Introduction of Source Term Estimation method for radioactive materials

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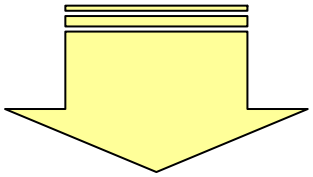
Ref: Hayakawa et al., Proceedings at annual meeting of Japan society of nuclear energy, 2011 (in Japanese)

Background

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

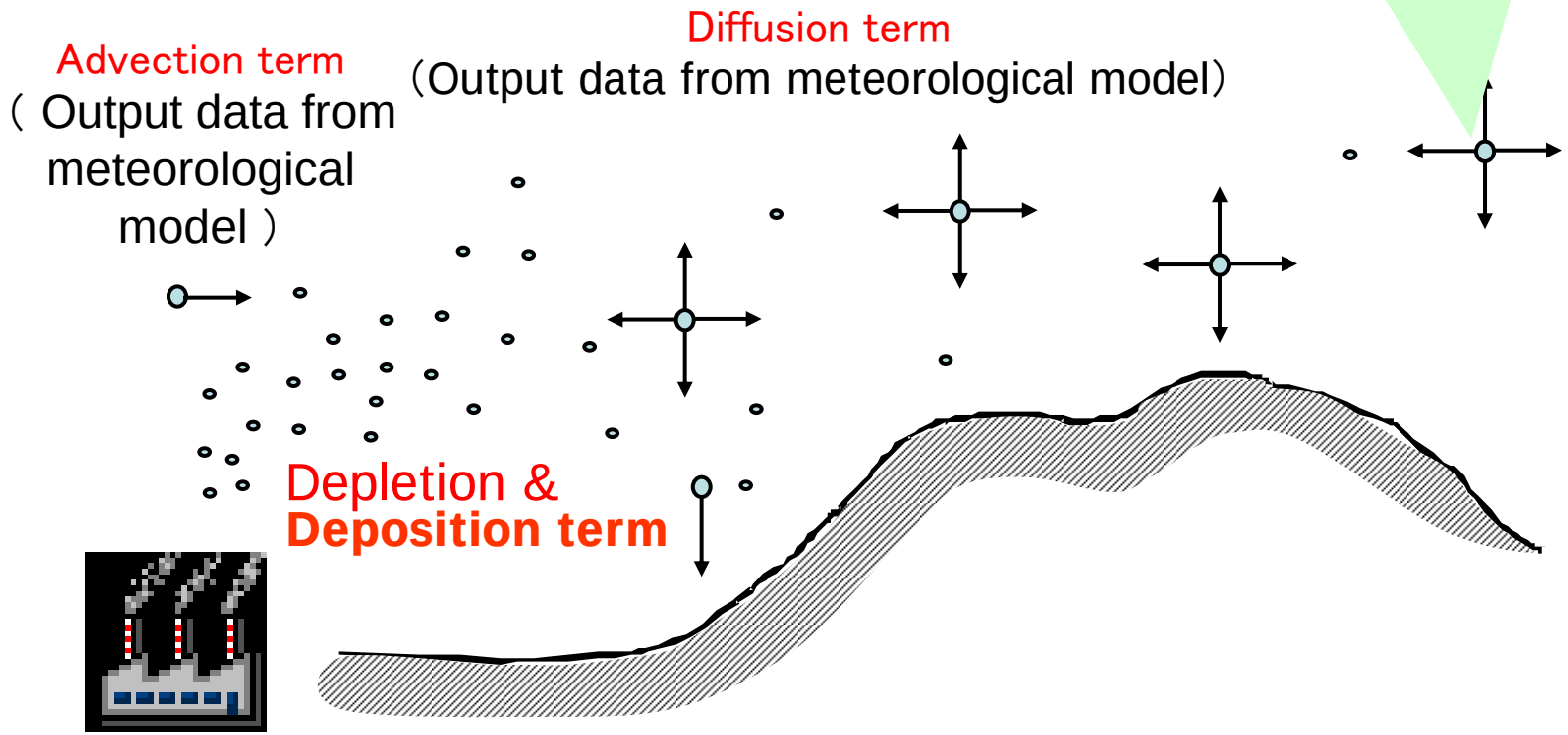


- Nuclear accident
  - Source position: Known
  - Release volume and time : Unknown
  - Observed data: Radiation dose of Gamma ray

