Session 1: Back-Trajectory Methods

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Advantages

• Easy to implement and computationally efficient
  – Conceptual technique
  – Ideal for emergency response as opposed to retrospective analysis
  – Works seamlessly across many meteorological scales of motion
  – Can incorporate particle effects of different contaminants

• Backward trajectories (Lagrangian), are defined by the flow field
  – Offline

• Flexible
  – Same model could be used in a simple or expert mode depending on which information you use or search for
  – Can readily handle multiple release events
Identify and Prioritize Gaps

• **Lagrangian Particle Back Tracking**
  – Weather data needs to be very dense
  – Need to quantify uncertainty within this method
    Uncertainty in the predicted source location
    Uncertainty in sensor measurement as well as meteorological data
    that defines the particle trajectory
  – Need to define the mass through forward matching

• **Reverse Eulerian/Lagrangian Modeling**
  – Need to quantify uncertainty within this method
    Uncertainty in sensor measurement as well as meteorological data
    that defines the particle trajectory (need to map out the hazard
    release area).

• **Reverse Lagrangian Puff Modeling**
  – Need to have a dense concentration sensor array
  – Requires function fitting to determine puff trend
Path Forward (1)  
(Improving the techniques)

• Ways to improve the backward trajectory method  
  – Such improvements degrade computational efficiency

• If the method can incorporate uncertainty in  
  – Meteorological measurements  
  – NWP output  
  – Model parameterizations  
  – Contaminant sensor measurement

• No clear path forward on improving mass estimates and time varying sources
For emergency response, quick estimates of the hazard area are crucial.

Due to computational efficiency, we can include additional observations as they come online:
- Thus refining the hazard area
- Providing additional information for contaminant mitigation

Thus providing good background estimate for computationally intensive models.

Also, with forward modeling give quick solutions for mitigation techniques and additional targeted observations.

Need to ensure that consistency is maintained as one uses coarser resolution meteorological data in space and time.