CFD simulation of atmospheric dispersion over a flat field in low-wind stable conditions using anisotropic turbulence models

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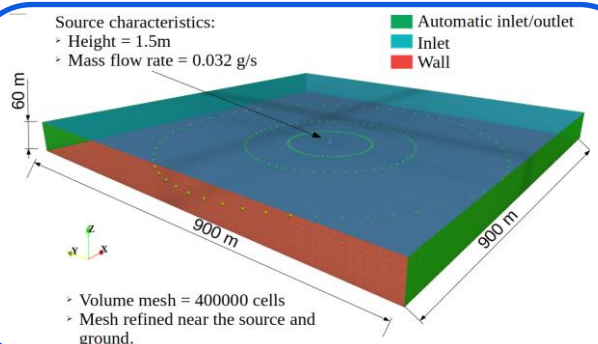
Objective

- Investigating the behavior of **anisotropic RANS model Rij-ε** (Launder et al., 1975) for dispersion of a pollutant in low wind stable conditions, using a 3-D CFD code, **Code_Saturne®** (EDF).
- Comparison with the standard k-ε model (Launder & Spalding, 1974).

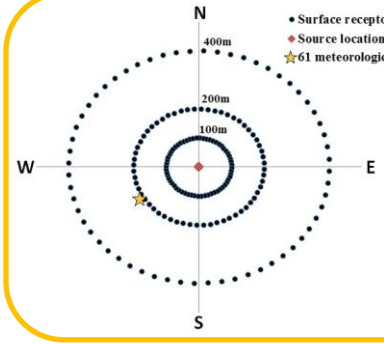
Numerical setup



Comparison of models

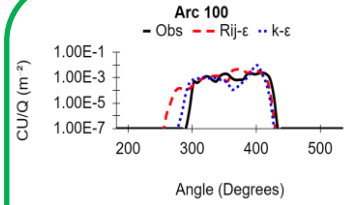
- Prediction percentage of overall observations within a factor of two:
  - 38% for Rij- ε
  - 35% for k-ε
- Better prediction of overall peak concentrations by Rij-ε model ↔ Better representation of the anisotropic turbulent flow

Dataset for validation



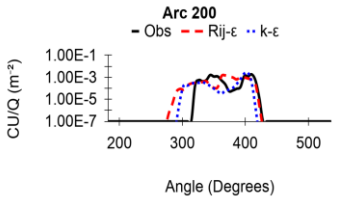
Idaho Falls field experiment (Sagendorf & Dickson, 1976):

- **Run 10 (duration : 49 min)**
- **Variable wind direction**
- **360°sampling grid, 180 positions of receptors**



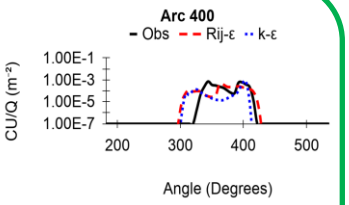
$(C_{p,peak}/C_{o,peak})_{Rij-\varepsilon} = 1.84$

$(C_{p,peak}/C_{o,peak})_{k-\varepsilon} = 3.36$



$(C_{p,peak}/C_{o,peak})_{Rij-\varepsilon} = 0.81$

$(C_{p,peak}/C_{o,peak})_{k-\varepsilon} = 1.37$



$(C_{p,peak}/C_{o,peak})_{Rij-\varepsilon} = 0.60$

$(C_{p,peak}/C_{o,peak})_{k-\varepsilon} = 0.97$

Conclusion