Bringing Scientists out of the Ivory Tower

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"What about Water?

A Reality Check for the 21st Century"

AMS Forum, Washington DC, March 27, 2008

The public wants to understand climate change!

- **More than fifty talks/OpEd on climate change across Vermont in past year**
- State legislature, business and professional groups, elementary and high schools, colleges, citizens' groups, and churches.
- Vermont Public Radio, newspaper columns and interviews.

The public realizes the future of Vermont is at stake!

- Without reliable information, they cannot adapt and contribute to the transformation of our society.
- They know the central government is lying to them, but they have difficulty sorting through the sea of deceit to know what is credible information.
- **My strategy is to explain key climate issues in terms people can grasp**
- *To outline the likely future impact on Vermont's climate and environment.*
- *And present the broad strategy for mitigation and adaptation in personal and regional terms.*

Politicization of science

- ***Traditional view: scientists lose credibility if they venture into public arena***
- Now: scientists & institutions losing credibility if they leave public information to the spin doctors
- *Scientific integrity & value and public knowledge of science crumble under ideological attack*
- Scientists laughed at the politicization of science in the USSR. Now it is happening here.
- **What is 'acceptable' deceit in DC is unacceptable in Vermont**

IPCC-AR4-WG1 [Feb 2, 2007]
Global Warming is *unequivocal*

Since 1970, rise in:

- Global surface temperatures
- Lower atmosphere temperatures
- Global sea-surface temperatures
- Global sea level
- Ocean heat content
- Water vapor
- Rainfall intensity
- Extratropical precipitation
- Hurricane intensity
- Drought
- Extreme high temperatures
- Heat waves

[www.ipcc.ch]

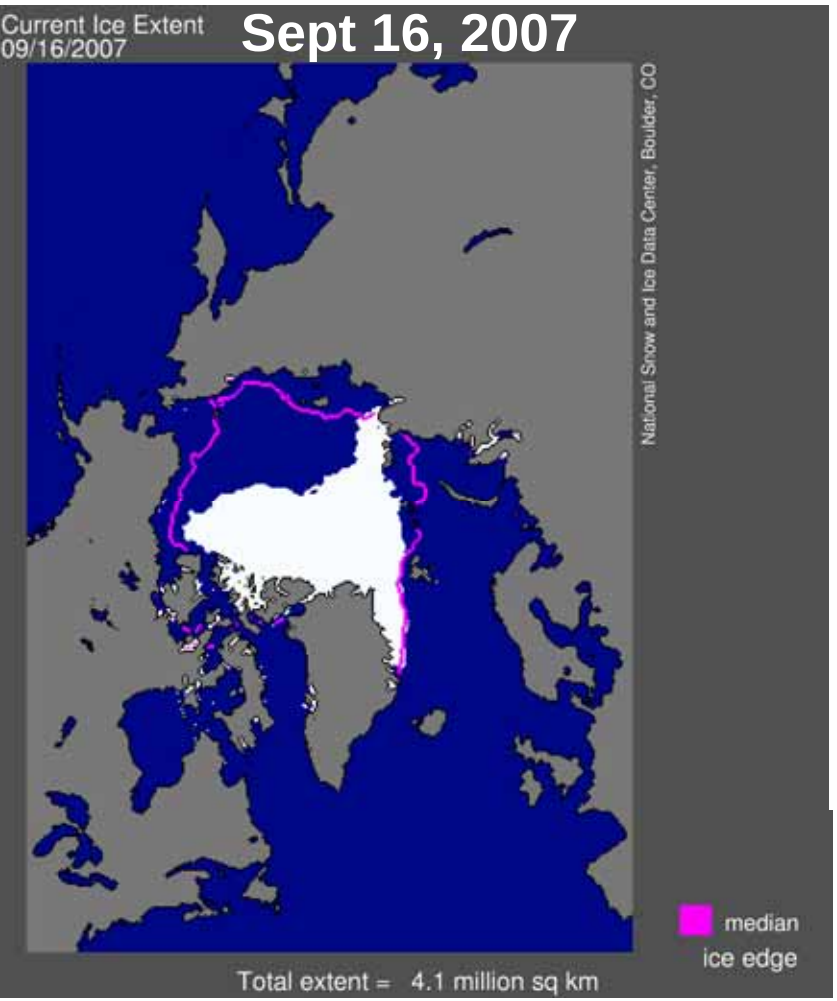
Decrease in:

