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Big Data Assimilation: Real-time Demonstration Experiment of 30-second-update Forecasting in Tokyo in August 2020

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The Japan's Big Data Assimilation (BDA) project started in October 2013 and ended its 5.5-year period in March 2019. Here, we developed a novel numerical weather prediction (NWP) system at 100-m resolution updated every 30 seconds for precise prediction of individual convective clouds. This system was designed to fully take advantage of the phased array weather radar (PAWR) which observes reflectivity and Doppler velocity at 30-second frequency for 100 elevation angles at 100-m range resolution. By the end of the 5.5-year project period, we achieved less than 30-second computational time using the Japan's flagship K computer, whose 10-petaflops performance was ranked #1 in the TOP500 list in 2011, for past cases with all input data such as boundary conditions and observation data being ready to use. The direct follow-on project started in April 2019 under the Japan Science and Technology Agency (JST) AIP (Advanced Intelligence Project) Acceleration Research. We continued the development to achieve real-time operations of this novel 30-second-update NWP system for demonstration at the time of the Tokyo 2020 Olympic and Paralympic games. The games were postponed, but the project achieved real-time demonstration of the 30-second-update NWP system at 500-m resolution using a powerful supercomputer called Oakforest-PACS operated jointly by the Tsukuba University and the University of Tokyo. The additional developments include parameter tuning for more accurate prediction and complete workflow to prepare all input data in real time, i.e., fast data transfer from the novel dual-polarization PAWR called MP-PAWR in Saitama University, and real-time nested-domain forecasts at 18-km, 6-km, and 1.5-km to provide lateral boundary conditions for the innermost 500-m-mesh domain. A real-time test was performed during July 31 and August 7, 2020 and resulted in the actual lead time of more than 27 minutes for 30-minute prediction with very few exceptions of extended delay. Past case experiments showed that this system could capture rapid intensification and decays of convective rains that occurred in the order of less than 10 minutes, while the JMA nowcasting did not predict the rapid changes by its design. This presentation will summarize the real-time demonstration during August 25 and September 7 when Tokyo 2020 Paralympic games were supposed to take place.

