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The dimethylsulphide propionate (DMSP) content in microalgae and its influence on DMS emission: Experimental and modelling study in the Southern North Sea

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Dimethylsulphide propionate (DMSP) is the precursor of dimethyl sulphide (DMS), a potentially key player in climate regulation. Current knowledge suggests that DMSP synthesis is restricted to some microalgae (mainly Haptophyceae and Dinophyceae) and varies with environmental conditions. Assessing the species-dependence and regulation mechanisms of DMSP microalgal quotas is the first step towards appraising the role of DMS in climate feedback mechanisms. Here we use a combination of laboratory studies and model simulations to determine to which extent the variations of the microalgal DMSP content might affect marine DMS emissions to the atmosphere. The Southern North Sea is chosen as case study, as it is characterized by diatoms/Phaeocystis successions, two phytoplankters known as contrasted DMSP producers. The DMSP:cell content of Phaeocystis globosa and two diatoms, Skeletonema costatum and Chaetoceros socialis, was measured on pure monospecific cultures. While P. globosa and C. socialis showed respectively expected high and low DMSP content, the cell quota measured for S. costatum was unexpectedly high. Based on these results, the sensitivity of the DMS emissions to the variability of the DMSP content of microalgae was estimated by using the MIRO-DMS model. This model couples a DMSP/DMS module to the ecological MIRO model describing carbon and nutrient cycle in the planktonic and benthic system and includes an explicit description of the diatoms/Phaeocystis successions. The model was implemented in a multi-box 0D frame covering the eutrophied Eastern English Channel and Southern North Sea and shows simulations of DMSP and DMS concentrations and DMS emissions in relationship with species succession along a seasonal cycle. Budget calculations allow to estimate the species contribution to DMS emission and highlight the need of further understanding of factors controlling the species-specific synthesis of DMSP.