Towards an extreme scale global data assimilation on the post-K supercomputer: development of a throughput-aware framework for ensemble data assimilation

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The weather/climate simulation models and the data assimilation (DA) systems are placed as the important applications in the development of post-K supercomputer system. In a cyclic operation of the DA system, the simulation model and the DA system are executed cooperatively. In recent years, the horizontal resolution of the simulation model increases, and the ensemble size increases, too. In such situation, data movement between the two applications becomes a more significant issue.
We proposed an ensemble DA framework with a "throughput-aware" design that maintains data locality and maximizes the throughput of file I/O between the simulation model and the ensemble DA system. This framework is implemented to a DA system, which is used a local ensemble transform Kalman filter (LETKF) and a Non-hydrostatic Icosahedral Atmospheric Model (NICAM) (NICAM-LETKF, Terasaki et al., 2015). The results of benchmark test on the K computer showed a reduction in a total executed time and a better scalability up to 10,000 nodes in comparison with the current system. Our new concept is effective for the speedup of the workflow and enables to expand the computational scale of the DA system.

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