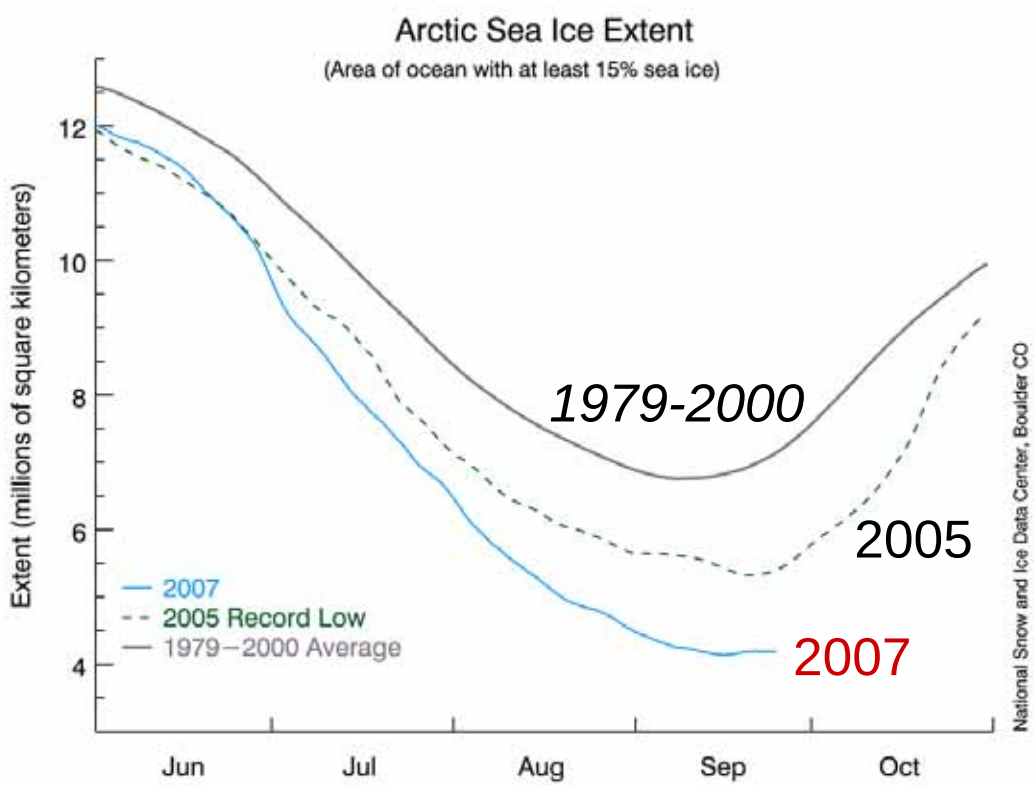
- NH Snow extent
- Arctic sea ice
- Glaciers
- Ocean pH [increasing acidity]

Burning fossil fuels has upset the energy balance of the earth

- Half this ‘fossil’ carbon dioxide stays in the atmosphere, some for centuries
- This upsets the energy balance of the earth, increasing the ‘greenhouse blanket’
- **So earth will get warmer, as long as we burn fossil fuels [coal, oil and gas] at present rate**

Arctic sea-ice loss is accelerating





Double feedback: loss of reflective ice and increased water vapor greenhouse from more evaporation

(www.nsidc.org)

- 2007 saw new record ice-loss by huge margin
- 40% melted by September → warm Fall for Vermont

Gardening in Pittsford, VT in January

Jan 7, 2007

December, 2006, *warmest on record*

[since 1894 at Fairbanks Museum]

Jan 10, 2008

Warm Fall, *record Arctic sea-ice melt*

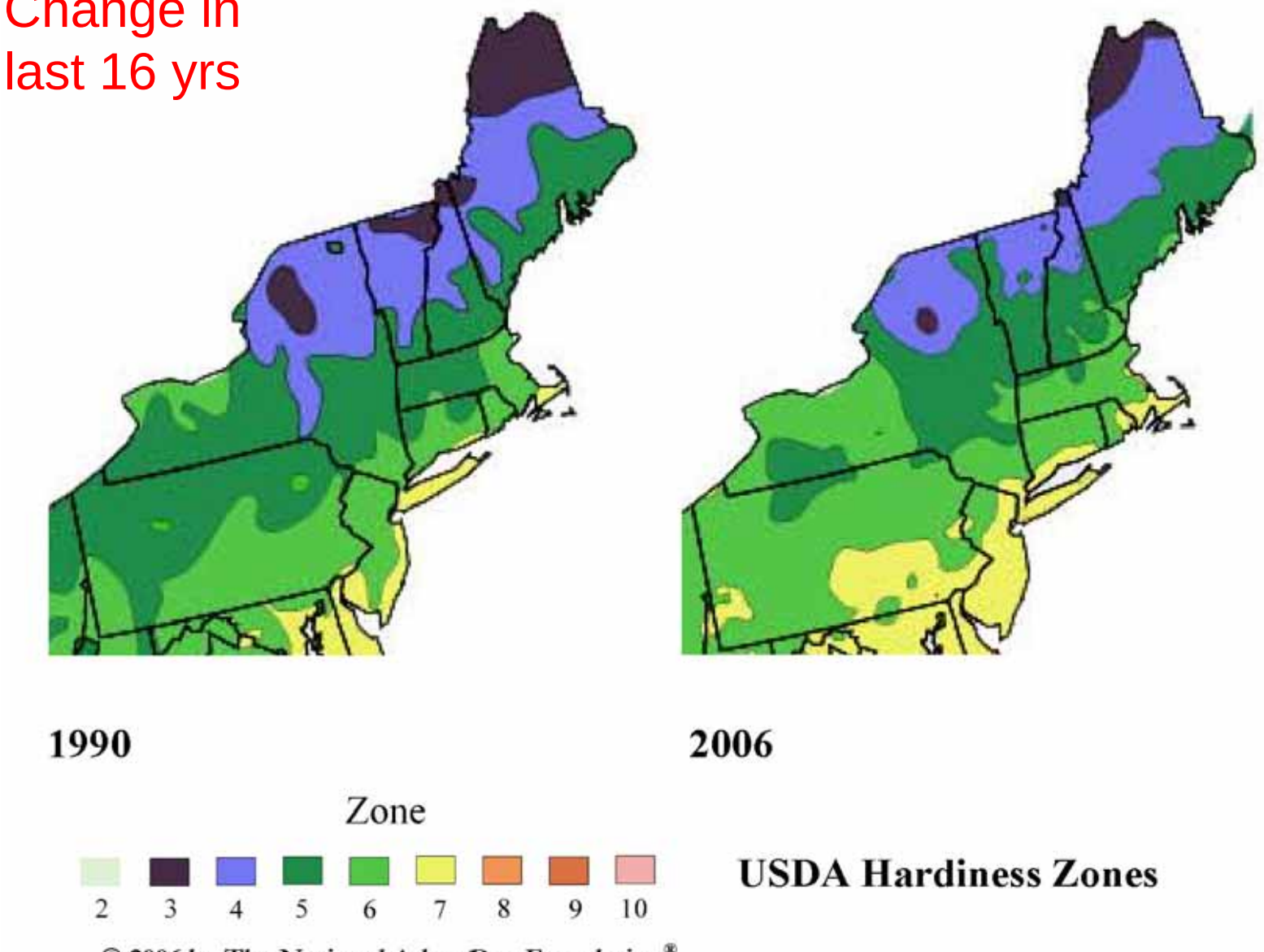
Snow cover in December, ground unfrozen

Brussel sprouts can now survive VT winter [protected by leaves & snow]