STE technique of Lagrangian Particle model(1)

- Diffusion model
  - Data of each particle

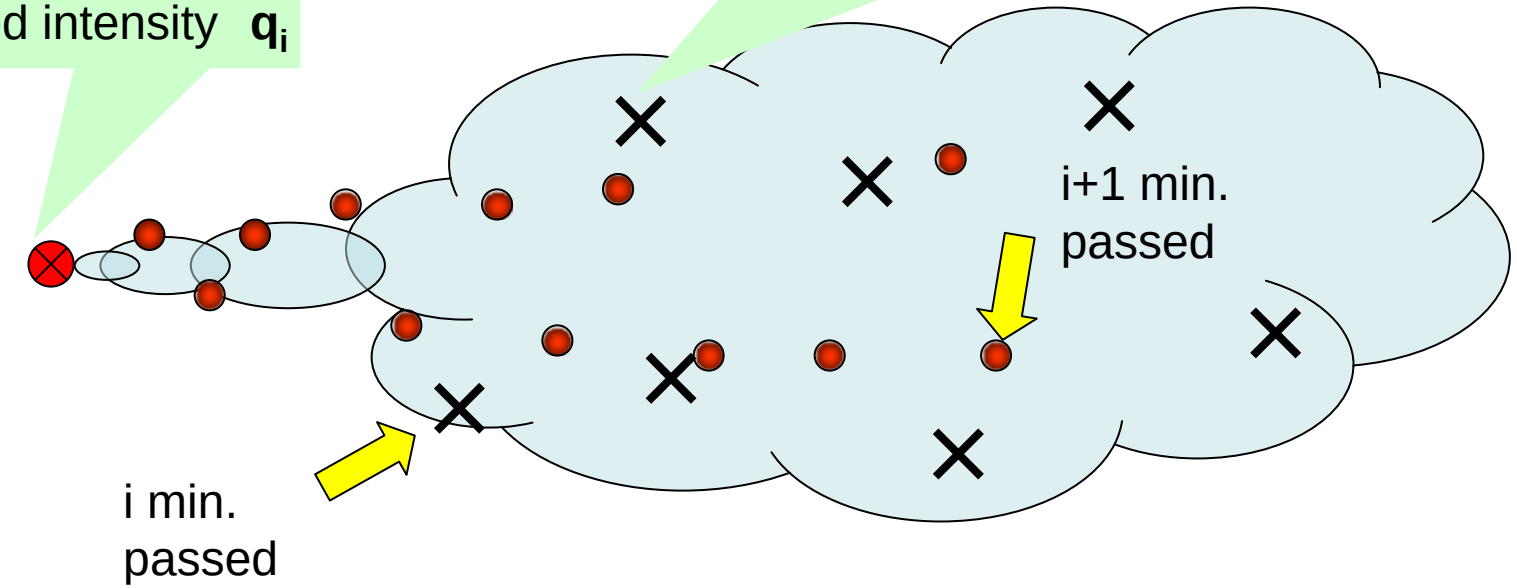
- Present position
- Released time
- Released intensity



- STE method
  - Calculation variables

- **Influence function** ϕ_{ij}
- **Calculated data** $F_j = \Sigma \phi_{ij} q_i$
- **Observed data** f_j
- **Residual norm** $\pi_j = \Sigma \{F_j - f_j\}^2$

- Released intensity q_i



Determine qi of released intensity, so as to minimize π

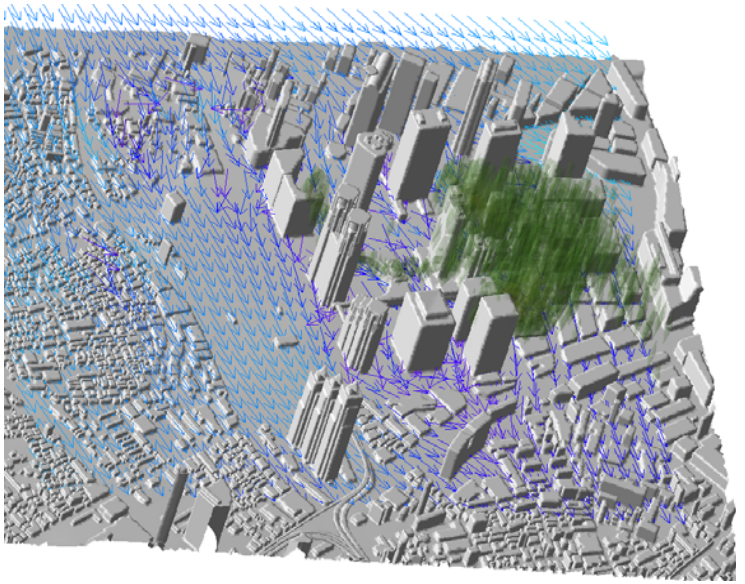
Test calculation (1)

