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An observation sensitivity method to identify targeted observations is implemented in the context of four dimensional variational (4D-Var) data assimilation. This methodology is compared with the well-established adjoint sensitivity method using a nonlinear Burgers equation as a test model. Automatic differentiation software is used to implement the first order adjoint model to calculate the gradient of the cost function required the 4D-Var minimization algorithm and adjoint sensitivity computations and the second order adjoint model to obtain the Hessian matrix of the 4D-Var cost required in the observation sensitivity computations. Numerical results indicate that the observation targeting is particularly successful in reducing the forecast error for moderate Reynolds numbers. The potential benefits of the observation sensitivity targeting approach over the adjoint sensitivity are investigated. The effect of random perturbations on the performance of adjoint sensitivity and observation sensitivity methods are also investigated. (Received September 20, 2010)