

**Pseudo-Orbit Gradient Descent for Lagrangian Data Assimilation**

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**2013 SIAM Conference on Mathematical & Computational**

**Issues in the Geosciences**

**18 June 2013**

**Abstract**

A nonlinear approach to data assimilation, known as pseudo-orbit gradient descent, is presented and illustrated in the context of assimilating Lagrangian tracer trajectories in two-dimensional flows of point-vortex systems. The approach centers on minimizing a cost function in sequence space, initialized with the noisy observations. The tracer advection equations augment the point vortex model equations, allowing the observed tracer positions to update the state information about unobserved vortex positions. Pseudo-orbit gradient descent has been successfully demonstrated for the case of both full and partial observations.

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