Calculation conditions

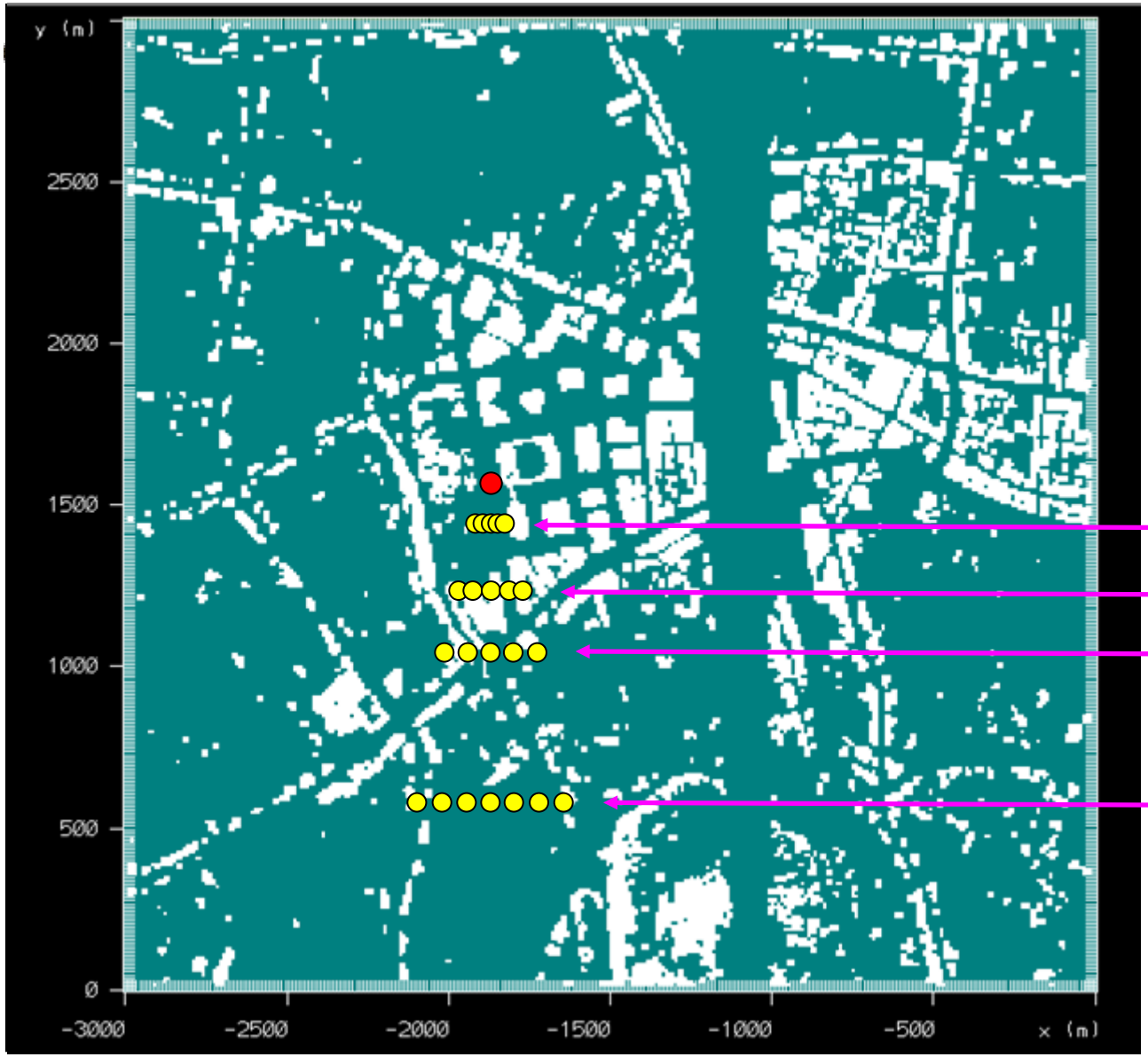
- Area : Downtown in Tokyo
- Wind : North to South 1m/s
- Observed data : Simulated results

(Released intensity : decreased from 1 to 0 during 30 min.)

