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Ensemble/Variational Observation (EnVO): a rigorous approach to adaptive observation built on the framework of EnVE DAVID ZHANG, JOSEPH CESSNA, CHRISTOPHER COLBURN, THOMAS BEWLEY, UC San Diego — Building directly on the foundation of our group's hybrid Ensemble/Variational Estimation (EnVE) algorithm, a new algorithm is proposed for adaptive observation. This algorithm, EnVO, is based on the application of adjoint-based model predictive control (MPC) applied to an ensemble of realizations in order to minimize a well targetted objective: specifically, a quantification of the estimate uncertainty at the forecast time. This estimate uncertainty, in turn, is quantified using the EnKF procedure by marching the ensemble forward to the forecast time while assimilating the anticipated measurements along the candidate sensor trajectories. A noncooperative optimization framework is also outlined in order to robustify this optimization. We show how this algorithm may be applied to optimize the trajectories of several sensor-equipped unmanned aerial vehicles (UAVs) in order to measure and forecast an atmospheric contaminant release plume in a maximally effective manner.

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