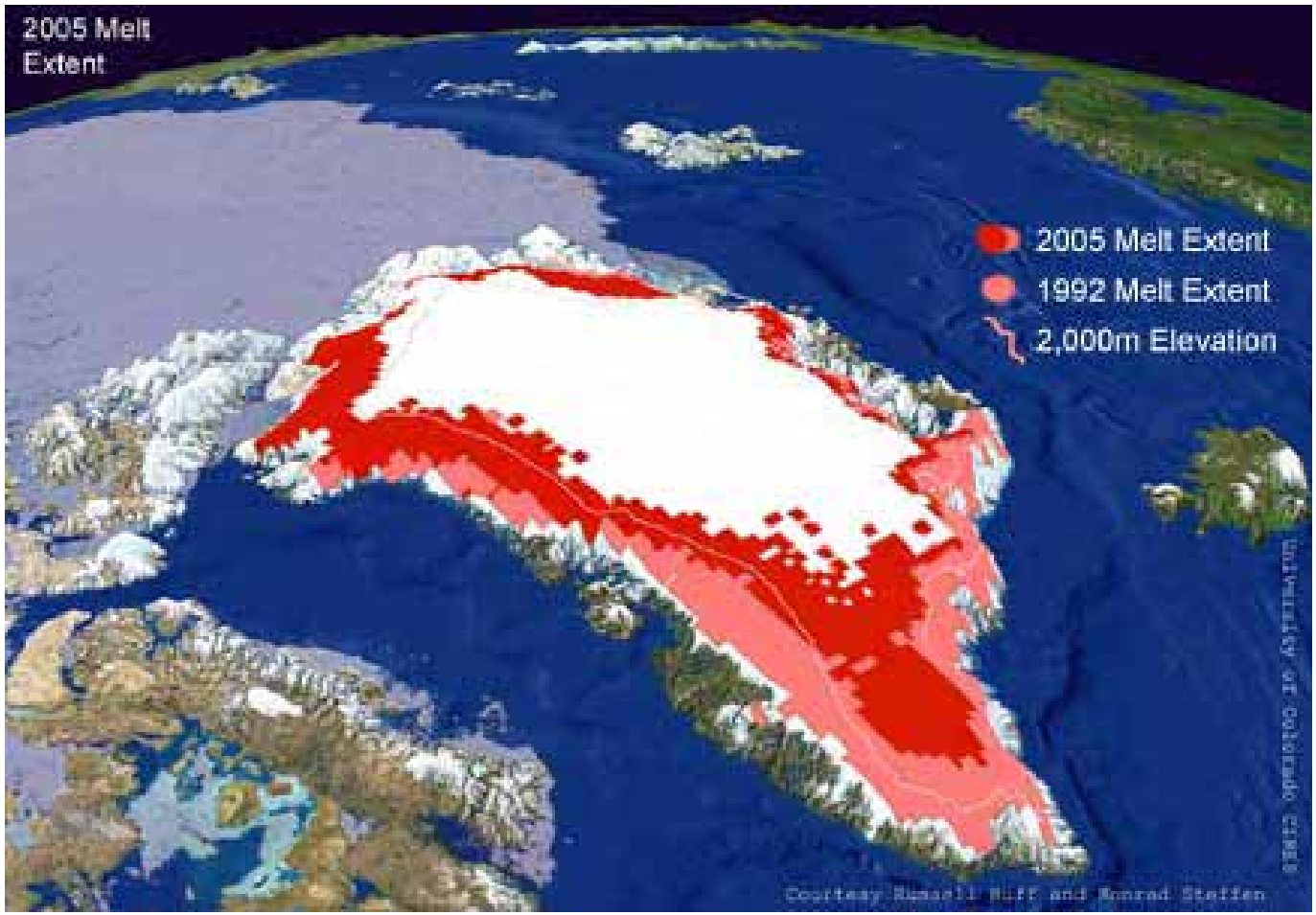
Picked February 10, 2008, Pittsford, VT

USDA Hardiness Zones - Northeast

Change in
last 16 yrs



Greenland ice-cap melt rapidly increasing



(Sea-level rise of 20 ft if ice-cap melts)

- Summer melt area increase from 1992 to 2005
- Ice loss doubled 1996 to 2005; ***2007 larger still***

Vermont winter, 2006

- **Sun is low; and snow reflects sunlight, except where trees!**
- **Sunlight reflected, it stays colder; little evaporation**

January 7, 2007

- **Rain, not snow; grass still green, evaporation continues**
- **Sunlight absorbed, not reflected; it stays warmer**

Sept-Nov. 2006 in N. Europe shattered all records

- Fall 2006 in Europe so warm that 'return time' **>10000 years**
- **Moving into new climate regime**

