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Extensive degradation of terrestrial POC and DOC over the Eastern Arctic Siberian Shelf

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The Eastern part of the Siberian Arctic is predicted to experience the highest increase in temperature on Earth as climate changes, and now observations indicate that the region is warming even faster than predicted. It has been suggested that these changes will lead to increased export of terrestrial organic carbon (particulate OC and dissolved OC). However, the fate of terrestrial OC in the Arctic Ocean is debated, and data from the eastern part of the Siberian Shelves are limited.

During the International Siberian Shelf Study 2008 (ISSS-08), a 50-day research expedition onboard the Russian vessel Yakob Smirnitskiy, 260 samples were measured for POC and DOC concentrations and optical parameters in the Laptev and the East Siberian Seas. The results demonstrate that extensive removal of terrestrial derived carbon occurs over these shelves. For DOC, this was most pronounced in areas where the residence time of the freshwater exceeded one year, while the removal of POC was rapid in the low salinity zones. However, the POC shows several sources and degradation patterns along the Eastern Siberian coastline, and the degradation rate was much higher than previous estimates.

Our findings suggest that a large proportion of riverine DOC is removed in the surface waters of the Eastern Siberian Arctic Shelves and that increased river discharge of DOC might cause a stronger positive feedback to global warming than expected. They also suggest that even though the riverine concentration of POC is only 10-15% of the DOC concentration, up to half of the inorganic carbon produced from degradation of terrestrial OC is due to degradation of POC.