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Biogeosciences Discussions

Interactive comment on "Testing the relationship between the solar radiation dose and surface DMS concentrations using high resolution in situ data" *by* C. J. Miles et al.

Anonymous Referee #1

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The authors have tested the recently proposed strong positive relationship between dimethylsulphide (DMS) concentrations and the solar radiation dose (SRD) received into the surface ocean. They utilised in situ daily data sampled concurrently with DMS concentrations from the Atlantic Meridional Transect (AMT) programme for the component variables of the SRD; mixed layer depth (MLD), surface insolation (Io) and a light attenuation coefficient (k), to calculate in situ SRDs. I think that the test is not conclusive on a quantitative basis (the value of the slope of the DMS vs. SRD relationship is highly uncertain) because (1) too much uncertainty is attached to the component variable Io of the SRD and, (2) data selection removed about 50% of the DMS data points collected during phase 2 of the AMT programme.

1. Central to this study are the measurements of surface insolation. Unfortunately, it is impossible to judge of the quality of surface irradiances in the present manuscript (the type of sensor is not provided; how often and by who was it calibrated, where was it located on board?). Indeed, I am rather surprised by the range of the SRDs shown in Figure 1a. Several values are over 350 W/m2! In Vallina & Simo (2007), maximum values were 290 W/m2 and 230 W/m2 in summer in Blanes Bay (41°N) and in Hydrostation S (Sargasso Sea, 32°N), respectively. In Belviso et al (2009), the highest SRDs, calculated as in V&S07, were lower than 200 W/m2 at 40°-45°N in spring or in summer. Are the SRD values over 350 W/m2 resulting from high irradiances (clear skies with Io = 450-500 W/m2), shallow MLDs and weak light attenuation in the sea, or from an Io sensor not calibrated properly? Moreover, I strongly recommend the plot of Io, MLD, k and SRDs as a function of latitude during cruises AMT 12 & 14 to evaluate how SRDs are influenced by in situ measurements of Io, k and MLD.

In Figure 1a, the in situ data is compared with the V&S07 relationship obtained at the global scale (Remark: plots are correct but in the legend of Fig. 1a, the authors report for the global scale the equation obtained for Blanes Bay, this is a mistake!). I think that this is not adequate because AMT data was obtained at the local/regional scale, not at the global scale. The new DMS vs. SRD relationship should rather be compared with the local/regional relationships put forward by V&S07 and Belviso et al. (2009) in Blanes Bay (DMS=0.138 + 0.028xSRD, potentially biaised as shown in Belviso et al. (2009)), in the Sargasso Sea (DMS=0.51 + 0.017xSRD), and in the northeast Atlantic (DMS=0.196 + 0.025xSRD).

2. I think that the DMS database is not well presented and the authors should explain why data selection removed some data files and some data points within a data file. Indeed, AMT data is available at http://saga.pmel.noaa.gov/dms/, under files numbered 159 to 163. The total number of surface DMS measurements during the AMT cruises was 388. Only about 69 data points are used in the present manuscript. Why?

The presentation of the DMS database is confusing for the following specific reasons:

P 3069 – line 8-10: “This study uses data collected during Northern Hemisphere autumn (cruises AMT 12 and AMT-14) and spring (AMT-13) (see Bell et al., 2006 for more detail)”. P 3070 – line 14-17: “In contrast the AMT data is composed of high temporal resolution data, which although exhibiting significant spatial coverage, represents less seasonal variation with only a few months of the seasonal DMS cycle represented (Northern Hemisphere autumn and spring).” This is confusing because, according to Bell et al. 2006 and file 162 of the international DMS database, cruise AMT-13 was carried out in the Southern Hemisphere (15°-45°S) during Northern Hemisphere autumn. Moreover, cruises AMT-12 and AMT-14 were carried out in May-June 2003 and May 2004 (springtime), respectively. Hence, this study uses only DMS data collected in the Atlantic ocean during Northern Hemisphere spring (cruises AMT 12 and AMT 14), between 0°N and about 45°N. The total number of data points was originally 71, but since 2 data points were removed (cruise AMT 12, DMS= 6.68 nM and 5.73 nM, why?), the number of data points is equal to 69. This makes a significant but rather modest new contribution to the study of the DMS-SRD relationship as compared to Vallina & Simo (2007) and Belviso et al. (2009). In this latter case the number of data points was n=232.

In situ data was not collected with high resolution. Indeed, the database is made of 2-3 daily measurements of surface DMS concentrations, so the temporal resolution is quite low. During each of the AMT 12 and AMT 14 cruises, about 35 samples were collected in the northern hemisphere between 0°N and 45°N. So the spatial resolution is quite low (less than one sample per degree of latitude, in average). So, that is why I think that the title does not clearly reflect the contents of the paper. Testing the relationship between the SRD and surface DMS concentrations using in situ data would be a more appropriate title.

The manuscript also investigates the relationship between DMS and the depth of the MLD (Fig. 2) in a similar way to Bell et al. (2006). I think that there is not much improvement since a smaller number of data points is used and the non-linear relationship still

demonstrates considerable scatter.

On the contrary, the DMS data shows an interesting relationship to a UV radiation dose (UVRD) calculated using in situ MLD, satellite derived UVA at the surface and a constant attenuation coefficient for UVA. This is an original contribution to the understanding of the spatio-temporal variability of marine DMS. In order to test the robustness of this relationship, it would be interesting to use the full AMT DMS database with n=388. If it is not possible, at least data from the northern and southern hemispheres could be combined (with 3 AMT cruises during phase II, n is equal to 149!). I look forward to seeing this new relationship.

Are the number and quality of references appropriate? Page 3077 - line 3-5: The authors use unpublished informations contained in a manuscript under consideration in another journal (Derevianko et al. Geophys. Res. Lett., submitted 2009). The consent of the author should be asked.

Interactive comment on Biogeosciences Discuss., 6, 3063, 2009.