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Source Term Estimation (STE) Methods Session

**Damon Room
National Center for Atmospheric Research
Boulder, CO**

22-23 February, 2012

***Sponsored By:
National Science Foundation and
National Center for Atmospheric Research***

NCAR/RAL - National Security Applications Program

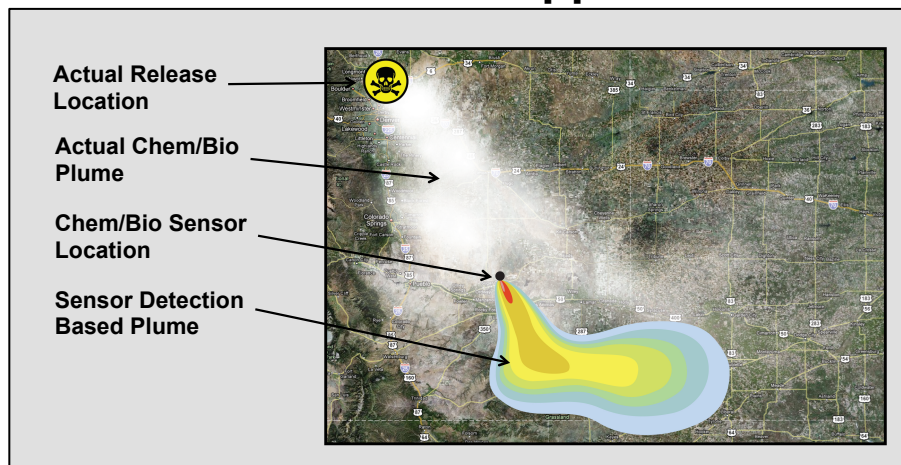


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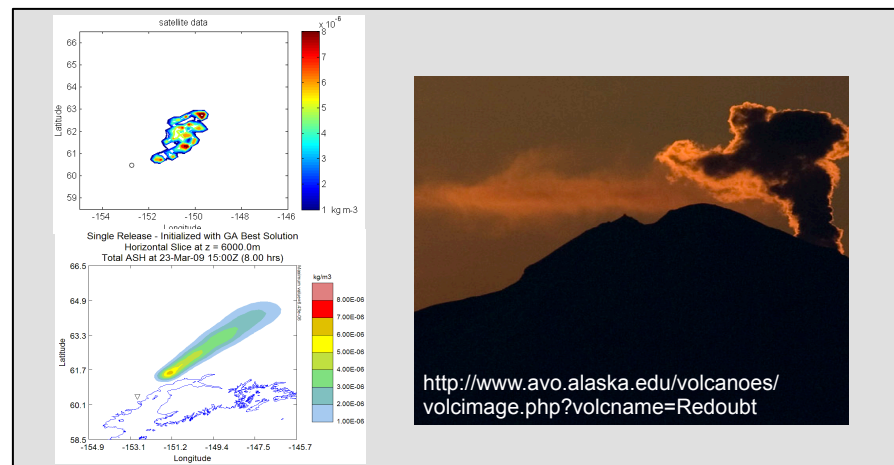
STE Problems



