Comparison of CH_4 Monitoring Methods at GEOSummit

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Our understanding of the global methane (CH_4) budget continues to have large uncertainties as methane is affected by both natural and anthropogenic sources that vary spatially and with time. Arctic observations of atmospheric methane are considered a critical component in deciphering the global methane budget and for investigating the potential for increasing methane sources in the Arctic rising from permafrost thawing. This study compares three independent atmospheric methane monitoring projects at the Greenland Environmental Observatory, Summit Station (GEOSummit), to determine consistency between measurements and for evaluation of research applications from these parallel data sets. The three methods are 1) *in situ* gas chromatography-flame ionization detection (GC-FID) with 2-3 hour time resolution conducted by the Institute of Arctic and and Alpine Research (INSTAAR), 2) *in situ* gas chromatography (GC) with electron capture detection (ECD) with 1-hour time resolution on the NOAA Global Monitoring Division (GMD) Halocarbons And other Trace Species (HATS) GC, and 3) GC-FID analysis of bi-weekly whole air samples collected within the NOAA GMD Global Greenhouse Gas Reference Network (GGGRN) after shipment to Boulder, CO. Monthly medians/averages from these different monitoring methods agree by -0.3 ± 2.8 nmol mol^{-1} (mean±1s), and trends derived from the data to within 0.2 nmol mol^{-1} yr^{-1}. The higher time resolution *in situ* data show enhancements and reductions in methane on the order of 30-40 nmol mol^{-1} from mean seasonal methane levels, illustrating the influence of transport of air from different source regions with elevated/depleted methane to Summit.

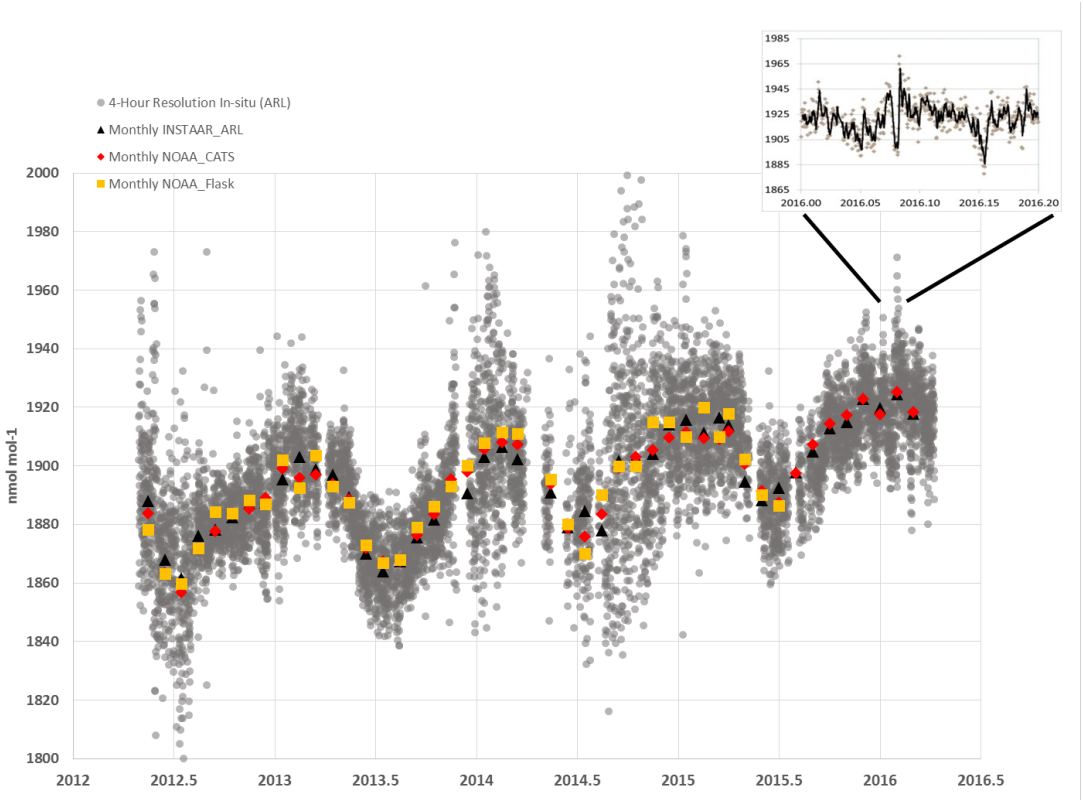

Figure 1. Monthly medians of methane by three measurement methods, underlain by 4-hour resolution *in situ* INSTAAR data, at GEOSummit from 2012 to mid 2016.