**A REMOTE SENSING DIAGNOSTIC MODEL FOR PLANKTONIC DMSP, THE PRECURSOR OF THE CLIMATE-COOLING GAS DMS**

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Dimethylsulfoniopropionate (DMSP) is a ubiquitous phytoplankton metabolite and the main precursor of the biogenic gas dimethylsulfide (DMS) in the oceans' surface. Thus, the ability to predict DMSP concentration from environmental variables is essential to better oceanic sulfur emission. Here we used DMSP and ancillary measurements from a global database to develop a remote sensing algorithm for DMSP in the upper mixed layer. Over 55% of DMSP variability (log10 scale) is explained by in situ chlorophyll *a* (Chl) after dividing the database into two subsets, according to “stratified” and “mixed” water column criteria, based on the ratio between euphotic layer depth (Zeu) and mixed layer depth (MLD). Up to 70% of the variability is explained when adding sea surface temperature (SST) and log10(Zeu/MLD) as predictors for the stratified and mixed subsets, respectively. Besides, particulate inorganic carbon is used as an additional DMSP proxy in coccolithophore blooms. Validation on satellite Chl match-ups indicates that the algorithm predicts DMSP with a mean absolute percentage error typically ranging from 40 to 60% (linear space), a root-mean-squared error spanning from 0.20 to 0.30 (log10 space), and R2 ranging from 0.45 to 0.72 (log10 space). We use the algorithm to produce a monthly global climatology, and estimate that planktonic DMSP synthesis amounts to at least 5% of oceanic primary production. We also show that the algorithm can resolve interannual variations at the regional scale. Our work fills an important gap in marine sulfur biogeochemistry and represents a step forward toward improved diagnosis of DMS emission.

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