Introduction of Source Term Estimation method for radioactive materials

Dr. Ryohji Ohba (Nuclear Safety Research Association)

Ref: Hayakawa et al., Proceedings at annual meeting of Japan society of nuclear energy, 2011 (in Japanese)
Background

**Environmental and CBRN issues**
- Source position, release volume and time: Unknown
- Observed data: Concentration

**Nuclear accident**
- Source position: Known
- Release volume and time: Unknown
- Observed data: Radiation dose of Gamma ray
Diffusion model

- Data of each particle

Advection term (Output data from meteorological model)

Diffusion term (Output data from meteorological model)

Depletion & Deposition term

Present position
Released time
Released intensity
**STE technique of Lagrangian Particle model (2)**

**STE method**

- Calculation variables

**Influence function**

\[ F_i = \sum \phi_{ij} q_i \]

**Calculated data**

**Observed data**

**Residual norm**

\[ \pi = \sum (F_i - f_i)^2 \]

Determine \( q_i \) of released intensity, so as to minimize \( \pi \)
Calculation conditions

- Area: Downtown in Tokyo
- Wind: North to South 1m/s
- Observed data: Simulated results
  (Released intensity: decreased from 1 to 0 during 30 min.)

Calculated results by RAMS&HYPACT codes
Test calculation (2): Source position and observation points

Point 1 ~ 4
Point 6 ~ 10
Point 11 ~ 15
Point 16 ~ 22
Test calculation (3): Wind vector around buildings
Sensibility study on noise of observed data

放出量同定精度

Test calculation (4): Accuracy of released intensity
Sensibility study on noise of observed data

Test calculation (5): Accuracy of radiation dose calculated by estimated released intensity
Conclusion

- Result
  - Development of STE method based on radiation dose
  - Confirmation of accuracy for released intensity

- Future subjects
  - Improvement of released intensity at initial stage
  - Validation study with wind tunnel and field data
  - Improvement of dry and wet deposition model

Application to emergency response system
拡散予測精度の向上（4次元同化）

\[
\tilde{q}_i = q_i + (q_{m_j} - q_i) \cdot (\phi_{ij} / \phi_{mk})
\]