

Monitoring Plastic in the Ocean Using Sentinel-1 SAR Images

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The problem:

❖ Approximately 15 – 51 trillion particles of plastic within ocean circulation (van Sebille et al, 2015)

The risks associated with microplastics pollution:

- ❖ Ingestion by marine animals and fish, transfer via food chain;
- ❖ Leaching of chemical ingredients into surrounding seawater.

The microplastics in SAR radar images:

❖ We hypothesise that the surfactants producing the dark strikes we see on images of the Indian and Atlantic Ocean are product of microbial colonisation of microplastics.

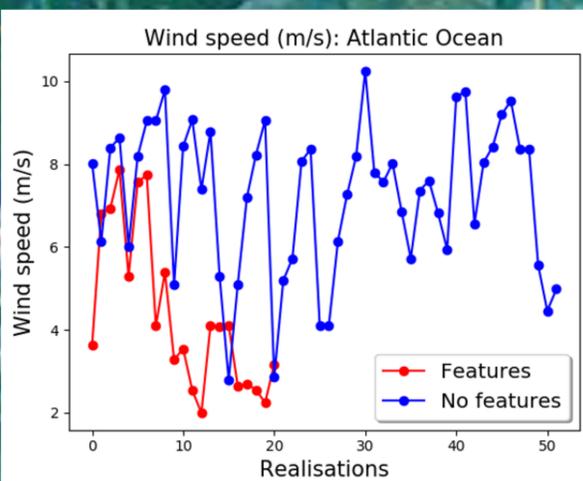


Figure-1 – Wind speeds of coordinates found to have no visible features or visible surfactant features within a SAR image

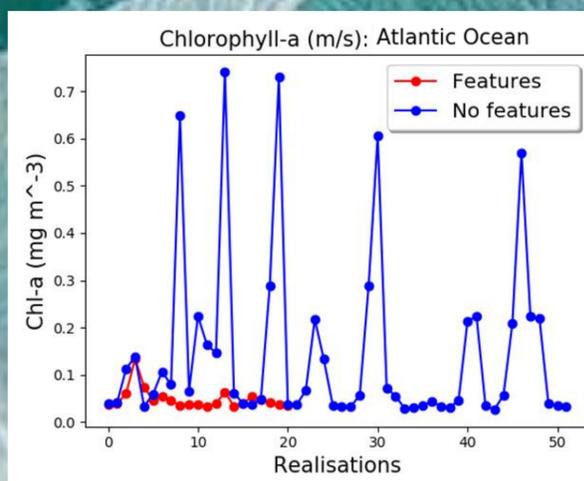


Figure-2 – Chlorophyll-a concentrations of features and no features within the Atlantic

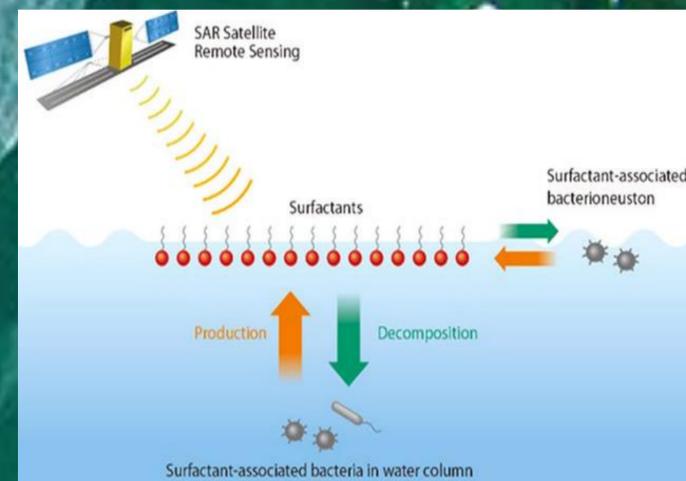


Figure-3 - Link between surfactant- microplastics associated bacteria, sea slicks and SAR satellite

