The start of a time series of CO_2 and CH_4 fluxes at the ocean–sea ice–air interface in a high Arctic fjord

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Arctic amplification of global warming has led to a sharp decrease of summer sea ice extent in the Arctic Ocean, resulting in greater quantities of low salinity water in the surface ocean. Alongside sea ice melt, glacier melt contributes to the supply of meltwater into fjord systems during the summer season. This affects the gas exchange between the ocean and atmosphere since enhanced water stratification induced by freshwater supply may inhibit the gas exchange between the ocean and atmosphere. Conversely, water convection induced by sea ice formation in autumn can potentially lead to emissions into the atmosphere. As winter progresses, impermeable sea ice may restrict gas exchange at the ocean–sea ice–air interface. Despite the importance of these dynamics, continuous greenhouse gas fluxes in high Arctic fjords are scarce, leading us with a poor understanding on how sea ice changes the Arctic Ocean and modifications in glacier dynamics may affect the gas exchange between the ocean and atmosphere. We aim to answer this question using continuous and near-real time measurements of carbon dioxide (CO_2) and methane (CH_4) fluxes in Young Sound, a high Arctic fjord system in Northeast Greenland. The flux measurements are part of an integrated system called the Greenland Integrated Observing System (GIOS), focused on understanding changes in air, ice, land, and ocean conditions. The eddy covariance tower was placed at the coast of Young Sound to collect measurements at a frequency of 20 Hz since August 2021. The tower is equipped with a LI-7200/RS enclosed CO_2/H_2O gas analyzer used in connection with a LI-7200–101 flow module and a heated inlet to measure fluxes of H_2O and CO_2. Additionally, a LI-7700 Open Path CH_4 gas analyzer is used for CH_4 flux measurements. The tower also records 3-D wind components and temperature with an ultrasonic anemometer, as well as the ambient relative humidity, air temperature, skin temperature, PAR (Photosynthetically Active Radiation), and net and global radiation. The data obtained in Young Sound will enhance our understanding of potential Arctic climate feedbacks related to the cycles of sea ice formation and melt in the Arctic.