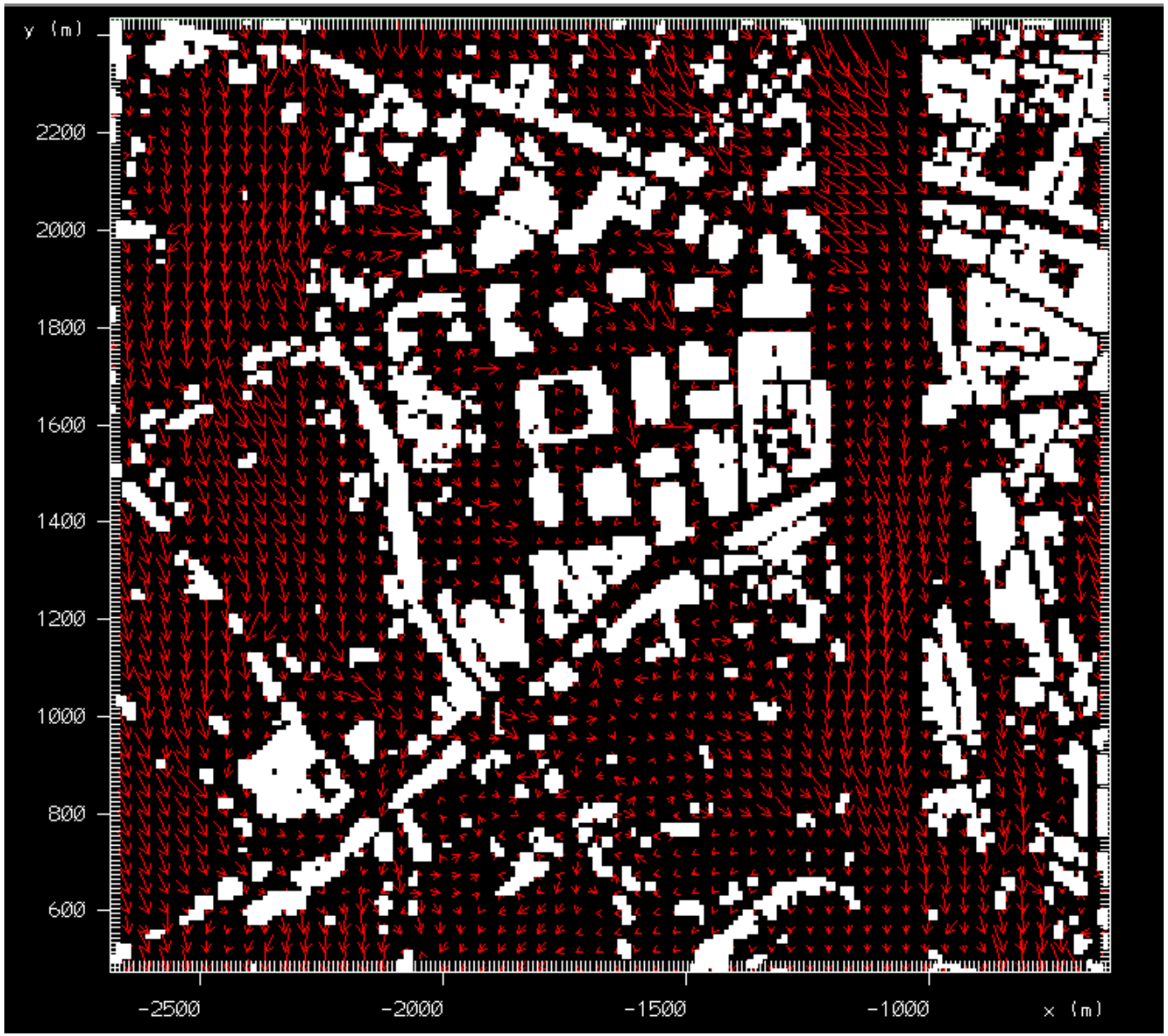
Calculated results by
RAMS&HYPACT codes



