Findings from Environment and Climate Change Canada Update Knowledge of Atmospheric Chemistry (Vertical Profiles of Light Absorption and Scattering Associated With Black Carbon Particle Fractions In the Springtime Arctic Above 79 Degrees N).

Date: Oct. 20, 2020
From: Journal of Physics Research
Publisher: NewsRX LLC
Document Type: Article
Length: 887 words

Full Text:
2020 OCT 20 (VerticalNews) -- By a News Reporter-Staff News Editor at Journal of Physics Research -- Investigators discuss new findings in Chemistry - Atmospheric Chemistry. According to news originating from Toronto, Canada, by VerticalNews correspondents, research stated, "Despite the potential importance of black carbon (BC) for radiative forcing of the Arctic atmosphere, vertically resolved measurements of the particle light scattering coefficient (sigma(sp)) and light absorption coefficient (sigma(ap)) in the springtime Arctic atmosphere are infrequent, especially measurements at latitudes at or above 80 degrees N. Here, relationships among vertically distributed aerosol optical properties (sigma(ap), sigma(sp) and single scattering albedo or SSA), particle microphysics and particle chemistry are examined for a region of the Canadian archipelago between 79.9 and 83.4 degrees N from near the surface to 500 hPa. Airborne data collected during April 2015 are combined with ground-based observations from the observatory at Alert, Nunavut and simulations from the Goddard Earth Observing System (GEOS) model, GEOS-Chem, coupled with the TwO-Moment Aerosol Sectional (TOMAS) model (collectively GEOS-Chem-TOMAS; Kodros et al., 2018) to further our knowledge of the effects of BC on light absorption in the Arctic troposphere."

Financial supporters for this research include Natural Sciences and Engineering Research Council (NSERC) of Canada, Environment and Climate Change Canada (ECCC), Fisheries and Oceans Canada, Alfred Wegener Institute, Major Research Project Management Fund at the University of Toronto, Deutsche Forschungsgemeinschaft (DFG -German Research Foundation) TRR 172, within the Transregional Collaborative Research Center, "ArctiC Amplification: Climate Relevant Atmospheric and SurfaCe Processes, and Feedback Mechanisms (AC)3", US Department of Energy's Atmospheric System Research (an Office of Science and Office of Biological and Environmental Research program), US National Science Foundation under the Atmospheric Chemistry program, US National Oceanic and Atmospheric Administration (an Office of Science and Office of Atmospheric Chemistry, Carbon Cycle, and Climate program).

Our news journalists obtained a quote from the research from Environment and Climate Change Canada, "The results are constrained for sigma(sp) less than 15 Mm(-1), which represent 98% of the observed sigma(sp), because the single scattering albedo (SSA) has a tendency to be lower at lower sigma(sp), resulting in a larger relative contribution to Arctic warming. At 18.4m(2) g(-1), the average BC mass absorption coefficient (MAC) from the combined airborne and Alert observations is substantially higher than the two averaged modelled MAC values (13.6 and 9.1m(2) g(-1)) for two different internal mixing assumptions, the latter of which is based on previous observations. The higher observed MAC value may be explained by an underestimation of BC, the presence of small amounts of dust and/or possible differences in BC microphysics and morphologies between the observations and model. In comparing the observations and simulations, we present sigma(ap) and SSA, as measured, and sigma(ap)/2 and the corresponding SSA to encompass the lower modelled MAC that is more consistent with accepted MAC values. Median values of the measured sigma(ap), rBC and the organic component of particles all increase by a factor of 1.8 +/- 0:1, going from near-surface to 750 hPa, and values higher than the surface persist to 600 hPa. Modelled BC, organics and sigma(ap) agree with the near-surface measurements but do not reproduce the higher values observed between 900 and 600 hPa. The differences between modelled and observed optical properties follow the same trend as the differences between the modelled and observed concentrations of the carbonaceous components (black and organic). Model-observation discrepancies may be mostly due to the modelled ejection of biomass burning particles only into the boundary layer at the sources. For the assumption of the observed MAC value, the SSA range between 0.88 and 0.94, which is significantly lower than other recent estimates for the Arctic, in part reflecting the constraint of sigma(sp) < 15 Mm(-1)."

According to the news editors, the research concluded: "The large uncertainties in measuring optical properties and BC, and the large differences between measured and modelled values here and in the literature, argue for improved measurements of BC and light absorption by BC and more vertical profiles of aerosol chemistry, microphysics and other optical properties in the Arctic."

For more information on this research see: Vertical Profiles of Light Absorption and Scattering Associated With Black Carbon Particle Fractions In the Springtime Arctic Above 79 Degrees N. Atmospheric Chemistry and Physics, 2020;20(17):10545-10563. Atmospheric Chemistry and Physics can be contacted at: Copernicus Gesellschaft Mbh, Bahnhofsallee 1E, Gottingen, 37081, Germany. (Copernicus Publications - www.copernicus.org; Atmospheric Chemistry and Physics - publications.copernicus.org)

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Keywords for this news article include: Toronto, Canada, North and Central America, Atmospheric Chemistry, Chemistry, Environment and Climate Change Canada.

The citation for this news report is: NewsRx. Findings from Environment and Climate Change Canada Update Knowledge of Atmospheric Chemistry (Vertical Profiles of Light Absorption and Scattering Associated With Black Carbon Particle Fractions In the Springtime Arctic Above 79 Degrees N). Journal of Physics Research. October 20, 2020; p 620.