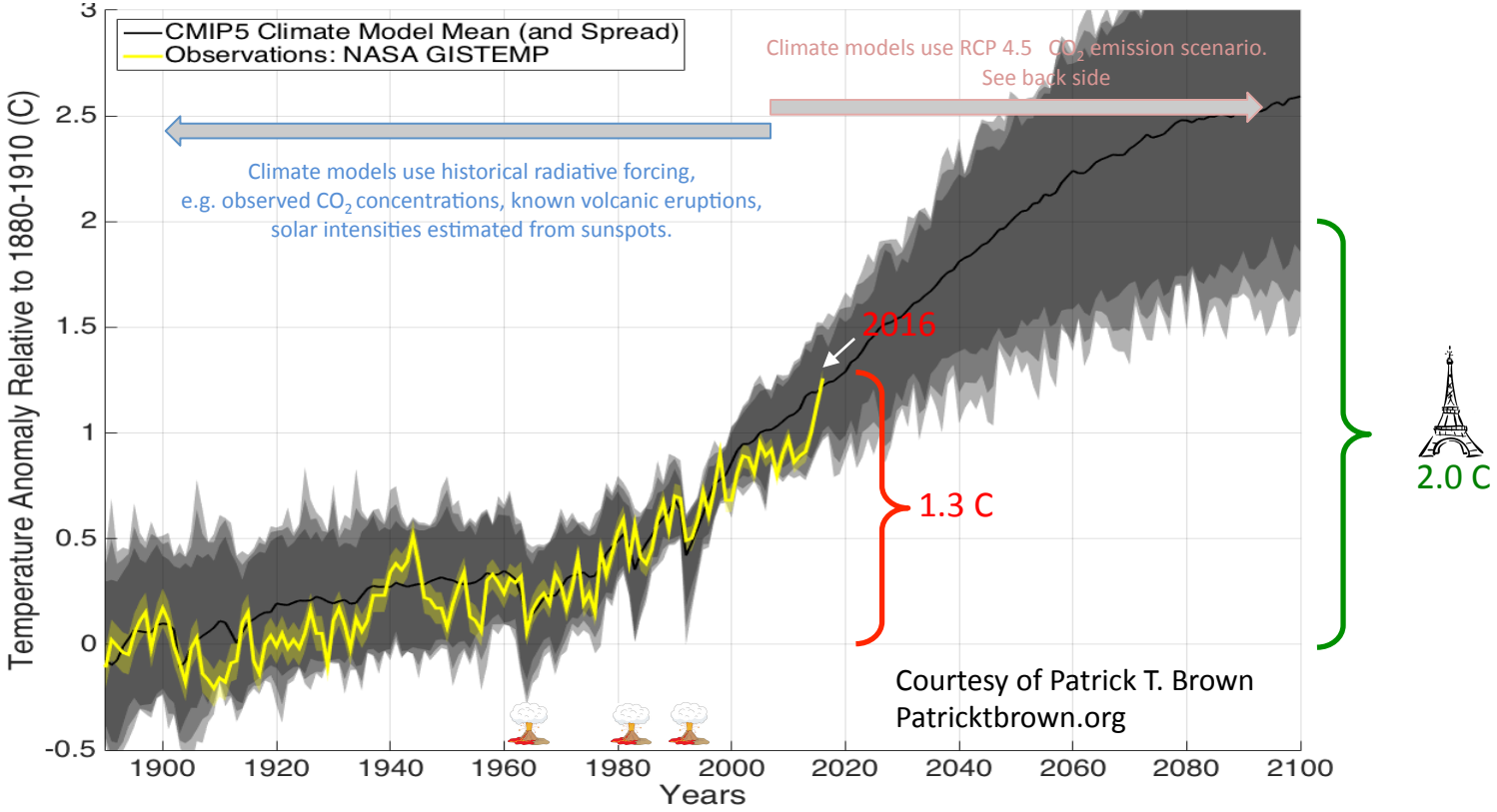
Modeled and Observed Global Mean Surface Temperature



Can Climate Models reproduce the observed global warming? From 1900-2000 climate models were able to simulate the weak warming observed prior to 1970, followed by the faster rise thereafter. After the year 2000 the observed rate of warming slowed, but the climate models continued to forecast warmer temperatures. (There are at least four different peer-reviewed explanations for this model-observation disparity.) Some argued that the climate models were too temperature sensitive to rising CO_2 concentrations. They concluded that the disturbing IPCC predictions of hotter temperatures and rising sea levels on into the next century should be reduced. However, for the last two years observed global mean surface temperatures are now more consistent with the climate models.

The Paris climate agreement's objective is to keep the global temperature rise to below 2.0 C during this century. The new 2016 annual surface temperature global average moves humanity ever closer to this value.

Plot description

The plot was produced by Patrick Brown (See https://patricktbrown.org/2017/01/18/2016-update-of-modelled-vs-observed-global-temperature/)

Shown in yellow are global mean surface temperatures measured over land and ocean and compiled by the GISTEMP team. A constant value has been removed so early temperatures are near zero. The grey trace and shading are comparable surface temperature trends from the Coupled Model Intercomparison Project Phase5 (CMIP5). This is a cooperative effort among the 20 different climate model groups from around the world.

All the modeling groups use the same historical radiative forcing up to 2005. A major contribution is forcing derived from known (historical) concentrations of CO_2. Forcing from known volcanic eruptions (e.g. Mt. Pinatubo, 1991) are also used.

Thereafter, radiative forcing from the RCP 4.5 future emission scenario is used. RCP means 'Representative Concentration Pathways' and are defined by their total radiative forcing. It is a cumulative measure of human emissions of Greenhouse Gases from all sources expressed in Watts / meter^2. The greater the cumulative emissions, the higher the radiative forcing and the warmer the future global mean temperature.

The RCP 4.5 scenario assumes significant reductions in CO_2 emissions with a peak global concentration of 540 parts per million (ppm). Today's value is about 405 ppm. RCP 4.5 forecasts warming between 1.8 to 3.4 C in year 2100 with respect to pre-industrial values.

References

GISTEMP Team, 2017: *GISS Surface Temperature Analysis (GISTEMP). NASA Goddard Institute for Space Studies. Dataset accessed 2016-01-15 at https://data.giss.nasa.gov/gistemp/.*

Coupled Model Intercomparison Project Phase 5 (CMIP5) *http://cmip-pcmdi.llnl.gov/cmip5/*

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