Communicating Uncertainty in Climate Change

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Chief Meteorologist
Minnesota Public Radio
So you wanna be a Broadcast Meteorologist???

You might want to be a Broadcast Meteorologist if:
• Explain a complex science to general public
• Issue weather forecasts of varying uncertainty...
• Suffer public ridicule when forecast goes horribly bad
• Endure ‘Polar Vortex weather hate mail’
• Enjoy constant joking about “being wrong half the time and still getting paid.”

• Meteorologists must communicate varying levels of uncertainty daily! (forecast models & outcomes)
MPR weekly radio show on climate science

Established in February 2013
MPR weekly radio show on climate science

Climate Cast

What economists can teach climate change scientists
Bob Litterman, former head of the risk department at Goldman Sachs, explains how risk models common to the financial industry can help craft climate policy.
The Daily Circuit, September 10, 2014

Our continuing look at climate change
The latest research on our changing climate.
The Daily Circuit, September 3, 2014

How climate change could ruin your breakfast
Hazelnut prices are spiking and that’s bad news for lovers of Nutella spread.
The Daily Circuit, August 28, 2014

Climate Cast
MPR Meteorologist Paul Huttner and University of St. Thomas Professor John Abraham will be talking about the unusually hot world temperatures in 2014 and take your questions.
The Daily Circuit, August 21, 2014
Climate Cast mission

• What is the latest evolving climate science?
• How to best *communicate* climate science?
• Make sometimes obscure trends *meaningful*
• Relate to peoples weather/climate experience
• Use analogies to make trends clearer
• Stick to science – avoid policy advocacy
How do we communicate inherent uncertainty in CC?

• What data is observed? (measured)
• What trends are forecast? (modeled)
• What extreme weather events “fit”?
• Observed extreme weather trends through the lens of what was predicted by climate change?
Highest certainty: Observed/measured data

Atmospheric CO$_2$ at Mauna Loa Observatory

Scripps Institution of Oceanography
NOAA Earth System Research Laboratory
These are just some of the indicators measured globally over many decades that show that the Earth’s climate is warming. White arrows indicate increasing trends; black arrows indicate decreasing trends. All the indicators expected to increase in a warming world are increasing, and all those expected to decrease in a warming world are decreasing. (Figure source: NOAA NCDC, based on data updated from Kennedy et al. 2010\textsuperscript{1}).
## Global Climate Change: Recent Impacts

<table>
<thead>
<tr>
<th>Phenomena</th>
<th>Likelihood that trend occurred in late 20th century</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold days, cold nights and frost less frequent over land areas</td>
<td>Very likely</td>
</tr>
<tr>
<td></td>
<td>&gt;90%</td>
</tr>
<tr>
<td>More frequent hot days and nights</td>
<td>Very likely</td>
</tr>
<tr>
<td></td>
<td>&gt;90%</td>
</tr>
<tr>
<td>Heat waves more frequent over most land areas</td>
<td>Likely</td>
</tr>
<tr>
<td></td>
<td>&gt;66%</td>
</tr>
<tr>
<td>Increased incidence of extreme high sea level *</td>
<td>Likely</td>
</tr>
<tr>
<td></td>
<td>&gt;66%</td>
</tr>
<tr>
<td>Global area affected by drought has increased (since 1970s)</td>
<td>Likely in some regions</td>
</tr>
<tr>
<td></td>
<td>&gt;66%</td>
</tr>
<tr>
<td>Increase in intense tropical cyclone activity in North Atlantic (since 1970)</td>
<td>Likely in some regions</td>
</tr>
<tr>
<td></td>
<td>&gt;66%</td>
</tr>
</tbody>
</table>

* Excluding tsunamis, which are not due to climate change.
### Global Climate Change: Future Trends

<table>
<thead>
<tr>
<th>Phenomena</th>
<th>Likelihood of trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contraction of snow cover areas, increased thaw in permafrost regions, decrease in sea ice extent</td>
<td>Virtually certain &gt;99%</td>
</tr>
<tr>
<td>Increased frequency of hot extremes, heat waves and heavy precipitation</td>
<td>Very likely to occur &gt;90%</td>
</tr>
<tr>
<td>Increase in tropical cyclone intensity</td>
<td>Likely to occur &gt;66%</td>
</tr>
<tr>
<td>Precipitation increases in high latitudes</td>
<td>Very likely to occur</td>
</tr>
<tr>
<td>Precipitation decreases in subtropical land regions</td>
<td>Very likely to occur</td>
</tr>
<tr>
<td>Decreased water resources in many semi-arid areas, including western U.S. and Mediterranean basin</td>
<td>High confidence</td>
</tr>
</tbody>
</table>

**Definitions of likelihood ranges used to express the assessed probability of occurrence:**

- **virtually certain** >99%
- **very likely** >90%
- **likely** >66%

Source: Summary for Policymakers, IPCC Synthesis report, November 2007
http://www.ipcc.ch/
National Climate Assessment: Percent changes in the amount of precipitation falling in very heavy events (the heaviest 1%) from 1958 to 2012 for each region. There is a clear national trend toward a greater amount of precipitation being concentrated in very heavy events, particularly in the Northeast and Midwest. Karl et al. 2009
Follow the money?
Hurricane Sandy?
Water temps +5F
Is all weather now colored by climate change?

The answer to the oft-asked question of whether an event is caused by climate change is that it is the wrong question. All weather events are affected by climate change because the environment in which they occur is warmer and moister than it used to be....

The air is on average warmer and moister than it was prior to about 1970 and in turn has likely led to a 5–10 % effect on precipitation and storms that is greatly amplified in extremes. The warm moist air is readily advected onto land and caught up in weather systems as part of the hydrological cycle, where it contributes to more intense precipitation events that are widely observed to be occurring.

Kevin E. Trenberth, senior scientist, National Center for Atmospheric Research, in the journal *Climatic Change*, released under a Creative Commons-Attribution license (PDF here, HTML here)
What can we tie to humans?

Increases in extreme temperatures (heat waves)

Increased intense precipitation events (both continental as well as along coasts with more rainfall from hurricanes)

Increased rate of evaporation and drought setting on faster and longer

Increased extreme weather from jet stream fluctuations – potentially tied to loss of arctic ice and snow cover in NH

Increased regional flooding

Rising Sea level (not really a “weather” problem but when you connect it to storm surge with hurricanes, a real problem)

Increased thunderstorms

Where are there real questions?

Tornadoes?

What will happen to hurricanes?