European Commission

Science for Environment Policy

Shipping emissions can lead to high local ocean acidification

Strong acids formed from shipping emissions can produce seasonal 'hot spots' of ocean acidification, a recent study finds. These hot spots, in ocean areas close to busy shipping lanes, could have negative effects on local marine ecology and commercially farmed seafood species.

Oceans have become more acidic since pre-industrial times. The average global ocean pH – which decreases with increasing acidity – has dropped by 0.1 because the seas have absorbed 30-40% of manmade CO_2. However, it is not only CO_2 that can acidify oceans. Shipping emissions, a significant source of atmospheric pollution, annually release around 9.5 million metric tons of sulphur and 16.2 million metric tons of nitric oxides.

When dissolved in seawater, these pollutants are converted into the strong sulphuric and nitric acids, adding to ocean acidification. Increasing acidity poses a threat to marine ecosystems, harming species such as coral and algae, as well as commercial aquaculture species, such as shellfish.

The researchers used state of the art computer modelling techniques and datasets to create a high resolution simulation of global shipping emissions' effects on ocean acidity. The simulation calculated the acidifying impacts of shipping sulphur and nitric oxide emissions on a month by month basis, over one year. In addition to shipping-related influences on acidity, the model also included many physical and environmental factors, such as ocean surface water mixing and atmospheric effects.

The results agreed with previous studies of the average annual ocean acidification, but, importantly, revealed significant differences between regions and seasons. Ocean acidification was highest in the northern hemisphere, occurring in 'hot spots' close to coastal areas and busy shipping lanes during the summer months. These 'hot spots' coincide with peak activity of some biological processes, such as plankton blooms and fish hatching, where they may cause greater harm. On a local scale, the acidification – a pH drop of 0.0015-0.0020 – was equal to CO_2's global annual acidifying effects.

The model did not include some coastal ocean areas, such as the Mediterranean Sea, as there were limitations in the oceanographic atlases used. However, acidification is likely to be high in these areas given the heavy shipping traffic from ports.

International regulation is in place to reduce shipping atmospheric sulphur emissions through the International Maritime Organization's Emission Control Areas (ECA), which are in force in four ocean areas, including the Baltic and North Seas. One technology commonly used to achieve ECA targets is 'seawater scrubbing', where exhaust pollutants are removed using seawater.

This study drew on data from 2000 and 2002, prior to the enforcement of ECAs. However, the researchers note that seawater scrubbing, without additional steps to neutralise the acids that it produces, causes acidification in regions where biodiversity or commercial aquaculture may be most negatively affected. These previously overlooked sources of ocean acidification and policy impacts could be used to inform future discussions of controls relating to shipping emissions or ocean acidification.

18 July 2013
Issue 337

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Source: Hassellöv, I-M, Turner, D.R., Lauer, A., Corbett, J.J. (2013). Shipping Contributes to Ocean Acidification. *Geophysical Research Letters*. 40. DOI: 10.1002/grl.50521.

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