Climate Change 2013: The Physical Science Basis
Working Group I contribution to the IPCC Fifth Assessment Report

From global to regional climate assessment

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Overview

- Introduction to the WGI Atlas of global and regional climate change
- Changes in average temperature (Atlas, Chapters 11 – 14)
- Changes in average precipitation (Atlas, Chapters 11 – 14)
- Changes in climate extremes (SPM table 1, IPCC Special Report 2012)
  - Drought (Chapter 12, IPCC Special Report 2012)
  - Tropical cyclones (Chapter 14)
Warming in the climate system is unequivocal

For the longest period when calculation of regional trends is sufficiently complete, almost the entire globe has experienced surface warming.

Over every continental region except Antarctica, human influence has likely made a substantial contribution to surface temperature increases since the mid-20th century.
Atlas of Global and Regional Climate Projections

- 42 global climate models
- 35 regions
- 2 variables
  Temperature, Precipitation
- 4 scenarios
  RCPs 2.6, 4.5, 6.0, 8.5
- Annual and seasonal
- 3 time periods
  2016-35, 2046-65, 2081-2100
Temperature

- Warming over land will be larger than over the ocean, and the Arctic region will warm most rapidly.

- It is very likely temperatures will increase over the whole of South America, with greatest warming projected in southern Amazonia.

- The magnitudes of the projected warming are substantially affected by the choice of emissions scenario.
Precipitation

- The contrast in precipitation between wet and dry regions and between wet and dry seasons will increase with future warming.

- In the April to September half year there is a significant rainfall reduction in Southern Africa, but little change in other regions of the continent.
Extreme weather and climate events

Table SPM.1 (page 5)

<table>
<thead>
<tr>
<th>Phenomenon and direction of trend</th>
<th>Assessment that changes occurred (typically since 1950 unless otherwise indicated)</th>
<th>Assessment of a human contribution to observed changes</th>
<th>Likelihood of further changes</th>
<th>Early 21st century</th>
<th>Late 21st century</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warmer and/or fewer cold days and nights over most land areas</td>
<td>Very likely</td>
<td>(2.8)</td>
<td>Likely</td>
<td>Very likely</td>
<td>(10.4)</td>
</tr>
<tr>
<td>Warmer and/or more frequent hot days and nights over most land areas</td>
<td>Very likely</td>
<td>(2.8)</td>
<td>Likely</td>
<td>Very likely</td>
<td>(10.4)</td>
</tr>
<tr>
<td>Warmer and/or more frequent hot days and nights over most land areas</td>
<td>Very likely</td>
<td>(2.8)</td>
<td>Likely</td>
<td>Very likely</td>
<td>(10.4)</td>
</tr>
<tr>
<td>Warm spells/cool waves. Frequency and/or duration increase over most</td>
<td>Medium confidence on a global scale</td>
<td>Likely</td>
<td>Medium confidence</td>
<td>Not formally assessed</td>
<td>Very likely</td>
</tr>
<tr>
<td>Heavy precipitation events increase in frequency, intensity, and/or amount of</td>
<td>Likely</td>
<td>(2.8)</td>
<td>Medium confidence</td>
<td>Medium confidence</td>
<td>Very likely</td>
</tr>
<tr>
<td>Increases in intensity and/or duration of drought</td>
<td>Low confidence on a global scale</td>
<td>Likely</td>
<td>Medium confidence</td>
<td>Medium confidence</td>
<td>Very likely</td>
</tr>
<tr>
<td>Increases in intense tropical cyclone activity</td>
<td>Low confidence in long term (centennial) changes</td>
<td>Likely</td>
<td>Low confidence</td>
<td>Medium confidence</td>
<td>Not formally assessed</td>
</tr>
<tr>
<td>Increased incidence and/or magnitude of extreme high sea levels</td>
<td>Likely</td>
<td>(3.7)</td>
<td>Medium confidence</td>
<td>Medium confidence</td>
<td>Likely</td>
</tr>
</tbody>
</table>

- The AR5 builds upon the 2012 IPCC special report on Extreme Events (SREX).
- A comprehensive summary of the assessment of extreme weather and climate events is provided in the WGI Summary for Policymakers Table 1.
- Generally, confidence is lower for assessment at the regional scale.
Regional decreases in soil moisture and increased agricultural drought are likely (medium confidence) in presently dry regions.

The SREX provides a comprehensive assessment of drought indices for all 35 regions, including both observed and projected changes (Tables 3.2 and 3.3).

Increased drought in Southern Europe and the Mediterranean, central Europe, central North America, Central America and Mexico, northeast Brazil, and southern Africa.
The global frequency of tropical cyclones will *likely* either decrease or remain essentially unchanged by the end of the 21st Century.

Precipitation from tropical cyclones will *likely* be more extreme in most regions.

The frequency of the most intense storms will *more likely than not* increase substantially in some ocean regions.
Summary remarks

- Warming of the climate system is unequivocal, and human influence has made a substantial contribution to observed warming across all populated continents.
- Future warming will be larger over land than ocean, and largest in the high latitude regions.
- With future warming, the contrast in precipitation between wet and dry regions and between wet and dry seasons will increase.
- Widespread changes in climate extremes have been observed, and are projected for the 21st century (see the SREX for regional details).
- The global frequency of tropical cyclones will change little, but the frequency of the most intense cyclones will increase in some regions.
- Virtually all coastlines of the world will experience sea level rise, and a corresponding increase in extreme sea level events.