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The role surfactant-associated bacteria in the sea surface microlayer in slick formation and air-sea interactions

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Many of the Earth's biogeochemical processes, such as nutrient cycling, marine aerosol formation, and heat, momentum and gas exchange, occur in the sea surface microlayer (SML). Microbial communities are highly variable in time and space in the SML, which is easily disturbed by wave breaking, advection, bubble scavenging, and other physical processes.

Various organisms, such as seaweed, phytoplankton, zooplankton, and bacteria, produce surfactants for food capture, aggregation, motility, and as byproducts of other natural life functions. This study focuses on surfactant-associated bacteria in the near-surface layer and their role as indicators of natural sea slicks. Under low wind speed conditions, surfactants accumulate in the microlayer and dampen short gravity-capillary waves due to the resulting decrease in surface tension. The ensuing sea slick can been seen in synthetic aperture radar (SAR) imagery, similar to an oil spill.

An innovative technique has been expanded upon to reduce contamination during sample collection, storage, and processing, (Kurata et al. 2016; Hamilton et al. 2015). During the LAgrangian Submesoscale ExpeRiment (LASER) in February 2016, over 100 SML and SSW samples were collected in the Gulf of Mexico, some of them in association with a SAR satellite overpass. Initial qPCR results show a wide variability of relative abundance of Bacillus spp., a well-known surfactant-associated bacteria (Satpute et al. 2010), between the SML and SSW samples. Samples have been run through Illumina MiSeq and are currently being analyzed to determine the bacterial community composition of the SML and SSW. We plan to expand our in situ and satellite observations to other areas in the World Ocean.

References

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