Seasonality of nearshore marine snow in the southern North Sea

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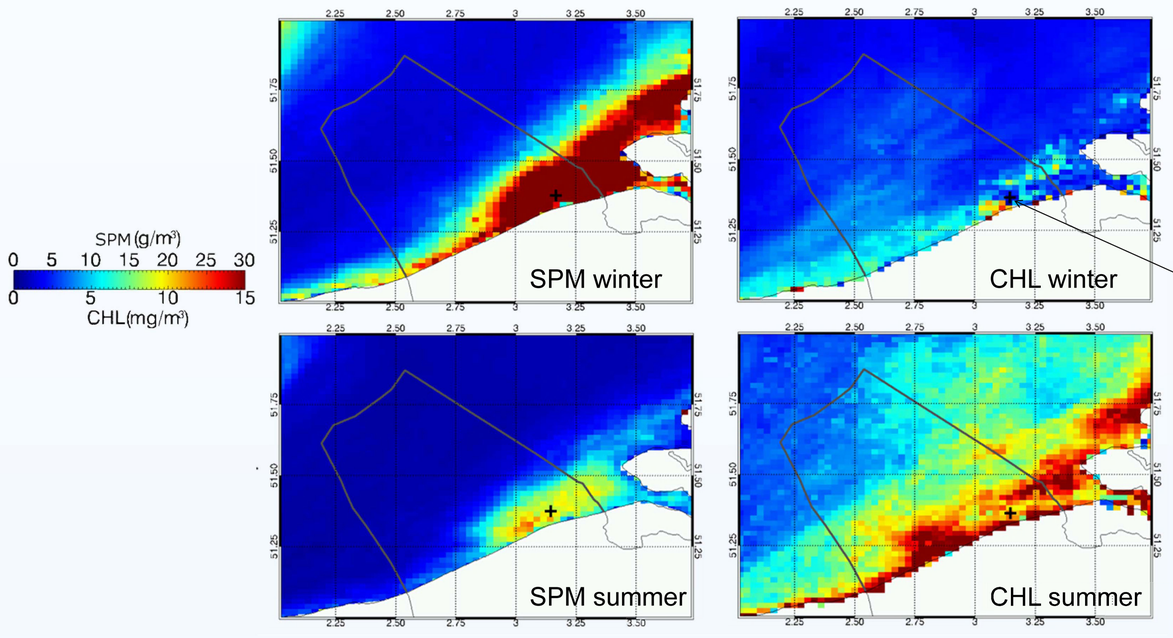
Facts: Seasonal pattern in SPM and Chl concentration

The suspended particulate matter (SPM) concentration in the Belgian coastal area (southern North Sea) is inversely correlated with chlorophyll (Chl) concentration. During winter SPM concentration is high and Chl concentration low and vice versa during summer.

REMOTE SENSING DATA

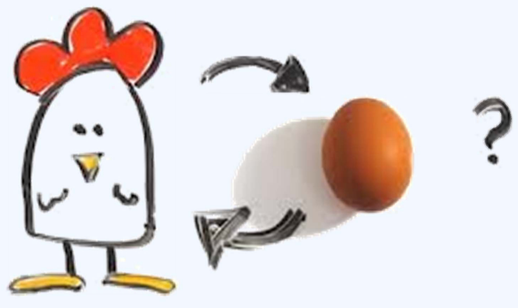


IN SITU DATA: MOW1 (Belgian coastal area)

Chicken or Egg ?

Hypothesis A: Physical Forcing

The water clears as a result of reducing wind stirring and sediment re-suspension after winter storms. This physical clearing of the water induces higher light levels and contributes to the subsequent onset of the spring bloom. According to this hypothesis, the turbidity decreases BEFORE the spring bloom.



Hypothesis B: Biology

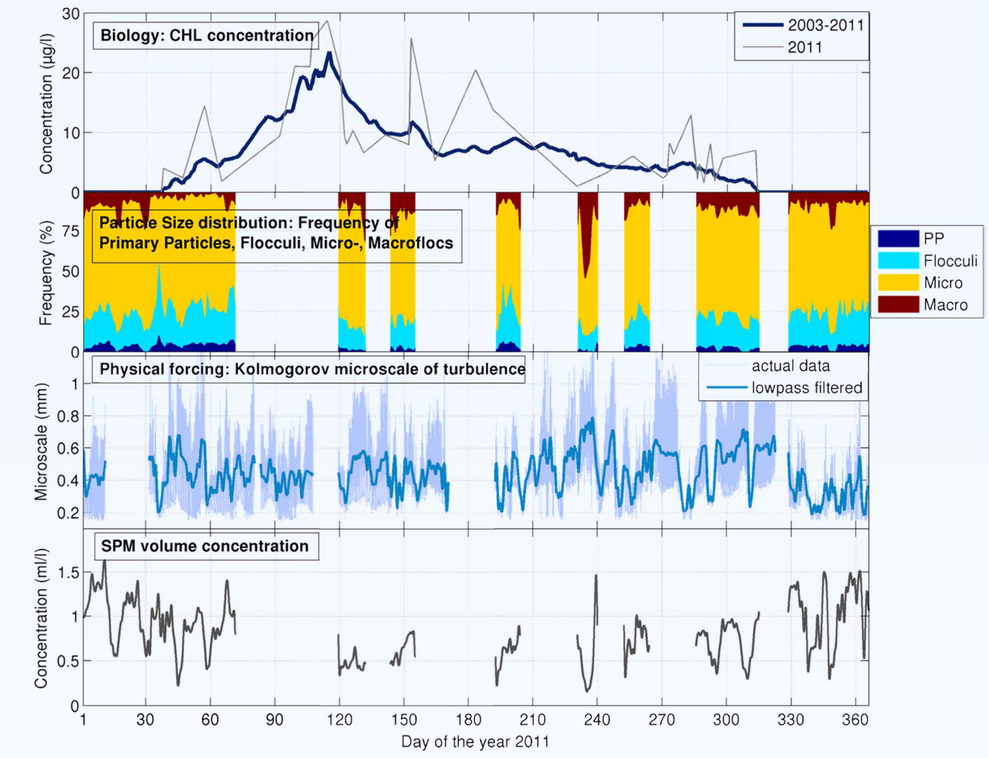
The turbidity decreases because of increased aggregation of particles brought about by biological activity (TEP concentration) during the bloom and biological activity in summer. According to this hypothesis, the bloom itself is the trigger for higher transparency and the water clears DURING and AFTER the spring bloom.

