Appendix

Highlights of Summary for Policymakers of Fifth Assessment Report of Working Group I of United Nations Intergovernmental Panel on Climate Change
(The SPM can be downloaded from http://www.climatechange2013.org)

1. Observed Changes in the Climate System

1.1 Atmosphere

- The first decade of the 21st century has been the warmest since 1850. In the Northern Hemisphere, the period 1983–2012 was *likely* (>= 66% probability) the warmest 30-year period of the last 1400 years.

- The global average surface temperature data show an increase of 0.85 °C over the period 1880–2012.

- It is *very likely* (>= 90% probability) that the number of cold days and nights has decreased and the number of warm days and nights has increased on the global scale.

- There are *likely* more land regions where the number of heavy precipitation events has increased than where it has decreased.

1.2 Ocean

- Warming of the ocean accounts for more than 90% of the change in energy stored in the climate system between 1971 and 2010.

- It is *virtually certain* (>= 99% probability) that upper ocean (0–700 m below surface) warmed from 1971 to 2010.

- It is *very likely* that regions of high salinity have become saltier, while regions of low salinity have become fresher since the 1950's, indicating strengthening of the global water cycle.

1.3 Cryosphere

- The Arctic summer sea ice retreat in the last three decades was unprecedented in at least the last 1450 years.

- The average rate of mass loss from the Greenland ice sheet *very likely* increased from 34 Gt/yr over the period 1992-2001 to 215 Gt/yr over the period 2002–2011.

- The average rate of mass loss from the Antarctic ice sheet *likely* increased from 30 Gt/yr over the period 1992–2001 to 147 Gt/yr over the period 2002–2011.

1.4 Sea Level

- The rate of sea level rise since the mid-19th century has been larger than the

mean rate during the previous two millennia.

- It is *very likely* that the mean rate of global average sea level rise was 1.7 mm/yr and 3.2 mm/yr during 1901-2010 and 1993-2010 respectively. It is *likely* that similarly high rates occurred between 1920 and 1950.

1.5 Carbon Cycle

- Present-day concentrations of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are unprecedented in at least the last 800,000 years.

- About 44% of human induced CO_2 emissions from 1750 to 2011 have accumulated in the atmosphere, while about 30% of the emissions have been taken up by the ocean.

- Oceanic uptake of human induced CO_2 results in acidification of the ocean.

2. Drivers of Climate Change

- The main driver of climate change is the increase in the atmospheric concentration of CO_2 since 1750.

3. Understanding the Climate System and its Recent Changes

- Climate models can reproduce the rapid warming in the second half of the 20th century when human influence is included.

- It is *extremely likely* (>= 95% probability) that human influence has been the dominant cause of the observed warming since the mid-20th century.

- The observed reduction in warming trend in the recent decade or so is mainly due to heat uptake by deep ocean, reduction in solar activity, and volcanic eruptions.

- Changes in solar activity have not contributed to global warming over the period 1986 to 2008. No robust association between changes in cosmic rays and climate change on Earth has been identified.

4. Future Climate Change

Projections of changes in the climate system are based on climate model simulations under scenarios of different greenhouse gas (GHG) trajectories in the 21st century, namely RCP2.6, RCP4.5, RCP6.0 and RCP8.5. They are identified by their approximate total radiative forcing in year 2100 relative to 1750: 2.6 W m^{-2} for RCP2.6, 4.5 W m^{-2} for RCP4.5, 6.0 W m^{-2} for RCP6.0 and 8.5 W m^{-2} for RCP8.5. RCP2.6 and RCP8.5 correspond to the lowest and highest GHG concentration scenarios respectively. Projected changes are relative to the average of 1986-2005 unless otherwise stated.

4.1 Temperature

- Projected increase of global mean surface temperatures will *likely* be in the following ranges:

Scenario	2045-2065	2081-2100
RCP2.6	0.4 - 1.6 ^{o}C	0.3 - 1.7 ^{o}C
RCP4.5	0.9 - 2.0 ^{o}C	1.1 - 2.6 ^{o}C
RCP6.0	0.8 - 1.8 ^{o}C	1.4 - 3.1 ^{o}C
RCP8.5	1.4 - 2.6 ^{o}C	2.6 - 4.8 ^{o}C

- It is *virtually certain* that, over most land areas, there will be more hot and fewer cold temperature extremes on daily and seasonal timescales as global mean temperatures increase. It is *very likely* that heat waves will occur with a higher frequency and duration. However, occasional cold winter extremes will continue to occur.

4.2 Water Cycle

- In a warmer world, extreme precipitation events over most of the mid-latitude land masses and over wet tropical regions will *very likely* become more intense and more frequent by the end of this century.

4.3 Cryosphere

- A nearly ice-free Arctic Ocean in September before mid-century is *likely* under RCP8.5.

4.4 Sea Level

- Projected global mean sea level rise will *likely* be in the following ranges:

Scenario	2045-2065	2081-2100
RCP2.6	0.17 - 0.32 m	0.26 - 0.55 m
RCP4.5	0.19 - 0.33 m	0.32 - 0.63 m
RCP6.0	0.18 - 0.32 m	0.33 - 0.63 m
RCP8.5	0.22 - 0.38 m	0.45 - 0.82 m