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Progress toward Cloud-Cleared Infrared radiance assimilation in a global modeling framework: Application to the 2017 Atlantic Tropical Cyclone Season.

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Previous work by this team has demonstrated that assimilation of IR radiances in partially cloudy regions is beneficial to numerical weather predictions (NWPs), improving the representation of tropical cyclones (TCs) in global analyses and forecasts. The specific technique used by this team is based on the “cloud-clearing CC” methodology. Cloud-cleared hyperspectral IR radiances (CCRs), if thinned more aggressively than clear-sky radiances, have shown a strong impact on the analyzed representation and structure of TCs. However, the use of CCRs in an operational context is limited by 1) latency; and 2) external dependencies present in the original cloud-clearing algorithm. In this study, the Atmospheric InfraRed Sounder (AIRS) CC algorithm was (a) ported to NASA high end computing resources (HEC), (b) deprived of external dependencies, and (c) parallelized improving the processing by a factor of 70. The revised AIRS CC algorithm is now customizable, allowing user’s choice of channel selection, user’s model's fields as first guess, and could perform in real time. This study examines the benefits achieved when assimilating CCRs using the NASA’s Goddard Earth Observing System (GEOS) hybrid 4DEnVar system. The focus is on the 2017 Atlantic hurricane season with three infamous hurricanes (Harvey, Irma, and Maria) investigated in depth. The impact of assimilating customized CCRs on the analyzed representation of tropical cyclone horizontal and vertical structure and on forecast skill is discussed.