Characterising marine and lacustrine methane macro-seeps in 14 steps

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The two main factors characterising marine and lacustrine methane macro-seeps are 1) ebullition through holes in the sea- or lake-bed, and, 2) hydroacoustic "flares" in the water column. After having reviewed multi-year, multi-scale, and multi-discipline results from several methane macro-seeps in the North Sea and elsewhere, a series of up to 12 additional factors of such seeps have been identified. This means that it may be possible to provide a quantitative number ("sum of factors") by which to characterise each methane-macro seep location.

The additional identified factors that characterise methane macro-seeps are as follows:
3) high CH_4-levels in water and pore-water, 4) visual and chemical aureole, 5) chemical and temperature anomalies, 6) topographical effects, 7) methane derived authigenic carbonate, MDAC, development, 8) bacterial mats and blooms, 9) upwelling seawater, 10) down-welling seawater into sub-surface conduits, 11) sea-surface effects, 12) slicks and nutrients on surface /birds feeding, 13) attraction of fish and other macro-fauna, 14) methane anomalies in lower atmosphere. With such a list of factors at hand, it should not only be possible to quantify and rank the seeps, but also to provide a methodology or guideline on how best to study such seeps in a comprehensive manner. The attached table suggests how one seep location in the North Sea (Tommeliten) can be quantified with a "sum". The higher this sum, the more influential and significant the seep is expected to be.

The total Sum for this methane macro-seep is found by adding all the scores, i.e., the Tommeliten A seep sum is 24. As more information from macro-seeps is gained in future surveys, it is expected that new observations will add new factors, one of which is expected to be magnetic susceptibility. Thus, the table presented here, just represents a methodological suggestion for how seeps can be compared in a quantifiable manner.

#	Factor	Score
1	Ebullition	2
2	Flare	3
3	CH4 anomaly	3
4	Aureole	2
5	Temp/Chem	1
6	Topography	1
7	MDAC	2
8	Bact. mats	3
9	Upwelling	1
10	Downwelling	1
11	Sea-Surf.	1
12	Nutrients	2
13	Fish attract.	1
14	Atmosph CH4	1
	Total sum:	24