The NOAA Annual Greenhouse Gas Index (AGGI)

NOAA Earth System Research Laboratory, Boulder, Colorado, USA

Abstract. For the past 30 years, the U.S. National Oceanic and Atmospheric Administration (NOAA) has monitored climate-forcing and ozone-depleting atmospheric gases. These global measurements have provided input to climate and ozone assessments (e.g., the quadrennial IPCC Climate Reports and WMO/UNEP Ozone Assessments). Recently, efforts to make these data more useful and available have been undertaken through release of the NOAA Annual Greenhouse Gas Index (AGGI). This concept of radiative climate forcing is used to determine the AGGI, which is normalized to 1.00 in 1990, the Kyoto Climate Protocol baseline year. For the year 2006, the AGGI was 1.23, i.e., global radiative forcing by long-lived greenhouse gases has increased 23% since 1990. As will be emphasized, the increase in carbon dioxide (CO₂) alone was about 32% over this time interval. Reductions in the growth rates of methane and the CFCs have effectively tempered the increase of CO₂ since 1990.

RADIATIVE FORCING OF CLIMATE

IPCC: An externally imposed perturbation in the radiative energy budget of the Earth climate system, e.g., through changes in solar radiation, changes in the Earth albedo, or changes in atmospheric gases and aerosol particles. The perturbation that has the largest magnitude and the least scientific uncertainty is the forcing related to changes in atmospheric gases that absorb Earth infrared radiation (greenhouse gases) and that are long-lived and well-mixed in the atmosphere. These “major” greenhouse gases are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and the halocarbons (mainly CFCs).

Method. Measurements of the long-lived greenhouse gases – carbon dioxide, methane, nitrous oxide and halocarbons (mainly CFCs) – have optimal scientific uncertainty, independence of climate models and thus provide a climate benchmark free of controversy.

All of these gases have been monitored around the world since the 1970’s mainly by NOAA’s Earth System Research Laboratory (ESRL), Global Monitoring Division (formerly CMDL), in Boulder, Colorado. To provide the data required for the AGGI, continuous measurements from five baseline climate observatories at Pt. Barrow, Alaska; Mauna Loa, Hawaii; American Samoa; and the South Pole and flask air samples are collected through global networks, including an international cooperative program for carbon-containing and other greenhouse gases that provides samples from globally widespread clean air sites.

All measurements are reported on World Calibration Scales, produced and maintained by NOAA/ESRL in Boulder. These data are used to calculate annual global average concentrations from which changes in radiative forcing of the global climate since the pre-industrial era (1750) for the 28-year period encompassing 1979 through 2006 are determined. This includes all major greenhouse gases and 10 minor halogenated gases. Results are normalized to radiative forcing in 1990, the baseline year for the Kyoto Climate Protocol, to produce the AGGI.