

## Monitoring of Atmospheric Acetylene in the NOAA Global Greenhouse Gas Reference Network

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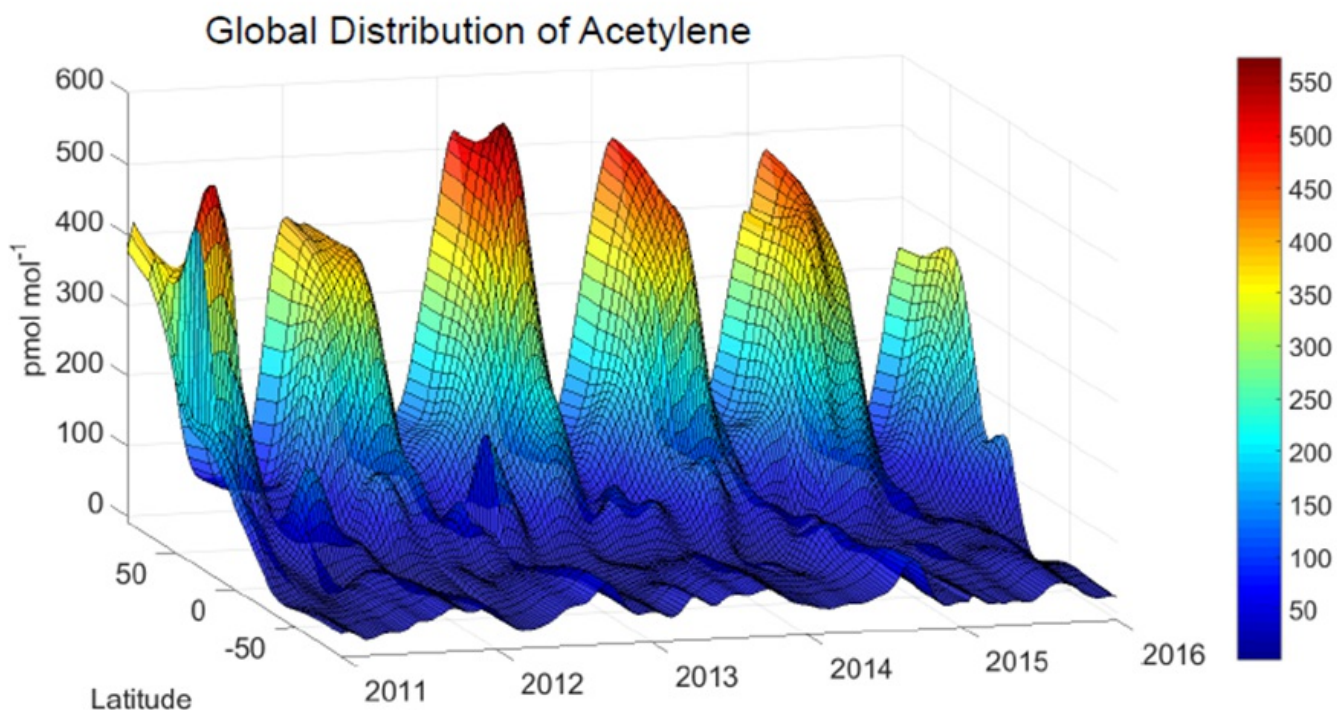
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Flask samples collected within the ESRL/GMD Global Greenhouse Gas Reference Network (GGGRN) have been routinely analyzed for a suite of hydrocarbons by INSTAAR's Atmospheric Research Lab (ARL) since 2005, using a custom-built Peltier-cooled microadsorbent trap pre-concentration system coupled with a GC-FID. Over the past three years, the feasibility of quantification of acetylene on this analytical system has been investigated. The main challenges encountered include a low available sample volume (about 500 mL), analyte break-through in the pre-concentration system, chromatography issues (co-elution with other compounds), and lack of a consistent calibration scale, leading to larger uncertainties than for alkane hydrocarbons. Breakthrough issues have been resolved by a redesign of the adsorbent trap assembly to reach a  $-40^{\circ}\text{C}$  sample focusing temperature compared to  $-20^{\circ}\text{C}$  in the previous design. The choice of an HP Al/KCL PLOT column and carefully chosen GC oven temperature parameters have allowed sufficient separation of acetylene from other compounds. As for the calibration scale, the acquisition in 2015 of two consistent reference standards from the National Physics Laboratory, UK, has allowed the alignment of the ARL standards with the Global Atmospheric Watch (GAW) scale. After adjustment of the ARL scale and reprocessing of the whole flask network dataset, a comparison has been conducted between flask results and *in situ* measurements at Hohenpeissenberg, Germany, resulting in an agreement within the 15% measurement uncertainty goal of GAW for acetylene. Time series data were calculated for network sites and synthesized to create the first carpet plot showing the global distribution of acetylene. The reproducibility of the acetylene determination is on the order of 2-5%. Detection limits in the 500 ml sample volumes are  $\sim 20 \text{ pmol mol}^{-1}$ , and the drift in the response factor from 2011- 2016 was on the order of 16%.



**Figure 1.** Carpet plot showing the global distribution of acetylene at GGGRN background sites from 2011-2016. This analysis illustrates the striking difference in atmospheric acetylene mole fractions between the Northern and Southern Hemisphere.