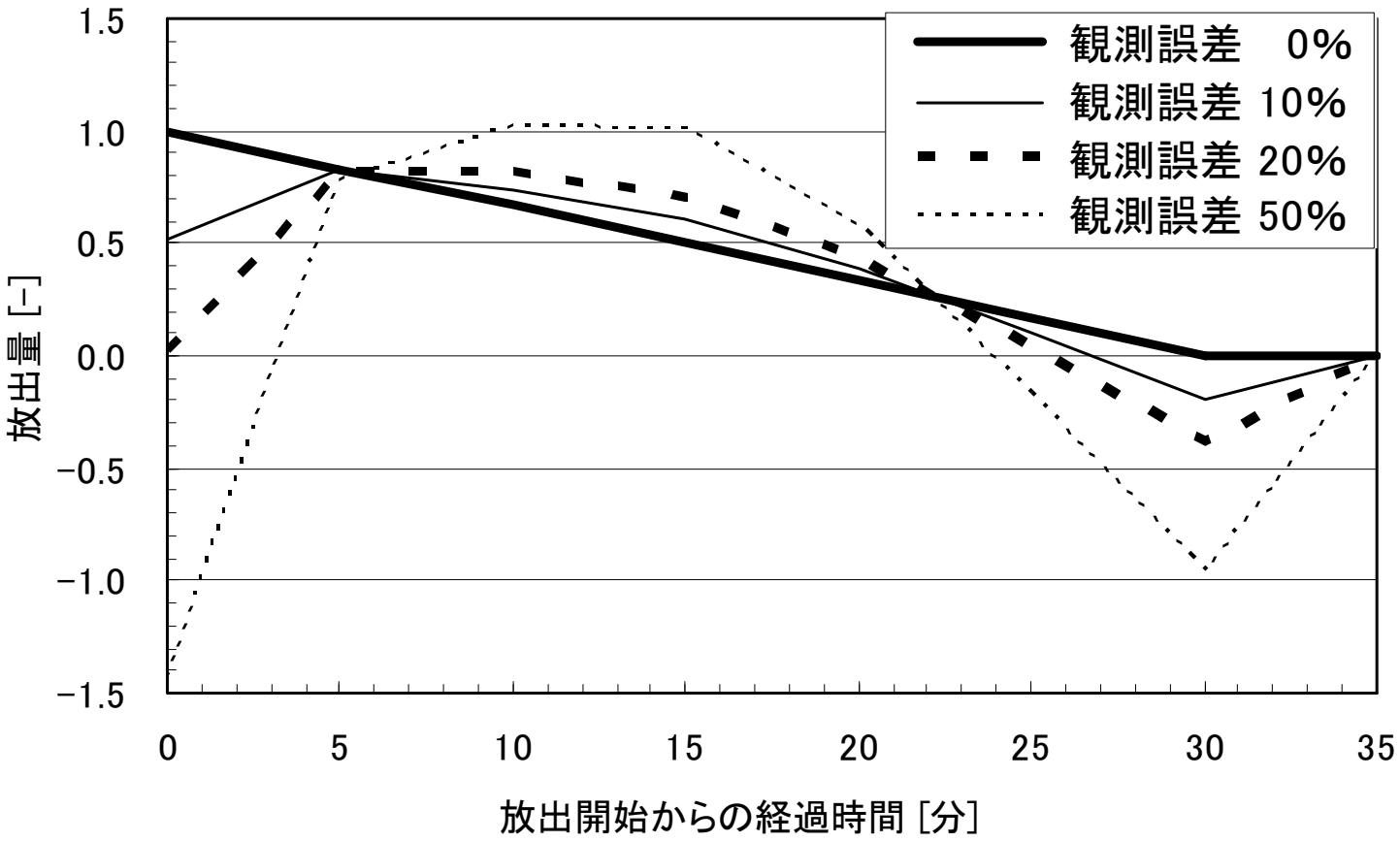
Test calculation (2): Source position and observation points



