Prof. Dr. Örjan Gustafsson
Professor of Biogeochemistry

My fundamental interest is to understand how human activities are perturbing the climate and the related biogeochemical cycle of carbon in the global land-ocean-atmosphere system. I am also interested in cross-disciplinary initiatives contributing towards a more sustainable and resilient stewardship of our planet.

We investigate two grand challenges in climate change science. The first is on Arctic carbon-climate linkages with a focus on thawing land+subsea permafrost and collapsing methane hydrates, which may add greenhouse gases to the atmosphere. We have for two decades pursued field campaigns in the key yet remote and vast region of the Siberian-Arctic coastal margin and unearthed extensive methane releases from thawing subsea permafrost and the dynamics of land permafrost remobilization around the entire circum-Arctic in both the present system and during earlier periods of abrupt climate change.

The second research challenge concerns the interactions of severe air pollution and climate change, with focus on key regions South Asia, the Sub-Saharan Africa, the Tibetan Plateau and East Asia. We have established atmospheric-climate observatories strategically located to intercept the outflow from e.g. India and China. These are continuously operated with decadal perspectives at locations such as in rural S. Bangladesh and on islands in the northern Indian

Ocean and in SE Yellow Sea. Placed within a comprehensive framework of satellite- and observatory data, we are isotopically fingerprinting climate- and health-affecting aerosols and gases to provide atmospheric constraints on the relative importance of different sources, to support air quality and climate modelling and to guide society's efforts to mitigate emissions. We recently also used the COVID shutdown in India as a large-scale geophysical perturbation experiment – a preview of what we may face when we go to net zero fossil emissions. While the skies got bluer and the air got cleaner, the climate warming increased. While atmospherically long-lived CO2 only dropped by 1%, the loading of short-lived net climate-cooling aerosol pollution dropped drastically resulting in an aerosol demasking that enhances climate warming.

The methane added from Arctic permafrost/hydrates and the aerosol demasking in Asia may both cause climate overshoot – that we miss the climate targets and risk passing dangerous thresholds in the earth system. I take a large interest in cross-disciplinary initiatives both in education and in interactions with society and policy makers to contribute towards finding solutions for us to bend the curve of climate change.

Selected to illustrate breadth, novelty and direction. **ÖG total citations (excl. auto citations): >17000; Total publications number 260; H-Index > 72 (Web of Science)** (* = senior/corr. author)

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