



Linear representation of clouds and their evolution in the Met. Office 4D-Var's inner loop in comparison with the full nonlinear model

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To assimilate geostationary infra-red (IR) imagery into 4D-Var and to extract dynamical information from sequences of these images to significantly improve model forecasts for rapidly developing weather systems, the background forecasted by 4D-Var's inner loop linear model has to be able to represent clouds and their evolution adequately (given the correct atmospheric state and the initial increment from the full nonlinear model). In incremental 4D-Var at the Met Office the inner minimization loop uses the linear perturbation forecast (PF) model which is simplified compared to a linearization of the full nonlinear forecast model. The ability of the PF model to represent the physics of clouds and their evolution in comparison with the full nonlinear model has been investigated. The sensitivity of PF model clouds to convection and PF model resolution is highlighted and analysed in detail. The implication from these investigations and further work needed for the next steps to assimilate geostationary IR imagery directly into the 4D-Var system will be discussed.