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Plain Language Summary: The regional data assimilation system at the Japan Meteorological Agency employs a variational data assimilation system on the basis of the non-hydrostatic model ASUCA (named ASUCA-Var). As a system for operational use, ASUCA-Var is designed for sustainable development. This paper reviews configurations, workflow of operational systems, and performances of ASUCA-Var.

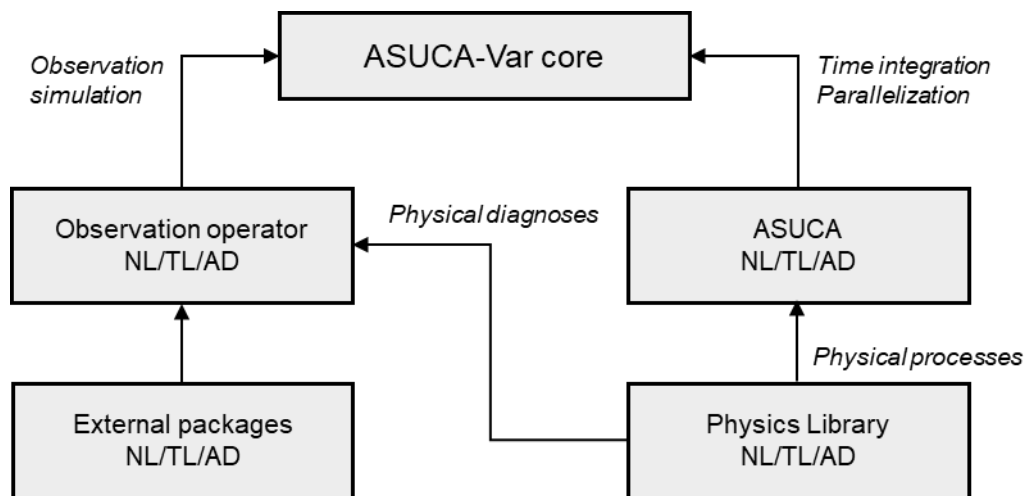


Figure 1. The structure of ASUCA-Var, which comprises an assimilation core to perform optimization and preconditioning, ASUCA as a forecast model to perform time integration, a physics library to compute physical processes, and observation operators to simulate observations. These subroutines contain nonlinear (NL), tangent-linear (TL), and adjoint (AD) codes for assimilation.

- The control variables of ASUCA-Var include soil variables and basic atmospheric variables.
- The background-error covariance is defined every three hours for land and sea grid, taking into account diurnal variation and differences in error structure on land and sea.
- The cost function is designed to be a perfect quadratic form, and the basic field update method in the optimization process allows the nonlinearity of observation and model operators to be incorporated into the solution of optimization problem in the incremental four-dimensional variational method.
- Variational quality control and variational bias correction are introduced for advanced observation handling within the variational system.