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Supplement of

Methane in the Danube Delta: the importance of spatial patterns and diel cycles for atmospheric emission estimates

Anna Canning et al.

Correspondence to: Anna Canning (acanning@geomar.de)

S1 Methods

S1.1 Rivers, Lakes, Channels and 'hot spot' Kruskal-Wallis Test

A non-parametric Kruskal-Wallis test was conducted in MATLAB due to the data following a non-normally distribution, comparing the medians. This was presented using the compare function. Each region was split between months (May: Spring, August: Summer and October: Autumn) for CH_4 nmol L^{-1} and O_2 µmol L^{-1}.

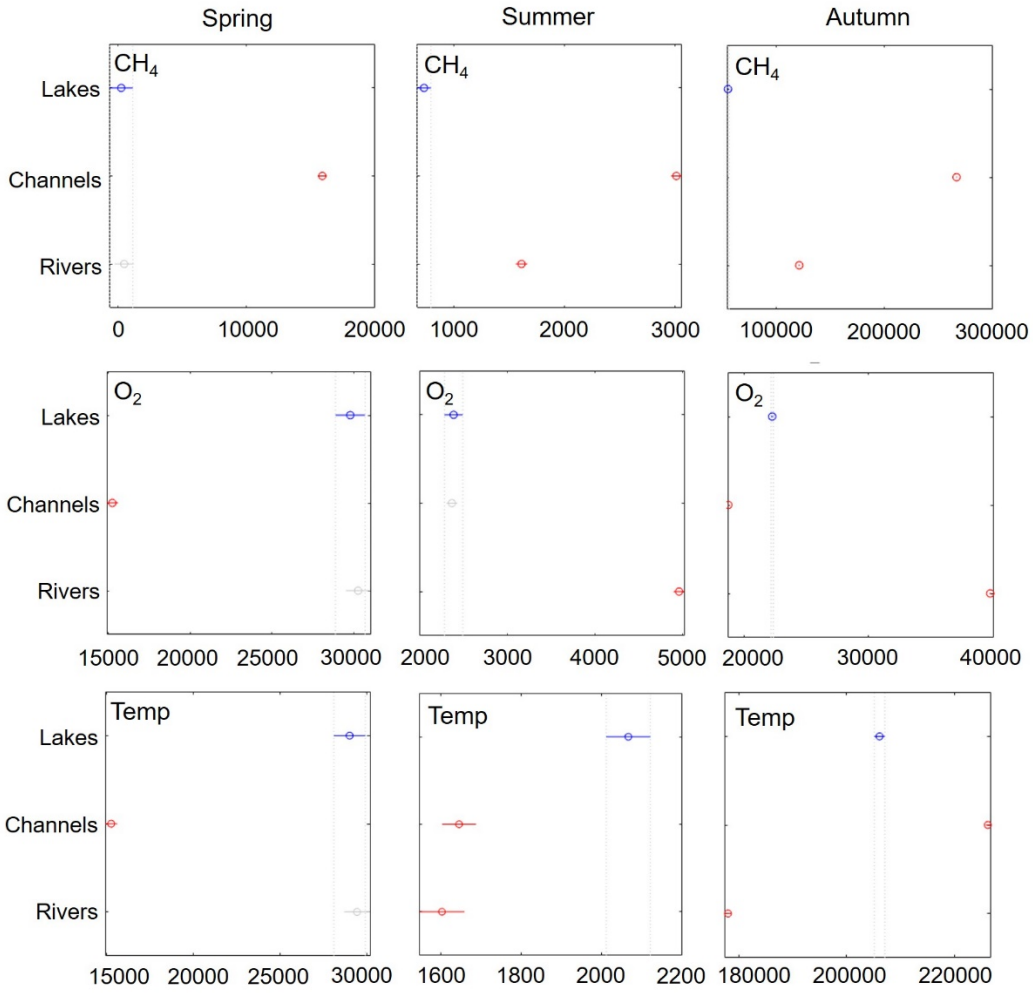

Figure S1 Kruskal-Wallis result visualisation using compare on MATLAB. For each season (spring, summer and autumn) during 2017 for CH_4, O_2 and temperature (Temp). Circles are the group mean, horizontal lines show confidence interval. Due to large sample sizes, these confidence intervals are narrowed. Red circles show significantly different region (rivers and channels to lakes). Grey circles signify no significant difference between lakes and rivers for temperature and O_2 during spring, and between channels and lakes for O_2 during summer.

