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CAM6-chem with Very Short-Lived Halogen Chemistry: Evaluation with the Whole Air Sampler Aircraft Data from Multiple Seasons and Locations

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A new version of the Community Atmosphere Model with chemistry (CAM6-chem) has recently been released to the atmospheric science community (June 2018). CAM6-chem has updated boundary layer processes, shallow convection and liquid cloud macrophysics, and two-moment cloud microphysics with prognostic cloud mass and concentration. A 4-mode prognostic aerosol representation (MAM4) has been added that includes a representation of dust, sea-salt black carbon, organic carbon, and sulfate in three size categories (Gettelman et al., 2019). CAM6-Chem has a detailed representation of both tropospheric and stratospheric chemistry. The tropospheric chemistry includes updates to the representation the organic nitrates, isoprene oxidization, and the speciation of the aromatic and terpenes (Emmons et al., 2019). This mechanism also includes a comprehensive secondary organic aerosol parameterization based on the Volatility Basic Set (VBS) model framework (Hodzic et al. 2016; Tilmes et al., 2019). The stratospheric halogen chemistry represents the distribution of CH3Cl, CFCs, HCFCs, CH3Br, and halons (Kinnison et al., 2007). For this study, the emissions, wet and dry depositions, and chemical processes that represent Very Short-Lived Halogens (VSLH) were added (e.g., Saiz-Lopez et al., 2016). Evaluation of the organic VSLH distributions are to compare with trace gas measurements collected during seven field campaigns, two with multiple deployments, to evaluate the model performance over multiple years. The campaigns include HIPPO (2009-2011) pole to pole observations in the Pacific on the NSF/NCAR GV over multiple seasons; SEAC4RS (Aug./Sept., 2013) in the central and southern U.S. and western Gulf of Mexico on the NASA ER-2 and DC8; ATTREX (2011-2015) on the NASA Global Hawk over multiple seasons and locations; CONTRAST (Jan/Feb, 2014) in the western Pacific on the NSF/NCAR GV; VIRGAS (Oct., 2015) in the south central US and western Gulf of Mexico on the NASA WB-57; ORCAS (Jan/Feb, 2016) over the southern ocean on the NSF/NCAR GV; and POSIDON (Oct, 2016) in the western Pacific on the NASA WB-57. The model was ‘nudged’ to NASA Modern-Era Retrospective analysis for Research and Applications, version 2 meteorological fields to represent the synoptic meteorology for each mission. The analysis will focus on along the flight tracks comparisons with the model and will also examine comparisons of vertical distributions and various tracer-tracer correlations. Implications of this new model version on estimated input of inorganic bromine and iodine into the lower stratosphere will be discussed.