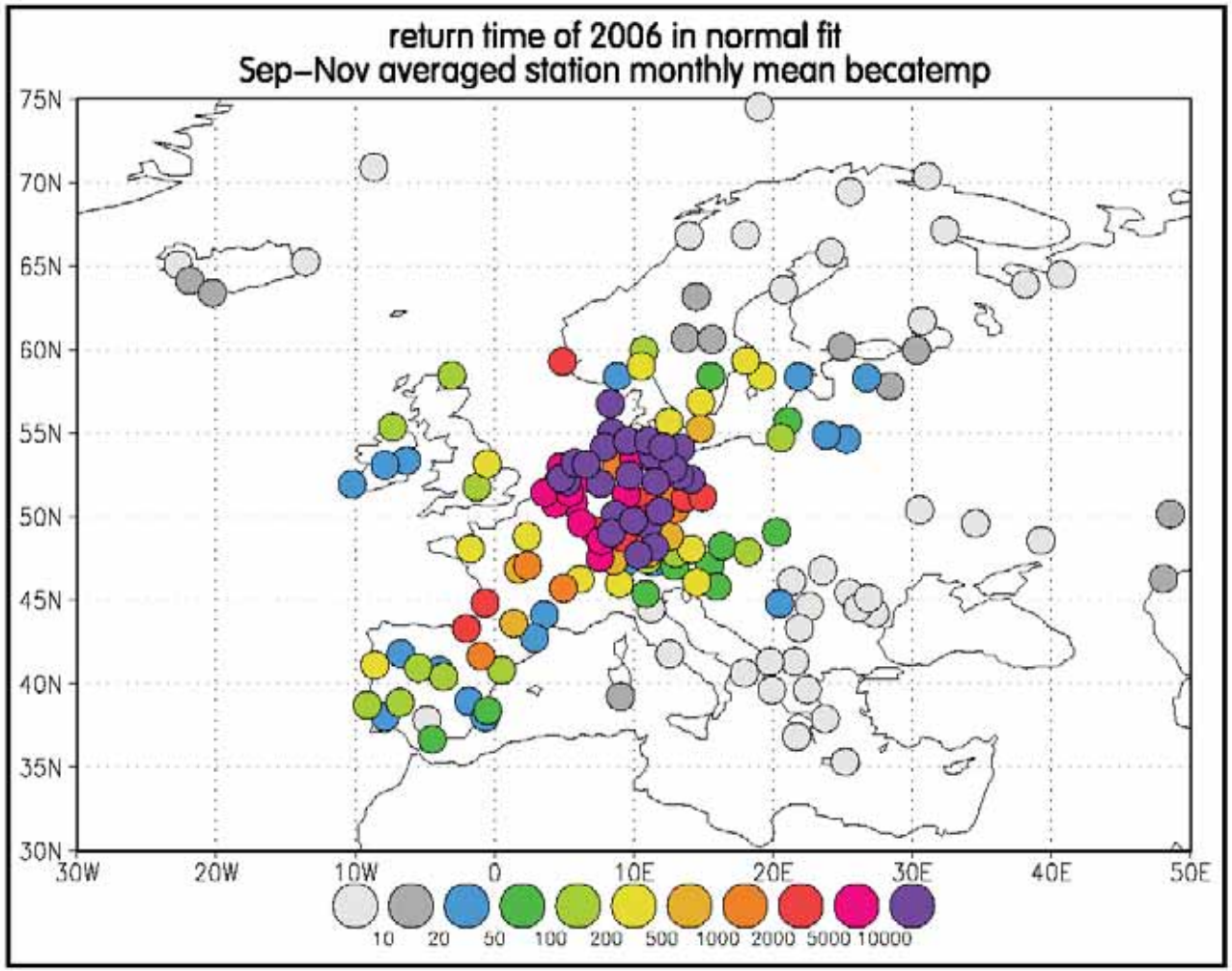
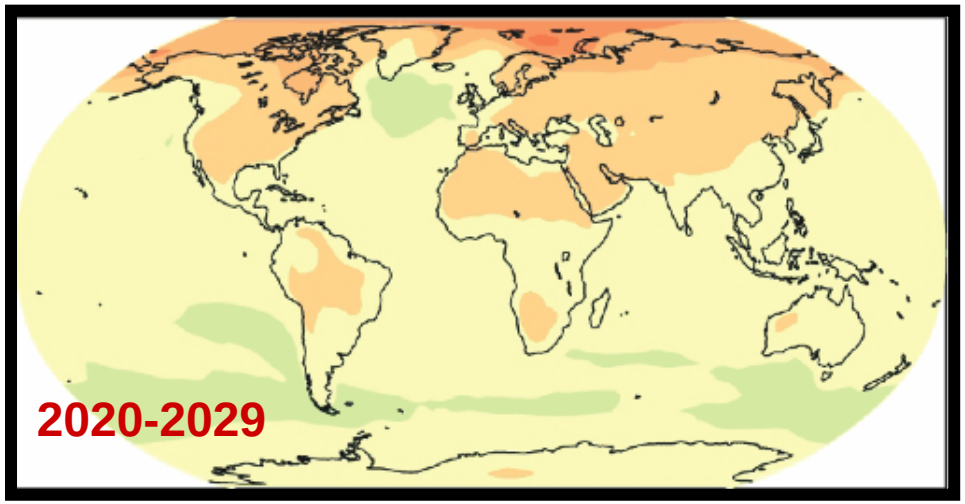


Figure 2. The return period of the autumn of 2006 at De Bilt, the Netherlands, computed from the distribution of the years 1901–2005 for all ECA&D stations with at least 40 years of data, using a Gaussian extrapolation (the GPD gives higher return periods).