Due to the large sample sets, the confidence interval is narrow. Comparison between channels and the 'hot spot' was also conducted and visualized in (Fig. S2). Kruskal-Wallis found significant difference ($P<0.001$) between channels and the 'hot spot' with the surrounding channels over all seasons for CH_4.

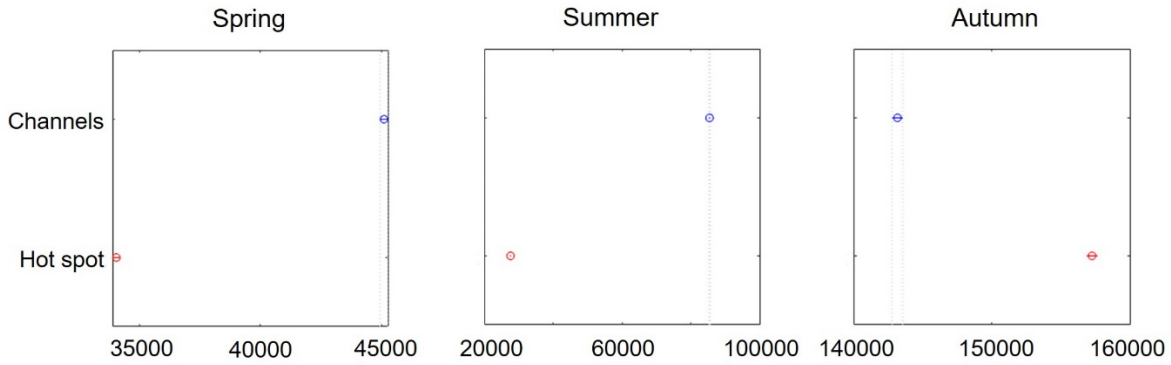

Figure S2 Kruskal-Wallis result visualisation using compare on MATLAB. For each season (spring, summer and autumn) during 2017 for CH_4 between channels and the hot spot channel (including adjacent channels). Circles are the group mean, horizontal lines show confidence interval. Due to large sample sizes, these confidence intervals are narrowed. Red circles show significantly different region (channels and the hot spot).

S1.2 Comparison of the calculated and measured k_{600}

Due to direct measurements for fluxes were taken in the previous years (2015 and 2016: Maier et al., 2021), comparison between our calculated k_{600} and their k_{600} could be conducted. Our k_{600} was calculated following Eq. (1):

$$K_{600} = 2.07 + 0.215 \cdot U^{1.7}\ cm\ h^{-1}\ , \quad (1)$$

where U is wind speed at 10 m height in m^{-1}, measured in the middle of the delta at the Gorgova station. Due to similar locations having been measured, Table S1 shows the mean comparison between the previous years from direct flux chamber measurements and our study (values taken at the closest location to Maier et al. 2021). Due to differing years, it is not feasible to use their direct values in our study, however, comparison can establish if the model used has some validity. In all, it is in good agreement with channels, however, our lake values are lower, potentially due to wind data not being measured insitu.

Table S1 k_{600} comparison between calculated (this study, calculated from wind data in 2017), and insitu measured values (Maier et al. 2021, mean measured values from 2015 + 2016) in m d^{-1} from closely measured locations within the Danube Delta.

Channels	**St George Channel**		**‚Hot Spot‘**		**Channel before Sulina**		**First channel north of Sulina**	
Observer	This study	Maier et al.	This study	Maier et al.	This study	Maier et al.	This study	Maier et al.
May	0.5484	0.521721712	0.6603	0.642634197	0.8308	1.928621778	1.0219	1.167705578
Aug	0.6182	0.831756764	0.6543	0.521201747	0.8247	0.492006857	0.9162	0.494386117
Oct	0.5484	0.437676454	0.598	0.544277992	0.5484	0.470583221	0.7744	0.752565937
Mean	0.5717	0.597051643	0.6375	0.569371312	0.7346	1.058083371	0.9042	0.791805892

Channels	**Second channel north of Sulina**		**House Hotel Channel**	
Observer	This study	Maier et al.	This study	Maier et al.
May	0.8308	0.780167566	0.6829	0.873965762
Aug	0.861	0.465201026	0.6644	0.603044595
Oct	0.6644	0.476772049	0.8308	2.143172905
Mean	0.7854	0.549728173	0.726	1.206727754

