Physical model for air quality prediction

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ITT10

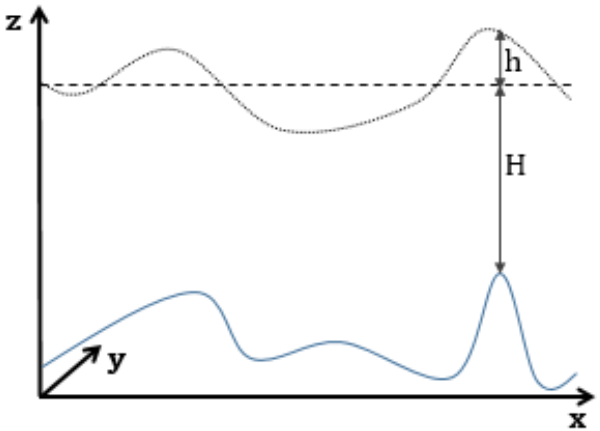
Use a physical model to predict pollutant concentrations and use data to calibrate the model

Fluid model

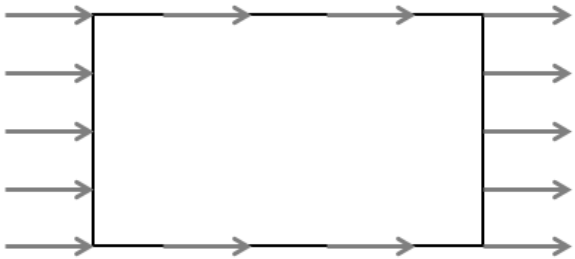
$$\frac{\partial \eta}{\partial t} + \frac{\partial}{\partial x}(\eta u) + \frac{\partial}{\partial y}(\eta v) = 0$$

$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} = -g\frac{\partial \eta}{\partial x}$$

$$\frac{\partial v}{\partial t} + u\frac{\partial v}{\partial x} + v\frac{\partial v}{\partial y} = -g\frac{\partial \eta}{\partial y}$$



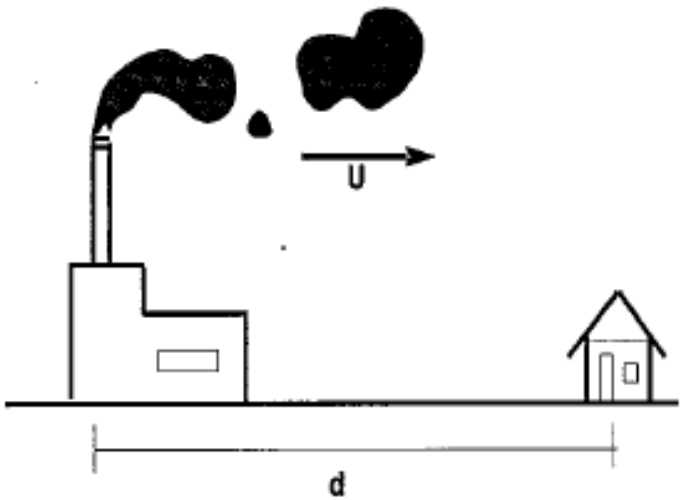
Boundary condition: fixed wind direction and velocity



u= velocity component in x direction
v= velocity component in y direction
$\eta = H + h$
H= heigh from the city profile to the reference level
h= heigh variation from the reference level
g= gravity

Advection - diffusion

$$\frac{\partial C}{\partial t} + \mathbf{u} \cdot \nabla C = D\nabla^2 C + f$$



Use data to calibrate the model:

- Predict the sensors measurements based on model
- Calculate the error
- Make adjustments to the model

Diffusion coefficients are initially unknown.