Sea spray losing its sparkle?

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Atmospheric aerosols are tiny particles that scatter and absorb sunlight but also influence climate indirectly through their role in cloud formation. One of the largest sources of aerosols is sea spray which is produced over the world's oceans. Understanding how these particles take up water from the atmosphere, their so-called hygroscopicity, is

important because it determines how much sunlight they reflect and how well they can form clouds. This was the topic of a new study by researchers from Stockholm University and international partners published in *Nature Communications*.

"It is widely understood that aerosols have a net cooling effect on climate, counteracting the warming caused by greenhouse gases. However, the magnitude of this cooling is highly uncertain, in part due to knowledge gaps in how natural aerosol particles interact with solar radiation and clouds," says Matt Salter, researcher at the Department of Environmental Science and Analytical Chemistry (ACES), Stockholm University, and co-author of the study.

Sea spray is a complex mixture of inorganic salts, organic material present in the ocean and living organisms such as bacteria, viruses and fungi. The ability of the inorganic component of sea spray particles to take up water has been the focus of this international study where a large suite of well-controlled laboratory experiments have shown, for the first time, that the hygroscopicity of the inorganic component of sea spray is significantly lower than pure sodium chloride, a substance routinely used to describe their hygroscopicity in climate models.

"All numerical models are simplified reflections of reality which require approximations. It was previously thought that sodium chloride was a good approximation for the hygroscopicity of the inorganic fraction of sea spray. We have now shown that the hygroscopicity of pure inorganic sea spray particles is significantly lower than sodium chloride. This finding has implications for the role of sea spray aerosols in climate, especially on how they interact with solar radiation, " says Paul Zieger, assistant professor at ACES and co-author of the study.

Using models, the authors were able to show that the reduced hygroscopicity of sea spray means that these particles will grow less and

reflect less sunlight than previously thought. However, the picture may be more complicated.

"We suspect that water bound within sea salt, known as hydrates, play a significant role in defining the hygroscopicity of inorganic sea spray aerosol, If true, it means that the particles would take up less water because of the water already present as hydrates and, as a result, they would grow less. Overall, improving our understanding of one of the largest natural aerosol sources is critical if we are to understand the effects of man-made aerosols on climate, " says Matt Salter.

More information: "Revising the hygroscopicity of inorganic sea salt particles"*Nature Communications* (2017). DOI: 10.1038/ncomms15883

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