Global Change NewsLetter
No. 67 December 2006

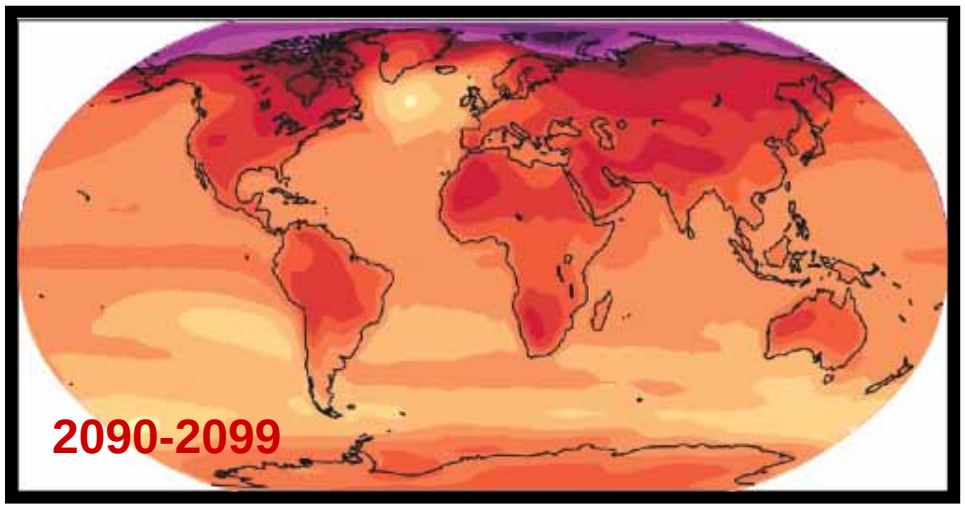
Multi-model Predicted Percent Change in Temperature (2020-2029 and 2090-2099 relative to 1980-1999) [^{o}C]

'Committed'



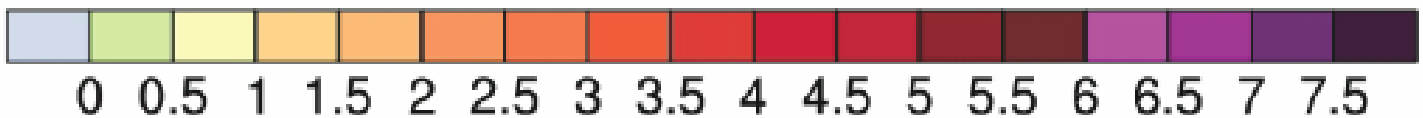
(We did nothing for the last 20 years)

Still up to us!

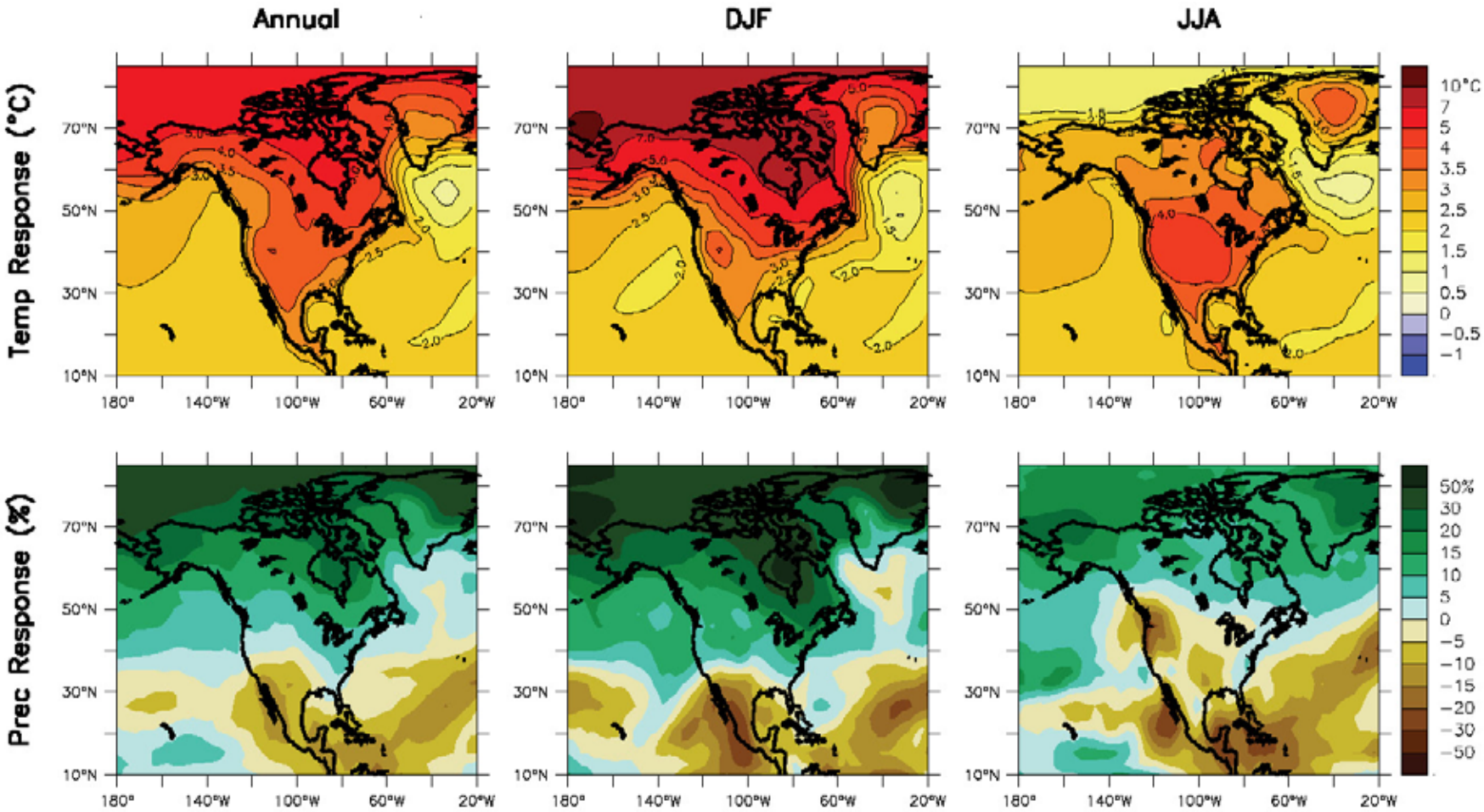


(We could halve this if we act now)

