



## **Detection and Attribution of Climate Change (from global to regional)**

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The evidence for a human influence on global temperatures has strengthened in the IPCC AR5 report; which concluded that it is 'extremely likely (>95%) that 'more than half of the observed increase in global average surface temperature from 1951-2010 was caused by the anthropogenic increase in greenhouse gas concentrations and other anthropogenic forcings together'. For the first time, the report provides an estimate of the contributions by greenhouse gases and other influences to global temperature changes. Recent temperature changes provide constraints on climate system properties such as the transient climate response (TCR), and relate to estimates of the equilibrium climate sensitivity (ECS). These estimates overlap with, but are not identical to those from modelling and palaeoclimate. Despite progress, stronger constraints on the human contribution to recent warming, and on ECS and TCR are presently hampered by uncertainties in quantifying the role of aerosols and multidecadal climate variability to regional climate change.

For climate impacts, changes in the water cycle are very important. For the first time, the report concluded that human influences have 'likely' affected the global water cycle since 1960. Since the IPCC report, evidence has further strengthened, despite substantial observational uncertainty. The report also concludes that human influence has increased the probability of heat waves in some locations. Quantifying the changing risk of extreme events is an important continuing research question.