

RC2: ['Comment on bg-2021-308'](#), Anonymous Referee #2, 28 Jan 2022 [reply](#)

The study by Lindroth et al. characterises growing season net CO<sub>2</sub> and CH<sub>4</sub> fluxes in a tundra environment on Svalbard and attempts to extrapolate the growing season measurements to estimate annual fluxes. The manuscript certainly addresses an important research question related to possible climate change effects on greenhouse gas fluxes in the Arctic and provides important direct measurements of these fluxes. However, in my opinion, the methodology used in this study is not appropriate to answer these research questions. Extrapolating growing season fluxes to winter fluxes using a universal functional relationship with temperature risks causing major biases in annual fluxes. Ecosystem respiration function parameters can be expected to change between seasons and should not be assumed to be constant. Therefore, in my opinion, the main results (estimates of annual fluxes) of this study are not robust. Additionally, the use of a global warming potential to compare climate impacts of net CH<sub>4</sub> and CO<sub>2</sub> emissions is not justified for continuous greenhouse gas emissions in ecosystems. Other approaches should be considered in this case (see Neubauer, *Ecosystems*, 2021 or Neubauer & Megonigal, *Ecosystems*, 2015).

*Answer: We agree that the winter extrapolation is uncertain and that a focus on growing season is better. Thanks to this comment we discovered an error in the spread sheet calculation of growing season estimate and since we also adjusted the summer period a little, our numbers changed for both for summer and for growing season. We include a new Table 2 with the correct numbers (see below).*

*We also decided not to use the GWP concept and we only present the actual measured values.*

*Table 2. Summary of seasonal C-fluxes from Kapp Linne.*

| Period         | Component | Value<br>(gC m <sup>-2</sup> ) |
|----------------|-----------|--------------------------------|
| Growing season | Reco      | 110.2                          |
|                | GPP       | -112.7                         |
|                | NEE       | -2.5                           |
| Summer         | Reco      | 94.1                           |
|                | GPP       | -105.9                         |
|                | NEE       | -11.8                          |