IPCC-AR4-WG1-10
A1B [from data]



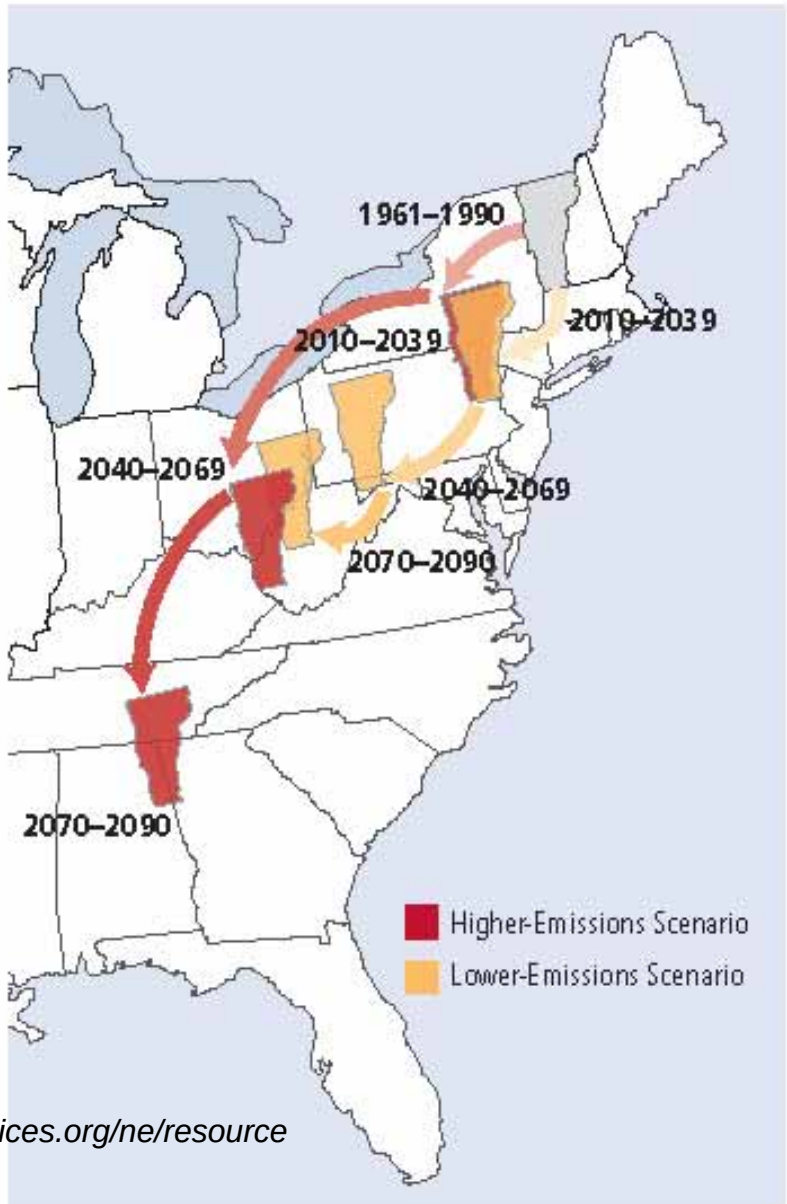
North American Changes: T, Precip.



- Temperature and precipitation changes over North America from an average of 21 AOGCM projections for A1B (high emission) scenarios. *[AR4-WG1, Ch11, p890]*
- Top row: Annual mean, winter (DJF) and summer (JJA) temperature change between 1980 to 1999 and 2080 to 2099. [VT winter: 4.5C, 8F]
- Bottom row: same as top, but for fractional change in precipitation. **[VT winter: 25%]**