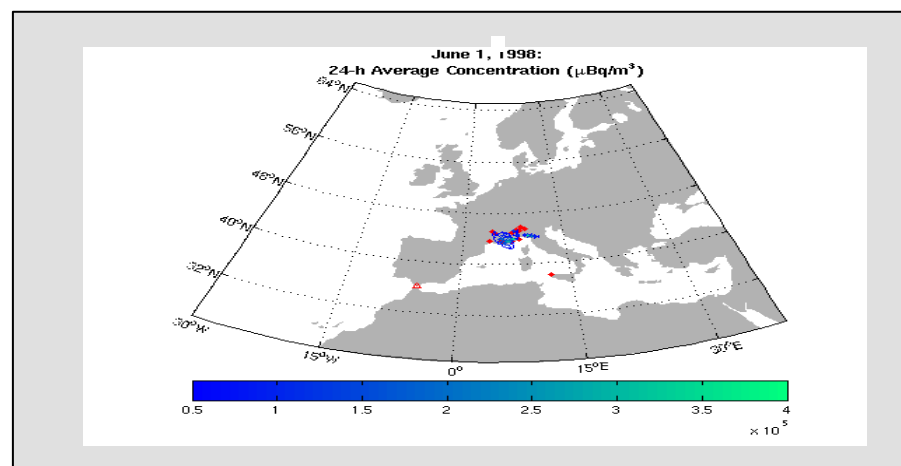
CBRNE Defense Applications



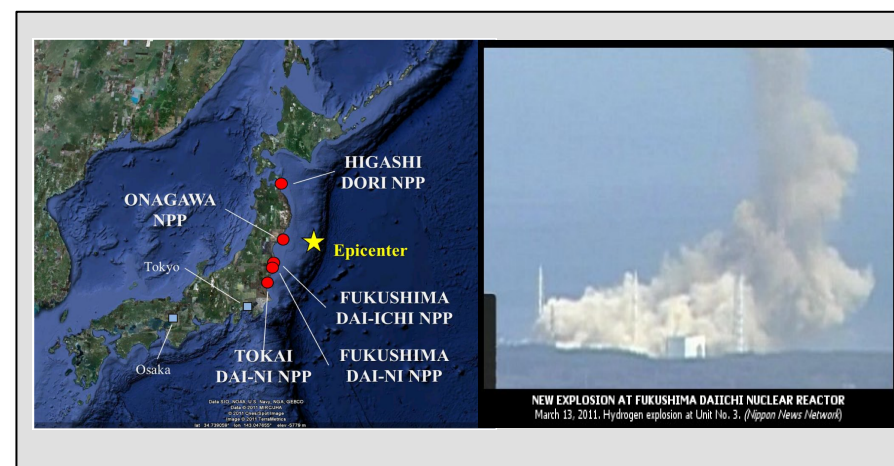
Volcanic Ash Prediction



Pollution/Accidental Releases



Fukushima Dai-ichi Accident



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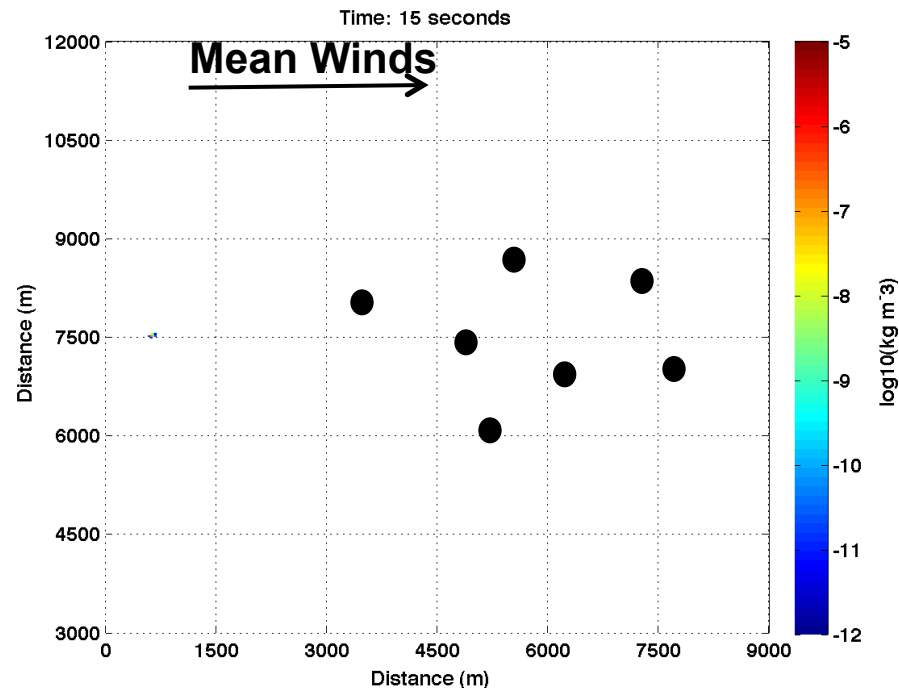


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Common Challenges to STE



- **Meteorological information**
 - Rarely adequate
- **Source information**
 - Varying degrees of knowledge
- **Concentration/deposition observations**
 - Too sparse
 - Variety of types of data
- **Dispersion modeling tools**
 - Model errors
 - Multiple Scales



**Complex Multi-dimensional
Problem that Typically Has Large Uncertainties**

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- **Effective**
 - Quantitative and accurate
- **Efficient**
 - Provide a solution within the given time constraints
 - This varies depending upon the application
- **Flexible**
 - Adaptable to a variety of problems
 - Adaptable to a variety of scales of motion
 - Adaptable to a variety of classes of observations
- **Robust**
 - Can be used in an operational or high consequence situation
- **Quantifies uncertainty**
 - “All models are wrong but some are useful” –George E.P. Box



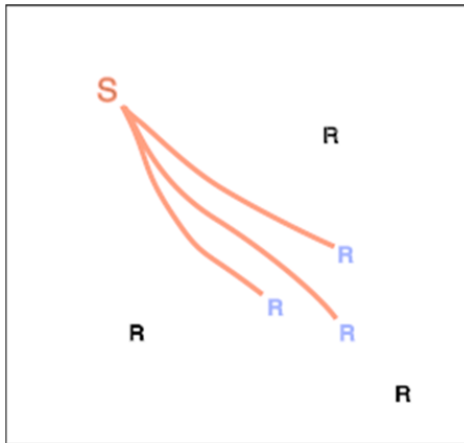
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General Categories of STE Approaches