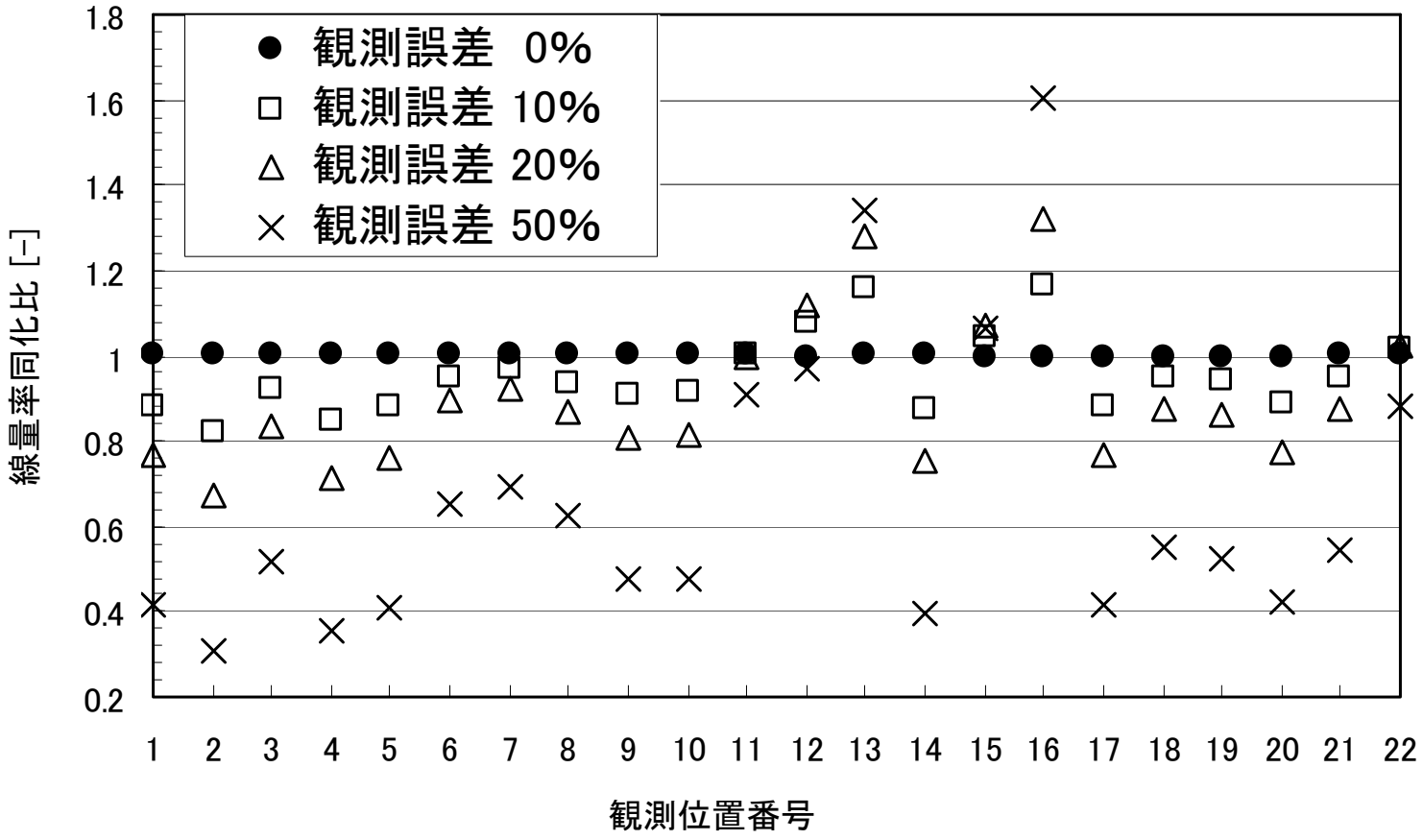
Test calculation (3): Wind vector around buildings



- Sensibility study on noise of observed data
  - 放出量同定精度



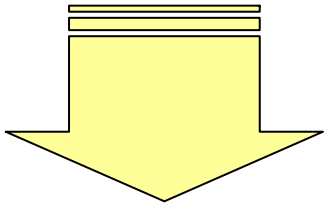
- Sensibility study on noise of observed data
  - 線量同定精度



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

補足(1)

- 拡散予測精度の向上(4次元同化)

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