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Interactive comment on "Modelling Silicate – Nitrate - Ammonium co-limitation of algal growth and the importance of bacterial remineralisation based on an experimental Arctic coastal spring bloom culture study" *by* Tobias R. Vonnahme et al.

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We want to thank reviewer 1 for the constructive feedback. All specific comments are changed in the manuscript as suggested by the reviewer. A more detailed response regarding the representativeness of Chaetoceros socialis for Arctic coastal systems is given below.

Reviewers comment: Chaetoceros socialis may not be representative of the the most important diatom species across all of the Arctic coastal areas. How representative do

you expect that it is?

We acknowledge that many different species contribute to the bloom formations in the Arctic coastal areas, including pennate sea ice algae and several pelagic centric diatoms (see below) Chaeotoceros socialis may not be the most dominant species in all coastal Arctic spring blooms, however it has been reported as dominating blooms in several areas (see below). We thus consider C. socialis to be overall a representative model organism.

Chaetoceros socialis is a widely occurring marine diatom species that has been observed from Arctic seas into warmer oceans like the Gulf of California (Hasle and Syvertsen 1997) that differ physiologically and morphologically (Degerlund et al. 2012, Huseby et al. 2012). Current research indicates several cryptic species to be within the C. socialis complex (Gaonkar et al. 2017, De Luca et al. 2019). It is frequently used in culture based experiments to evaluate for example the role of ocean acification (Li et al. 2017), and DMS (Baumann et al. 1994) and lipid production (Artamonova et al. 2017).

In Arctic waters, it has been observed as bloom forming species across the Arctic with for example bloom occurring in the North Water Polynya between July and September (Booth et al. 2002), the Barents Sea (Rey and Skjoldal 1987, Rat'kova and Wassmann 2002) and other Arctic coastal sites, often dominating phytoplankton biomass following the blooming of Thalassiosira spp. (von Quillfeldt 2005).

Besides C.socialis, coastal Arctic spring blooms are typically dominated by other chain forming diatoms, such as Thalassiosira spp., Fragillaripsis spp., Chaetoceros spp., Navicula spp., or Skeletonema spp.. All of these pennate or centric diatoms share similar requirements for inorganic nutrients and all of these groups are typically limited by silicate and/or nitrogen limitation in coastal Arctic systems. In addition, all of these groups have similar physiological opportunities to respond to nutrient limitations, can excrete EPS and interact with bacteria. Hence, we are confident that C. socialis is suitable as model organism, representative for coastal Arctic spring blooms unless silicate is limiting from the start in which case, flagellates, such as Phaeocystis may dominate (As discussed in line 302 in our manuscript).

We added a few more details and references in the manuscript to support these statements in the following way, with changes highlighted in green:

Line 53-58: Phytoplankton blooms may be dominated by a single or a few algal species, often with a similar physiology during certain phases of the bloom (e.g. Eilertsen et al., 1989; Degerlund and Eilertsen, 2010; Iversen and Seuthe, 2011). Chain-forming diatoms, sharing physiological needs and responses to nutrient limitations (e.g. Eilertsen et al., 1989; von Quillfeldt, 2005), typically dominate these blooms. In some Arctic and sub-Arctic areas the Arctic phytoplankton chosen for this model, Chaetoceros socialis, is a dominant species during spring blooms (Rey and Skjoldal, 1987; Eilertsen et al., 1989; Booth et al., 2002; Ratkova and Wassmann, 2002; von Quillfeldt, 2005; Degerlund and Eilertsen, 2010).

Line 297-299: While C. socialis may not be the dominant species in all coastal Arctic phytoplankton blooms, we argue that it is representative for chain-forming diatoms typically dominating these systems due to their shared needs and responses to nutrient limitations (e.g. Eilertsen et al., 1989; von Quillfeldt, 2005).

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