

# Virtual Event: ECMWF-ESA Workshop on Machine Learning for Earth System Observation and Prediction



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Type: **Oral presentation**

## Big Data, Big Computation, and Machine Learning in Numerical Weather Prediction

*Tuesday, 6 October 2020 11:00 (30 minutes)*

At RIKEN, we have been exploring a fusion of big data and big computation, and now with AI techniques and machine learning (ML). The new Japan's flagship supercomputer "Fugaku", ranked #1 in the most recent TOP500 list (<https://www.top500.org/>) in June 2020, is designed to be efficient for both double-precision big simulations and reduced-precision machine learning applications, aiming to play a pivotal role in creating super-smart "Society 5.0." Our group in RIKEN has been pushing the limits of numerical weather prediction (NWP) through two orders of magnitude bigger computations by taking advantage of the previous Japan's flagship supercomputer named "K computer". The efforts include ensemble Kalman filter experiments with 10240 ensemble members and 100-m-mesh, 30-second-update "Big Data Assimilation" by fully exploiting the novel phased array weather radar. Now with the new "Fugaku" in mind, we have been exploring ideas for fusing Big Data Assimilation and AI. The ideas include fusion of data-driven precipitation nowcasting with process-driven NWP, NWP model acceleration using neural networks (NN), applying ML to satellite and radar operators in data assimilation (DA), and NWP model's systematic error identification and correction by NN. The data produced by NWP models become bigger and moving around the data to other computers for ML may not be feasible. Having a next-generation computer like "Fugaku", good for both big NWP computation and ML, may bring a breakthrough toward creating a new methodology of fusing data-driven (inductive) and process-driven (deductive) approaches in meteorology. This presentation will provide general perspectives toward future developments and challenges in NWP, with some specific research examples of DA-AI fusion at RIKEN.

### Thematic area

1. Machine Learning for Data Assimilation - Including Model Error Estimation and Correction, Parameter estimation, Fast linearised models for DA, Hybrid DA

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**Session Classification:** Session 3: ML for Data Assimilation

**Track Classification:** ECMWF-ESA Workshop on Machine Learning for Earth System Observation and Prediction