EGU2020-7651
https://doi.org/10.5194/egusphere-egu2020-7651
EGU General Assembly 2020

The state of greenhouse gases in the atmosphere using global observations through 2018

Oksana Tarasova[1], Alex Vermeulen[2], Jocelyn Turnbull[3], Yousuke Sawa[4], and Ed Dlugokencky[5]
[1]WMO, Atmospheric Environment Research Division, Geneva, Switzerland (otarasova@wmo.int)
[2]Lund University, Lund, Sweden
[3]GNS Science, Wellington, New Zealand
[4]WMO World Data Centre for Greenhouse Gases, c/o Japan Meteorological Agency, Tokyo, Japan
[5]NOAA, Earth System Research Laboratory, Global Monitoring Division, Boulder, Colorado, USA

We present results from the fifteenth annual Greenhouse Gas Bulletin (https://library.wmo.int/doc_num.php?explnum_id=10100) of the World Meteorological Organization (WMO). The results are based on research and observations performed by laboratories contributing to the WMO Global Atmosphere Watch (GAW) Programme (https://community.wmo.int/activity-areas/gaw).

The Bulletin presents results of global analyses of observational data collected according to GAW recommended practices and submitted to the World Data Center for Greenhouse Gases (WDCGG). Bulletins are prepared by the WMO/GAW Scientific Advisory Group for Greenhouse Gases in collaboration with WDCGG.

Observations used for the global analysis are collected at more than 100 marine and terrestrial sites worldwide for CO_2 and CH_4 and at a smaller number of sites for other greenhouse gases. The globally averaged surface mole fractions calculated from this in situ network reached new highs in 2018, with CO_2 at 407.8 ± 0.1 ppm, CH_4 at 1869 ± 2 ppb and N_2O at 331.1 ± 0.1 ppb. These values constitute, respectively, 147%, 259% and 123% of pre-industrial (before 1750) levels. The increase in CO_2 from 2017 to 2018 is very close to that observed from 2016 to 2017 and practically equal to the average growth rate over the last decade. The increase of CH_4 from 2017 to 2018 was higher than both that observed from 2016 to 2017 and the average growth rate over the last decade. The increase of N_2O from 2017 to 2018 was also higher than that observed from 2016 to 2017 and the average growth rate over the past 10 years. The National Oceanic and Atmospheric Administration (NOAA) Annual Greenhouse Gas Index (AGGI) shows that from 1990 to 2018, radiative forcing by long-lived greenhouse gases (GHGs) increased by 43%, with CO_2 accounting for about 81% of this increase.

The Bulletin highlights the value of the long-term measurement of the GHGs isotopic composition. In particular, it presents the use of the radiocarbon and ^{13}C measurements in atmospheric CO_2 in discriminating between fossil fuel combustion and natural sources of CO_2. The simultaneous decline in both ^{13}C and ^{14}C content alongside CO_2 increases can only be explained by the ongoing

release of CO_2 from fossil fuel burning. The Bulletin also articulates how the measurements of the stable isotopes can be used to provide the insights into the renewed growth of methane that started in 2007. Though there are several hypotheses articulated in the peer-reviewed literature, the most plausible is that an increase has occurred in some or all sources of biogenic (wetlands, ruminants or waste) emissions, which contain relatively little ^{13}C. An increase in the proportion of global emissions from microbial sources may have driven both the increase in the methane burden and the shift in $\delta^{13}C\text{-}CH_4$.