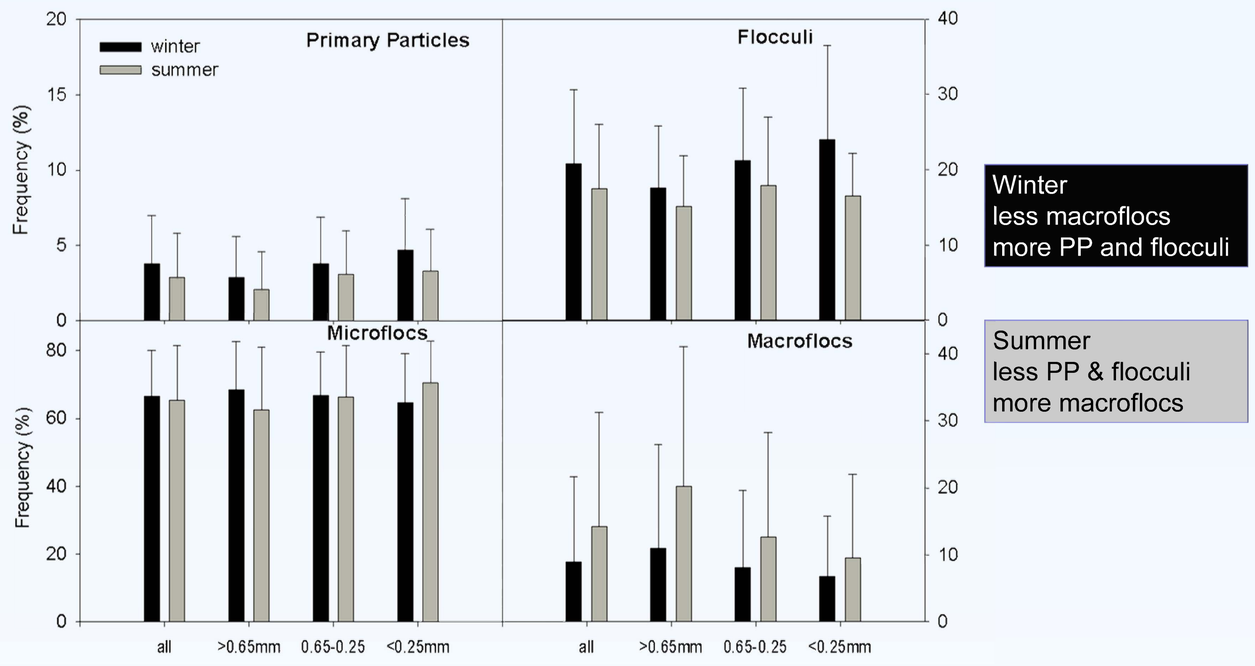
Hypothesis testing: data 2011

The hypothesis have been tested using in situ data of SPM concentration, floc size, turbulence; remote sensing data of chlorophyll concentration and meteorological and wave data at MOW1 site (Belgian nearshore area).

Physical forcing proxy: Kolmogorov microscale of turbulence (high values = low turbulence; low values = high turbulence)

Biology proxy: Chl concentration as indication of TEP concentration





Frequency of primary particles, flocculi, microflocs and macroflocs for the summer and winter season and according to Kolmogorov microscale

Winter
less macroflocs
more PP and flocculi

Summer
less PP & flocculi
more macroflocs

Conclusions

Wind strengths and wave heights have a seasonal signal, but these are not sufficient to explain the large differences observed in SPM concentration.

Biomass effects increase the strength of macroflocs rather than their size. The results highlight the transformation of mainly microflocs and flocculi in winter towards more muddy marine snow with larger amounts of macroflocs in spring and summer. The larger fraction of macroflocs reduces the SPM concentrations as they settle faster, increases light condition in the surface layer and enhances algae growth.

It is mainly the biological activity in spring and summer that lead to a decrease in SPM concentration rather than the (weak) seasonal pattern in physical forcing.

Further reading: *Fettweis M, Baeye M, Van der Zande D, Van den Eynde D, Lee BJ. 2014. Seasonality of floc strength in the southern North Sea. Journal of Geophysical Research.*

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