Radiation Management

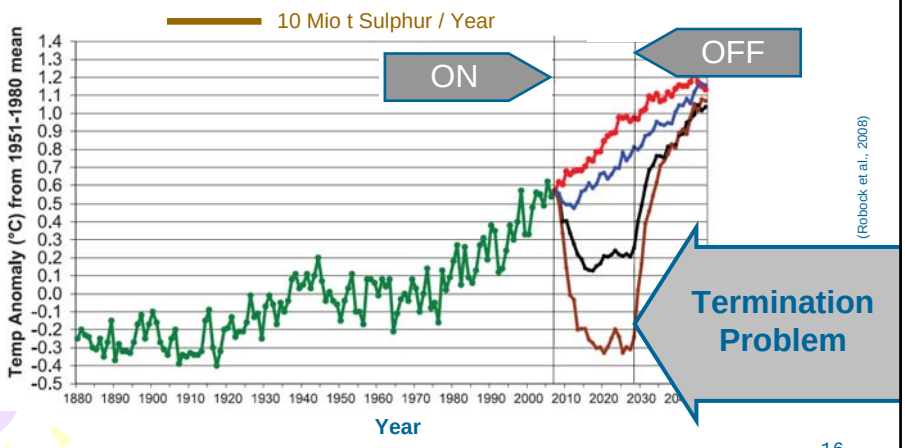
- (Sulphur-)aerosols in stratosphere
- Reflecting space screens (one large/many small)
- Creating light surfaces (desert, crops, urban, ocean)
- Cloud modification (e.g. sea water injection)
- *Quick response time but RD&D needed, risks, ethical questions*





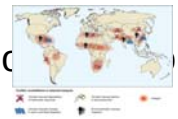


Abrupt climate changes caused by geoengineering



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 develo llaboration
  - 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

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

THANK YOU!

- 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)*