Rivers	**Sulina port**	
Observer	This study	Maier et al.
May	0.8915	0.464427439

Lakes	**Lake Uzlina**		**Lake Isac**		**Lake Puiu**		**Lake Roşu**	
Observer	This study	Maier et al.	This study	Maier et al.	This study	Maier et al.	This study	Maier et al.
May	0.7543	1.350453112	0.5552	1.321819274	0.7029	2.165240903	0.6806	1.519324619
Aug	0.6535	0.386761949	0.7253	1.369164479	0.6917	4.237596009	0.7054	1.007698146
Oct	0.6827	1.200232222	0.7627	1.062750687	0.6438	0.129641011	0.7889	1.508769715
Mean	0.6968	1.071975099	0.6811	1.237129921	0.6795	2.587062967	0.725	1.151301413

Lakes	**Lake Rosulette**	
Observer	This study	Maier et al.
May	0.5885	0.99160875
Aug	0.7293	2.156534571
Oct	0.7276	2.113009971
Mean	0.6818	1.673154402

S1.3 Detailed Map of Specific Locations

During the study, many areas are discussed in detail, including lakes, channels and the ‘hot spot’. Fig. S3 shows each area of interest, including direction of travel of the houseboat, main towns and locations, including areas used within S1.2.

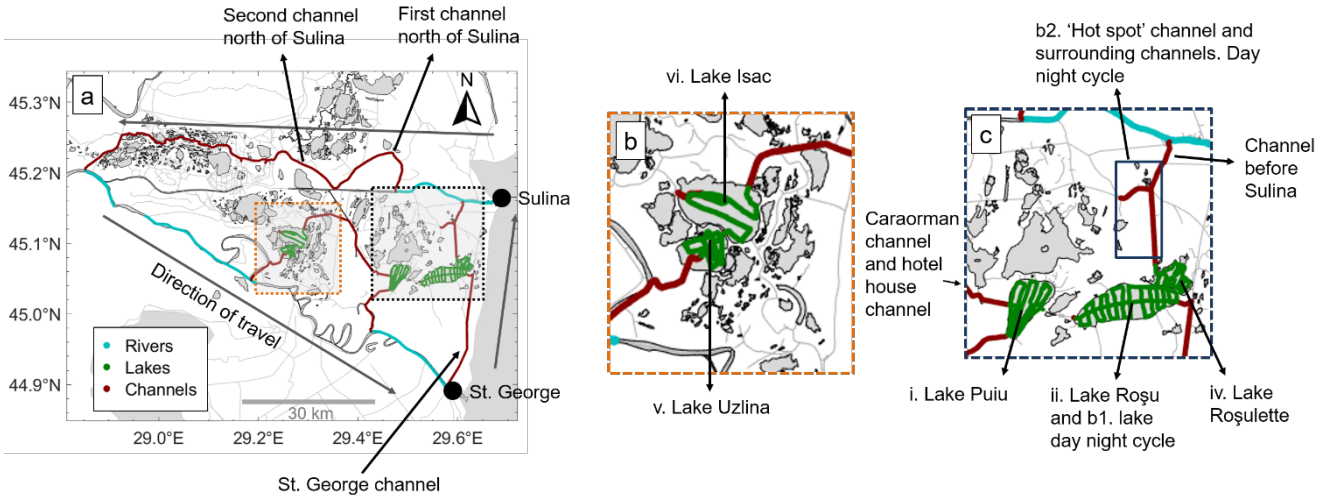

Figure S3 Detailed map of all locations used within the study, including in S1.2. (a) Overall map of the transect throughout, including direction of travel with the houseboat, the two main towns; St George and Sulina and three areas of interest; first and second channel north of Sulina, and St George channel used for k_{600} comparison (S1.2). (b) extract from the main transect showing two lakes of interest: Isac and Uzlina. (c) extract from main transect showing three main lakes and three channels of interest: Lake Puiu, Lake Roşu (where a day night cycle of conducted), Lake Roşulette and Crisan channel, 'hot spot' channel and channel before Sulina.

In-depth mapping of the measured lakes that are not shown in the study, are presented in Fig. S4. Mapping techniques improved over the seasons with concentration patterns showing distance from shore having an influence on the concentration. Channel input can be observed with higher concentrations.