The pieces of the puzzle

1. Plastic is colonised by microbes
2. Microbes produce surfactants
3. SAR can monitor surfactants

Checking they are surfactants

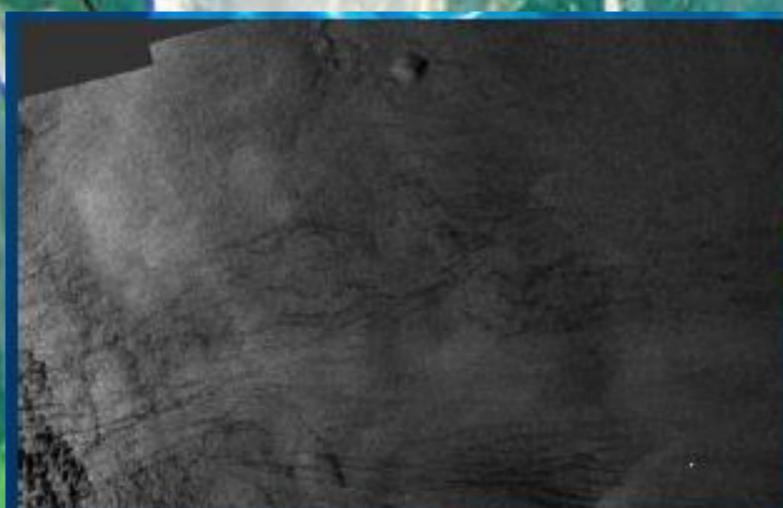
The wind speeds shows that surfactants are present at wind speeds below 8m/s

Checking they are not algal blooms

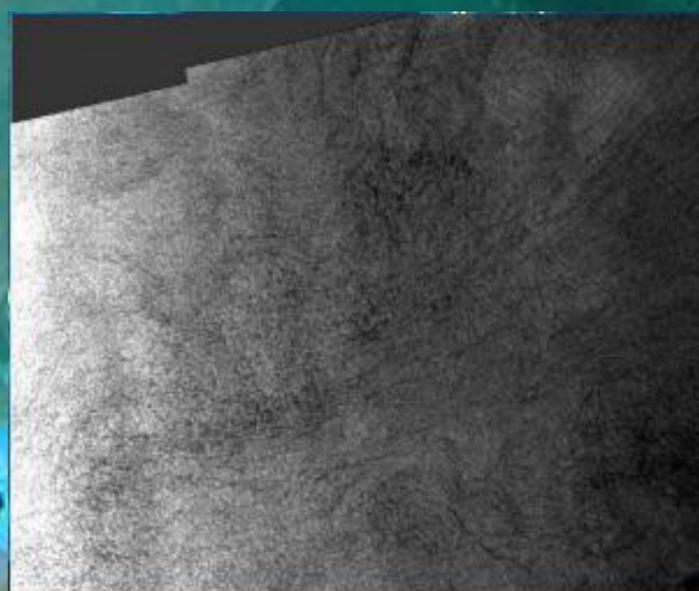
The chlorophyll data acquired via Terra MODIS Satellite shows that chlorophyll concentrations are low in sites found to have features.

Further study

We want to do lab experiments



Sentinel-1A; Indian Ocean: 77°55'57" E, 19°29'17" S
degree February 8th 2018, 13:13:54



Sentinel-1: Indian Ocean, 68°32'38" E, 23°13'33" S.
February 9th 2018, 13:54:29

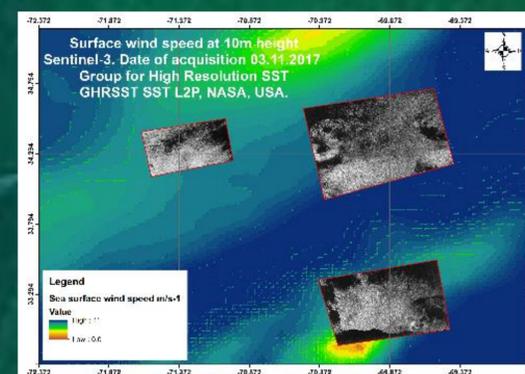


Figure- 6- Satellite images and surface wind

References:

- ❖ Erik van, et.al., 2015 "A global inventory of small floating plastic debris". Environmental Research Letters, 10, 124006.
- ❖ Figure 3- N. Kurata, et.al., 2016, "Surfactant- associated bacteria in the near-surface layer of the ocean," Scientific reports, vol. 6, pp. 19123, 2016.
- ❖ E. R. Zettler, et.al., 2013, "Life in the "plastisphere": microbial communities on plastic marine debris," Environmental science & technology, vol. 47, no. 13, pp. 7137-7146.
- ❖ J. C. McWilliams, et.al., 2000, "Vertical mixing by Langmuir circulations," Spill Science & Technology Bulletin, vol. 6, no. 3-4, pp. 225-237.
- ❖ V. Kudryavtsev, et.al., 2003, "A semi-empirical model of the normalized radar cross-section of the sea surface 1. Background model," Journal of Geophysical Research: Oceans, vol. 108.