Vermont's future with high and low GHG emissions

Red is high emissions



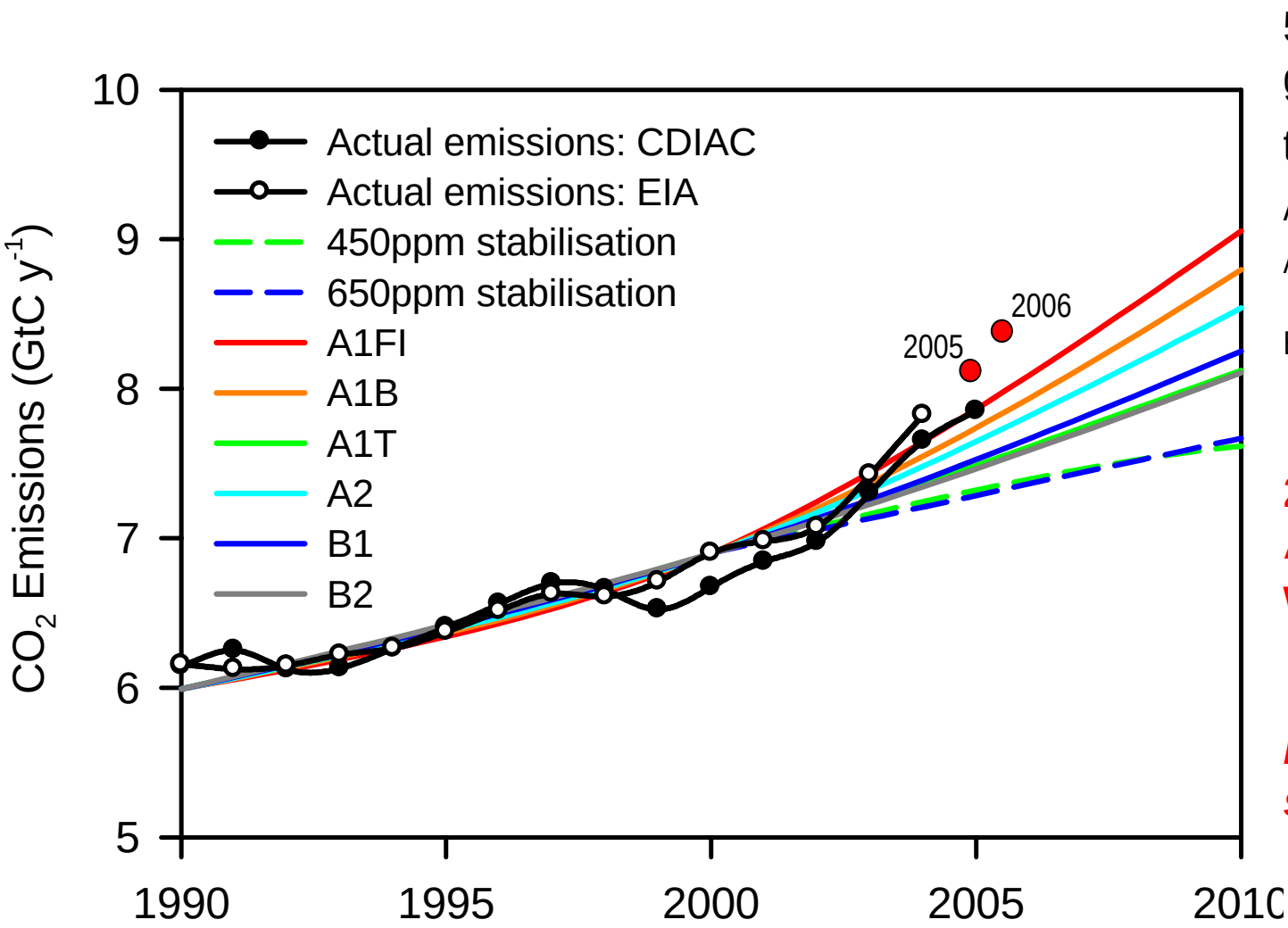
Migrating State Climate

Changes in average summer heat index—a measure of how hot it actually feels, given temperature and humidity—could strongly affect quality of life in the future for residents of Vermont. Red arrows track what summers in Vermont could feel like over the course of the century under the higher-emissions scenario. Yellow arrows track what summers in the state could feel like under the lower-emissions scenario.

