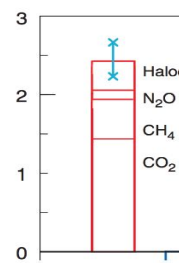


According to third assessment report, Over the 20th century the global average surface temperature has increased by 0.6 degree Celsius (p 12) and most of warming occurred during 1910 to 1945 and 1976 to 2000 . It is likely that the warmest decade was 1990 and 1998 year was the warmest (p 12). About three-quarters of the anthropogenic emissions of CO<sub>2</sub> to the atmosphere during the past 20 years is due to fossil fuel burning. Since 1995, the atmospheric concentrations of many of those halocarbon gases that are both ozone-depleting and greenhouse gases. The observed depletion of the stratospheric ozone (O<sub>3</sub>) layer from 1979 to 2000 is estimated to have caused a negative radiative forcing ( $-0.15 \text{ W m}^{-2}$ ). (p 7). The sustained direct monitoring of the atmospheric concentrations of carbon dioxide (CO<sub>2</sub> ) began about the middle of the 20th century and, in later years, for other long-lived, well-mixed gases such as methane (p 46). Examples of greenhouse gases that are affected by human activities, Concentration in 1998 CO<sub>2</sub> 365 ppm, CH<sub>4</sub> 1745 ppb, N<sub>2</sub>O 314 ppb (p 48). The atmospheric abundance of CH<sub>4</sub> continues to increase, from about 1,610 ppb in 1983 to 1,745 ppb in 1998 (p 51).

According to fifth assessment report, warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased (p 4) . The rate of warming over the past 15 years is 0.05 per decade, which begins with a strong El Niño, is smaller than the rate calculated since 1951 is 0.12 °C per decade. It is virtually certain that globally the troposphere has warmed since the mid-20th century (p 5). The total anthropogenic RF for 2011 relative to 1750 is  $2.29 \text{ W m}^{-2}$  , and it has increased more rapidly since 1970 than during prior decades (p 13). The RF from changes in concentrations in these gases is  $2.83 \text{ W m}^{-2}$  (p 13). It is extremely

likely that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in greenhouse gas concentrations and other anthropogenic forcings together. Greenhouse gases contributed a global mean surface warming likely to be in the range of 0.5°C to 1.3°C over the period 1951 to 2010) (p 17). In 2011 the concentrations of these greenhouse gases CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O were 391 ppm, 1803 ppb, and 324 ppb, and exceeded the pre-industrial levels by about 40%, 150%, and 20%, respectively (p11). Human influence on the climate system is clear. This is evident from the increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing, observed warming, and understanding of the climate system(p 15). Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions (P19).



Level of confidence (third assessment)

Total anthropogenic RF relative to 1750 Emitted compound	Level of confidence (Fifth assessment report)
CO <sub>2</sub>	1.68 (Very High)
CH <sub>4</sub>	0.97 (High)
Halo carbons	0.18 (High)
N <sub>2</sub> O	(0.17) High

## Work Cited

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IPCC, 2013: *Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA