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BLACK CARBON SPECTROMETRY AND STORAGE EXPERIMENT (BCSSE)

Abstract

Black carbon emissions have been a main reason behind global warming and climate change. The importance of addressing climate action issues and changing the way we solve the problems should be altered by modern day technologies such as nanotechnology and carbon capture. Currently rockets use chemical propulsion emitting Carbon monoxide mostly turning into carbon dioxide, Nitrogen oxides, black soot and water vapor which store heat in the atmosphere. Radiative forcing or RF can increment the rate of instantaneous effects of such substances, especially black carbon (BC). BC absorb solar flux; they cause a limiting concern with their contributions to day-to-day RF values which in turn are 168 mWm2 by rockets. We can then conclude that these values are comparable to global RF aviation caveats.

Main emissions from rocket combustions are contrasting by looking at them in different atmospheres. For instance in the stratosphere, due to its decoupling air coming from the troposphere, take 3-5 years for removal due to the mixture of downward air in tropopause folding. Tropopause folding is by the troposphere which is has a low air ratio in the ozone of 0.1 parts per million. This contradicts with the stratosphere which has high air ratios in the ozone of 10 parts per million. The thermal gradients should prevent these mixtures, but due to tropopause folding harmful constituents like black carbon, methane and nitrogen oxides sinking in the stratosphere. This is important to rocket emissions as chemical substituents from rocket emissions increase in the stratosphere due to their effects lasting longer and becoming more potent.

The BCSSE consists of a conductive material made of fluorescent carbon quantum dots (CQDs) in a nickel catalyst layer on the nozzle of a rocket, this is specifically designed in order to measure the amount of black carbons in the troposphere vs the stratosphere when a hybrid rocket passes through both atmospheres. We fit it with a nickel catalyst layer in order to transmit it through the storage compartment of a cubesat. The bedded layer will be set up with characteristics similar to a carbon bioplastic layer to ensure full sorption of the black carbon onto the ultraviolet–visible (UV/VIS) spectrophotometer.