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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

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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

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Path Forward (2)
(Emergency Response)

- 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