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Large Eddy Simulations of the Atmospheric Transport of Radionuclides from Subsurface Sources in Complex Terrain

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Radionuclides produced from underground nuclear explosions can slowly migrate through the subsurface and vent to the atmosphere, where they are transported to detectors downwind. Underground test sites located in remote areas surrounded by complex terrain features, can greatly affect the detectability of radionuclides once they reach the atmosphere. We describe efforts to validate a modeling system that transports radionuclides originating from below the surface through the atmosphere using high-resolution large eddy simulations (LES) in complex terrain. A computational LES grid has been created containing nearly 100 million grids cells over an area of about 2.5 square kilometers focused above a tunnel used to support mining activities near the Roselend reservoir in the French Alps. This grid captures the substantial elevation changes in the area, including the interface between the land surface and the water reservoir. Given meteorological inflow data as a driving boundary condition, this model predicts where gases leaking from the subsurface will be transported and how the local terrain features influence detection versus distance. This system will be validated using data from a set of planned field experiments that will inject controlled amounts of tracer gases into the surface and measure the atmospheric concentrations downwind.

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Promotional text

This contribution describes efforts to develop and validate an advanced, high-resolution atmospheric model to simulate the transport of radionuclides emanating from the subsurface to local atmospheric detectors in the presence of complex terrain features.

Oral preference format

in-person

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