Introduction:

Welcome to the 2020 NOAA Cooperative Global Air Sampling Network newsletter. We thank all cooperating partners and network affiliates for their continued support. This newsletter comes to you as the world continues to grapple with a global pandemic related to COVID-19. Through this crisis, our work documenting the main drivers of climate change remains important. At NOAA, many of us are working remotely, but we will try to maintain staff at our facilities in Boulder to keep the measurements going for as long as possible. But there may be disruptions to shipping and receiving flask-air samples that are out of our control.

The accompanying figure shows globally averaged CO2, CH4, N2O, and SF6 determined from measurements from the air samples you collect for us. As described in previous newsletters, these observations are used in our “**Trends**” webpages to keep the public informed on how rapidly atmospheric greenhouse gas burdens are increasing. These observations are also used to determine the contribution of long-lived greenhouse gases to increased climate forcing since the pre-industrial era, 3.18 W m-2 in 2018. Later in this newsletter, we give some examples of ways to think about this enormous amount of energy being added to our climate system.

Annual Greenhouse Gas Index:

Quantifying natural and anthropogenic changes to the flow of energy in and out of Earth’s climate is fundamental to understanding climate change. Our Annual Greenhous Gas Index (AGGI) web page (<https://www.esrl.noaa.gov/gmd/aggi/>) focuses on the role of long-lived greenhouse gases (LLGHG) in changing climate forcing since the start of the industrial revolution. We are revising our AGGI web page to present it in a broader context by indexing it to the *percent* increase in energy absorbed by the climate system due to LLGHG compared to pre-industrial times. We quantify the change in climate forcing (also called radiative forcing) by determining the atmospheric increase in LLGHG burdens from pre-industrial until today. Values from pre-industrial are determined by measurements of air bubbles extracted from ice cores. In 2018, LLGHGs were responsible for 3.181 W m‑2 additional climate heating. This is 1.347% more energy than was absorbed during the pre-industrial era. How can we visualize that much energy? Multiplying that additional climate forcing by the surface area of Earth gives 1622 terrawatts. That is the energy produced by 1.6 million large power plants. In terms of Earth’s climate, it is enough energy to melt about 5% of Greenland’s ice cap in one year, raising sea level by 37 cm. It is also enough energy to heat up, then evaporate, all the water in the North American Great Lakes (22600 km3 of water) in about 14 months. And because some of the CO2 emitted today will still be in the atmosphere hundreds of years from now, today’s emissions will continue to impact climate well into the future.