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Centennial to millennial variations of atmospheric methane during the early Holocene

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Atmospheric CH_4 is one of the most important greenhouse gases. Ice core studies revealed strong correlations between millennial CH_4 variations and Greenland climate during the last glacial period. However, millennial to sub-millennial CH_4 variations during interglacial periods are not well studied. Recently, several high-resolution data sets have been produced for the late Holocene, but it is difficult to distinguish natural- from anthropogenic changes. In contrast, the methane budget of the early Holocene is not affected by anthropogenic disturbances, thus may help us better understand natural CH_4 control mechanisms under interglacial climate boundary conditions. Here we present our new high-precision and high-resolution atmospheric CH_4 record from Siple Dome ice core, Antarctica that covers the early Holocene. We used our new wet extraction system at Seoul National University that shows a good precision of $\sim$1 ppb. Our data show several tens of ppb of centennial- to millennial CH_4 variations and an anti-correlative evolution with Greenland climate on the millennial time scale. The CH_4 record could have been affected by many different types of forcing, including temperature, precipitation (monsoon intensity), biomass burning, sea surface temperature, and solar activity. According to our data, early Holocene CH_4 is well correlated with records of hematite stained grains (HSG) in North Atlantic sediment records, within age uncertainties. A red-noise spectral analysis yields peaks at frequencies of $\sim$1270 and $\sim$80 years, which are similar to solar frequencies, but further investigations are needed to determine major controlling factor of atmospheric CH_4during the early Holocene.