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The negative feedback between anthropogenic ozone pollution and enhanced ocean emissions of iodine

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Natural emissions of iodine compounds from the oceans efficiently destroy atmospheric ozone reducing its positive radiative forcing effects in the troposphere. Emissions of inorganic iodine have been experimentally shown to depend on the deposition to the oceans of tropospheric ozone, whose concentrations have significantly increased (40%) since 1850 as a result of human activities. In this work a chemistry-climate model is used to quantify the current ocean emissions of inorganic iodine and evaluate the impact that the anthropogenic increase of tropospheric ozone has had on the natural cycle of iodine in the marine environment since pre-industrial times. Our results indicate that the human driven enhancement of tropospheric ozone has doubled the oceanic inorganic iodine emissions following the reaction of ozone with iodide at the sea surface. The consequent build-up of atmospheric iodine, with maximum enhancements of up to 70% with respect to preindustrial times in continental pollution outflow regions, has in turn accelerated the ozone chemical loss over the oceans with strong spatial patterns. We suggest that this ocean–atmosphere interaction represents a negative geochemical feedback loop by which current ocean emissions of iodine act as a natural buffer for ozone pollution and its radiative forcing in the global marine environment. This feedback represents a potentially important link between climate change and tropospheric O_3 since the oceanic emissions of iodine are not only linked to surface O_3, but also to SST and wind speed and might also be linked to climatically driven changes in the state of the world oceans.