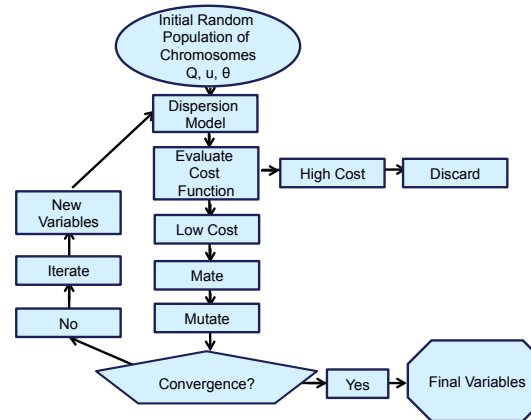
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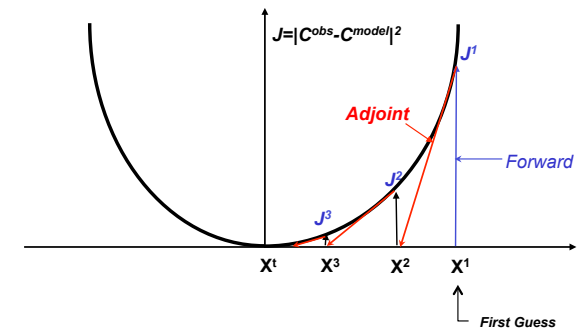
Back-trajectory Methods



Non-Gradient Descent



Gradient Descent



**Attempt to Match a
Dispersion Model to the Observations**



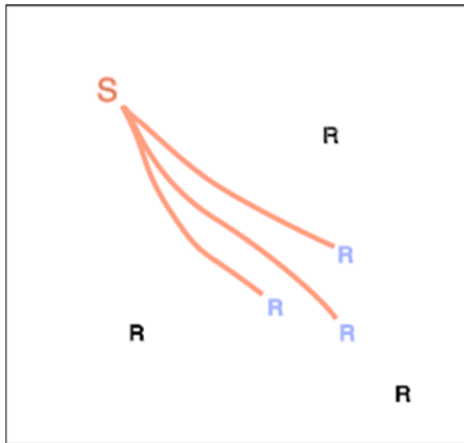
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General Categories of STE Approaches

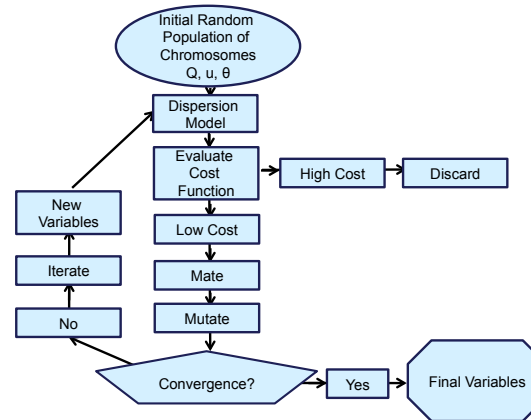
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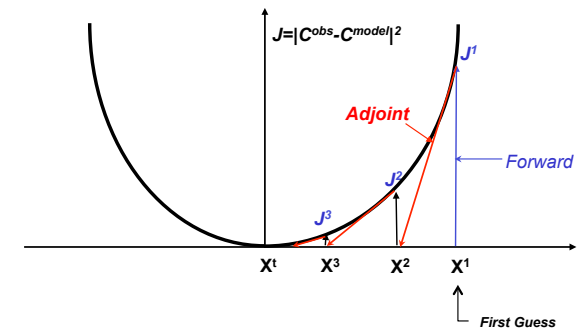
Back-trajectory Methods



Non-Gradient Descent



Gradient Descent



Attempt to Match a Dispersion Model to the Observations

Methods Can Also Be Categorized in Terms of Reference Frame in Which the Problem is Posed: Lagrangian vs. Eulerian



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Workshop Agenda

(Session III – Wed, February 22)



Session III – Methods for Source Term Estimation of Atmospheric Radiation Release

- 13:00 *Introduction of Wednesday STE Methods Session, **Dr. Paul E. Bieringer**, (National Center for Atmospheric Research)*
- 13:05 *Survey of Estimation Methods for Amount of Radioactive Materials Emitted from the Nuclear Power Station During Severe Accident, **Dr. Ryohji Ohba**, (Japan Nuclear Safety Research Association)*
- 13:15 *Source Term Estimation and Atmospheric Dispersion Simulations of Radioactive Materials Discharged from the Fukushima Daiichi Nuclear Power Plant due to Accident, **Dr. Haruyasu Nagai**, (Japan Atomic Energy Agency)*
- 13:45 *Development of an Estimation Method for the Amount of Radioactive Materials Emitted from the Nuclear Power Station During the Severe Accident, **Dr. Ryohji Ohba**, (Japan Nuclear Safety Research Association)*
- 14:15 *Back-trajectory Based Methods for Source Parameter Estimation, **Dr. Andrew Annunzio**, (National Center for Atmospheric Research)*
- 14:30 *Coffee break*

Reminder of Things to Keep In Mind



- **Take advantage of the broad spectrum of expertise**
 - **Radiation observation collection/analysis expertise**
 - **NPP and radiation modeling expertise**
 - **STE modeling expertise**
 - **Meteorological expertise**
- **Look for innovative new solutions that take advantage of the things you hear from colleagues here at the workshop**