

Title: Tracking the World's Carbon**Speaker: James H. Butler****Institute: Global Monitoring Division, NOAA Earth System Research Laboratory****Session I: Introduction and keynote presentations****Abstract:**

Rapidly rising carbon dioxide (CO₂) in Earth's atmosphere is the primary reason we are facing climate change and ocean acidification today. The amount of atmospheric CO₂ is 43% higher than it was during the entirety of human civilization and increasing faster every decade. Over 90% of this added CO₂ was put there by humans during the past century and what is present in the atmosphere now will remain there for thousands of years, as will most of what is emitted in the future. Given the complex balance among forces maintaining Earth's energy balance, there is no question that this rapid rise is increasingly affecting climate as we have known it. In an attempt to measure a trend of atmospheric CO₂, Dave Keeling of Scripps Institution of Oceanography began the first reliable, long term records in 1957 – the International Geophysical Year -- in the remote atmosphere of Mauna Loa, Hawaii, and Antarctica. Keeling's measurements were respected then because of his unrelenting attention to detail and his maintaining a calibration scale that was highly stable over decades. Since then, our measurement system has expanded considerably with evolving scientific questions. At the heart of this system is the World Calibration Scale for CO₂, maintained at first in the Keeling laboratory and later transitioned to NOAA and adopted by WMO as demand for calibration gases increased. Today, CO₂ is measured at hundreds of sites around the world, with many partners monitoring its trends and distributions in remote and regional areas. These data are critical for us to understand large scale trends and variability of this all-important gas and to be able to evaluate its sources and sinks on the planet. But as society begins to address this issue, measurements will have to increase considerably in number if we are to provide the information needed for successfully reducing, offsetting, or mitigating these emissions. Doing so, while maintaining high levels of compatibility among contributing sites, is challenging. We must continue to address this emerging challenge with the care and attentiveness Dave Keeling gave to the first measurements, with the added complication of the increasing number of players. This presentation will address the history of this measurement record and the emerging challenges of monitoring CO₂ at the increasingly granular levels needed for tomorrow.