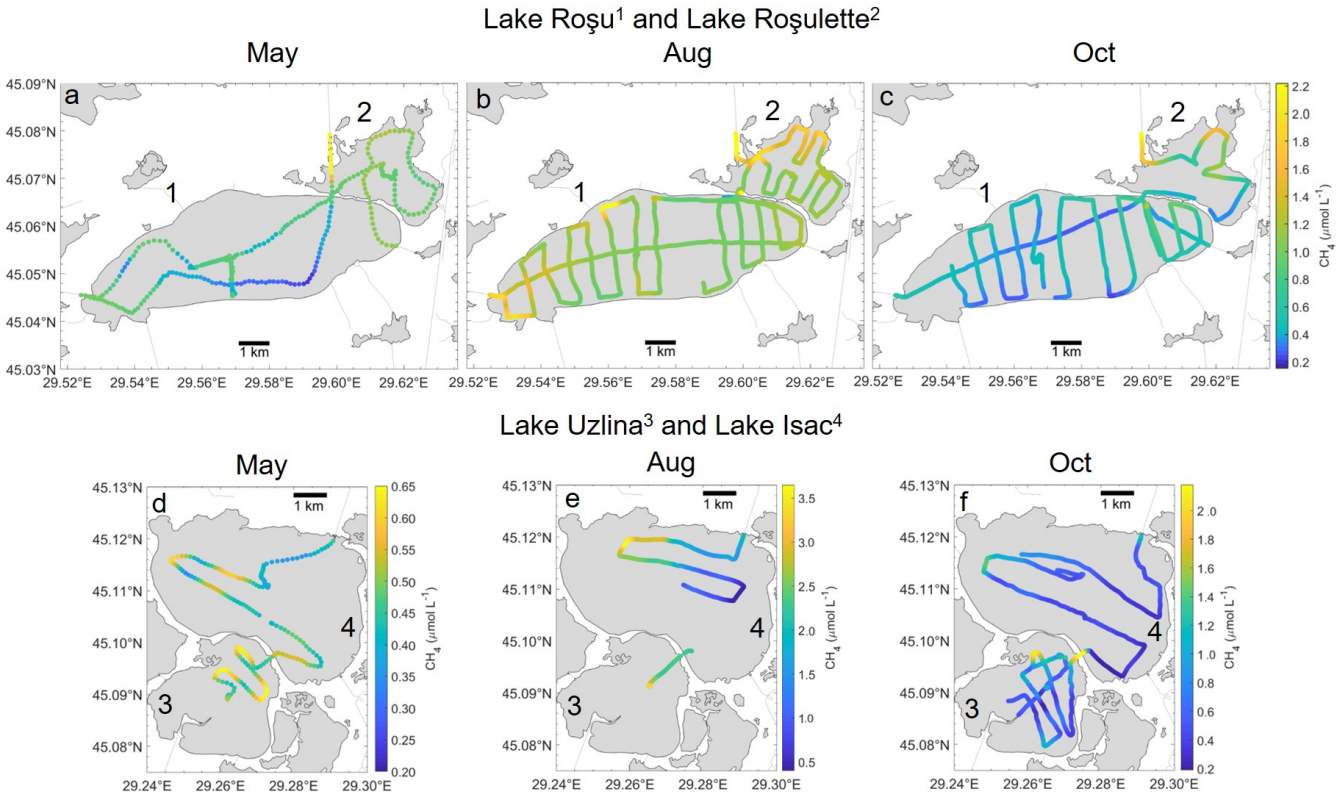

Figure S4 Spatial maps for CH_4 (μmol L^{-1}) over May, Aug and Oct 2017 for Lake Roşu, Lake Roşulette, Lake Uzlina and Lake Isac. CH_4 concentrations colouring for Lake Roşu, Lake Roşulette have been none linearly distributed to show change in distribution clearer and influence from lake edges. Note due to vastly differing concentration ranges over the months, Lake Uzlina and Lake Isac have differing concentration ranges for each month. See Fig. S3 for detailed map of locations.

References

Maier, M.-S., Teodoru, C. R., and Wehrli, B.: Spatio-temporal variations in lateral and atmospheric carbon fluxes from the Danube Delta, Biogeosciences Discuss., https://doi.org/10.5194/bg-18-1417-2021, 2021.