http://www.climatechoices.org/ne/resources_ne/nereport.html

NECIA, 2007

Trajectory of Global Fossil Fuel Emissions



50-year constant growth rates

to 2050

A1FI 2.4%

A1B 1.7%,

B1 1.1%,

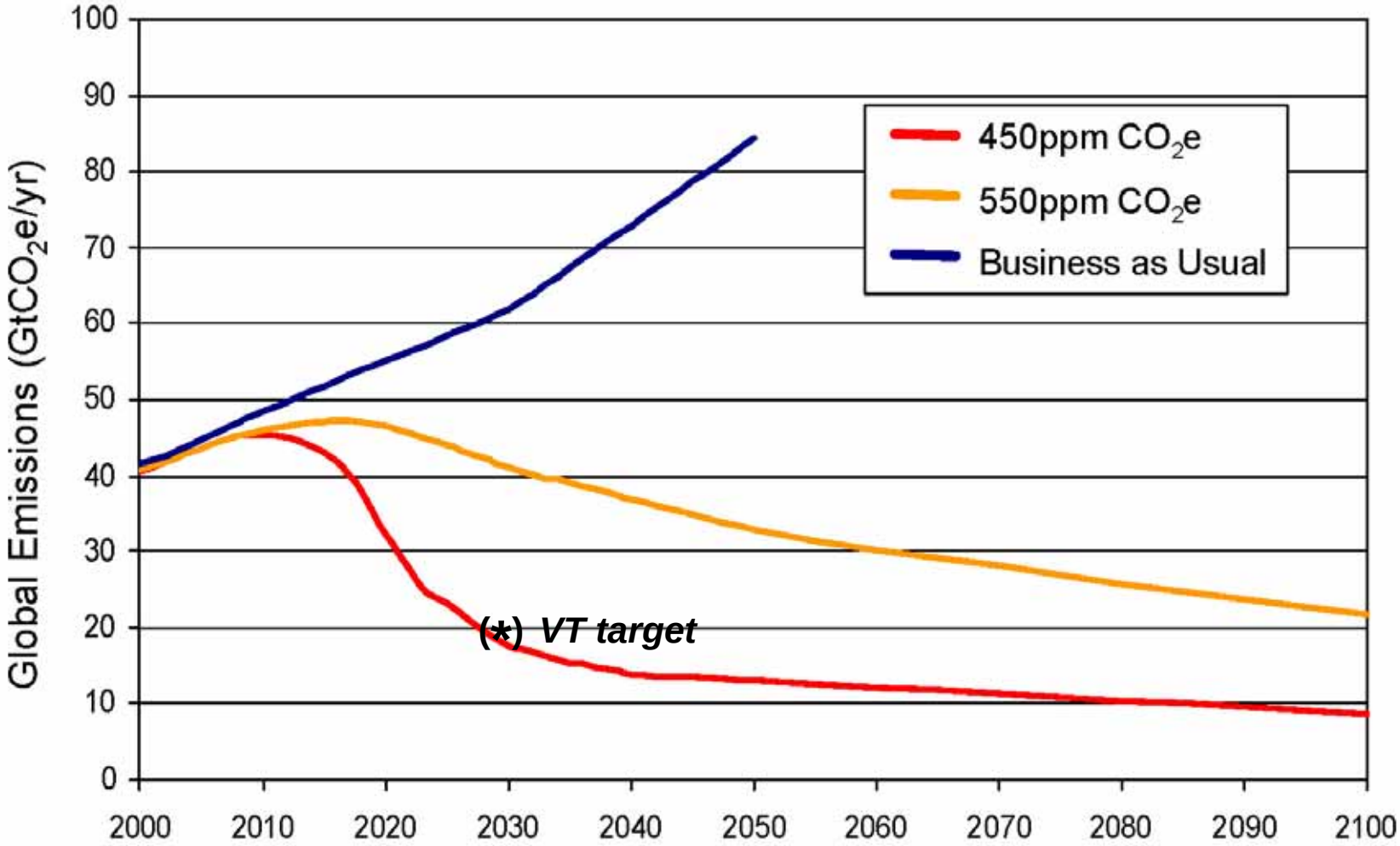
2000-2006 Actual growth was 3.3%

(above the highest IPCC scenario)

Raupach et al. 2007, PNAS; www.globalcarbonproject.org

How do we avoid 'Dangerous Climate Change"?

Emissions Paths to Stabilisation *[Stern, 2006]*



Wind to electricity

Cattle graze among turbines at the 300 MW Stateline wind park on the Oregon/Washington state border

- Oregon-Washington

- Germany
- ***We need 1 million 3MW wind turbines, replacing electricity from coal***
- *20 on Grandpa's Knob?*

Climate Change is a huge challenge for humanity

- **Current problem arises because our technology is having a global impact on the natural world**
- **We haven't integrated our science/technology and our moral responsibility for the earth**
- **We have a huge investment in a fossil fuel infrastructure, that must be replaced**

- ***We are already decades late in taking action***

What will this mean for society?

- ***Traumatic change for US society:***
  - ***the end of cheap fossil fuel and its waste***
  - ***the end of the throw-away 'growth' economy***
- Need to transform infrastructure in 1-2 decades
- **To an efficient one** *[better winterized buildings, more efficient cars, efficient use of electricity]*
- **Development of renewable energy economy** *[Wood/cellulose to fuels; algae to biodiesel; wind; solar; management of forests and land]*
- **Costs will be significant** *but far less than the cost of doing nothing, and far less than the military/oil option*

What will this mean for you?

- **A greater responsibility** to understand the big picture
- **You have a key educational role.** *Society needs to rethink its relationship to the natural environment and its ecosystems in less than one generation*
- ***Our 'lifestyle'*** is disconnected from what the earth can sustain
- **The large inertia** of the earth system is masking the extent of the crisis we face

Is our democracy well-informed?

- Till recently the media pretended that climate change was still in doubt! [*Some people say*…]

  [Nobel prize to the IPCC & Al Gore will make a difference?]

- Yes, it is complex. There are uncertainties as to exactly what will happen and when

  [since the earth system and human behavior are complex]

  but the direction, likely magnitude and cause of 'global warming' is clear

- In US, political and economic ideologies have trumped the science using deceptive propaganda

- **Few have grasped how deep the issue really is**

‘Anti-global warming’ tactics
[*delay, confuse and deny*]

- Fabricate ‘data’ or cherry-pick the science for unsolved issues and ignore the big picture. ‘This disproves global warming’ *or* ‘Science isn’t resolved; we need more science.’
- Models can’t predict the future with certainty, so the models are ‘unreliable’, ‘can’t be trusted’. Given this uncertainty, *we cannot be held responsible for the future*.
- If climate change were real, it would require collective government regulation of the ‘free market’, which we are opposed to; so *climate change must be a ‘hoax’*
- It is too costly to make structural changes to our society, and it would affect profit margins.
- [We will wait till China and India take action]
- [The poor in Africa need energy]

For church groups: map issues relating to the conflicts between science, politics & values

- **Strengths of science**:
  - integrity, honesty and communication
  - *particularly valuable in a society lost in ignorance and deceit*

- **Limits of science**:
  - tangible, measurable and communicable
  - *hard to deal with the complexity and interconnectedness of the living natural world, which includes humanity*

Perspective for the 21st century

- Much theological & political doctrine formed when humanity had a limited understanding of its place in the world; but the detailed beliefs didn't matter too much because our impact was small.
- All this started to change with the industrial revolution powered by fossil fuels. **Now humanity has a global impact on the natural world, and understanding our place in it is paramount.**
- Science and technology created this situation, and must help us find a way out, by helping us understand the earth as a global system, now out-of-balance.
- **But science is not enough**

Science has become ‘valueless’

- Centuries-old split of science from values/religion
- Science preserved its factual integrity
  but makes no value choices
- Theology feels free to choose doctrine
  over ‘reality’ [starting with Galileo!]
- ***Political ideologies have little interest in factual accuracy***
  -destroys the integrity & value of scientific knowledge
- ***No-one accepts responsibility for the earth***
- ***“Thy will be done on earth”***
  - requires an understanding of the earth system

Discussion - 1

- *Diverse groups with urgent desire to understand*
- **Their involvement & feedback is critical**
- ***Citizens groups are well ahead of the 'experts'***
- *Central government is corrupt & dysfunctional*

- **Humanity & society is at turning point**
- **Critical, informed choices must be made**
- **Value of science lies in its integrity & honesty**
- ***Scientific community has an obligation to speak & participate in the dialog***

Discussion - 2

- **Time commitment is large**
- *Communication skills are essential*
- Not for everyone: support those scientists in institution who understand need and are capable
- Real scientists have more credibility than ‘Information Officers’

[This is not organizational PR]