Strategy of the water fluid NN study in KAGRA

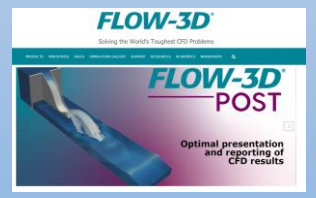
NN calculation

$$a(t) = \iint \frac{G\rho z(x,y,t)\cos\theta}{D^2 + x^2 + y^2}\mathrm{d}x\mathrm{d}y$$

$$h(t) = \frac{1}{L}\iint a(t)\mathrm{d}^2t$$

water level $z(x, y, t)$ [m]

Water fluid simulation

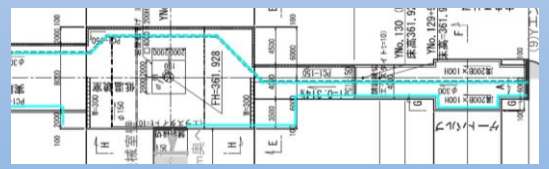


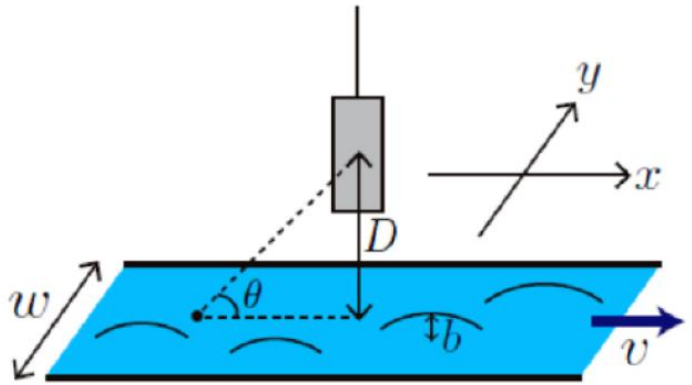
water current $J(t)$ [m^3/s]

geometry

Water fluid monitor

KAGRA Geometry





To get cogent results,
we are working on the
step-by-step studies.

Strategy of the water fluid NN study in KAGRA

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water level $z(x,y,t)$ [m]

Simple function

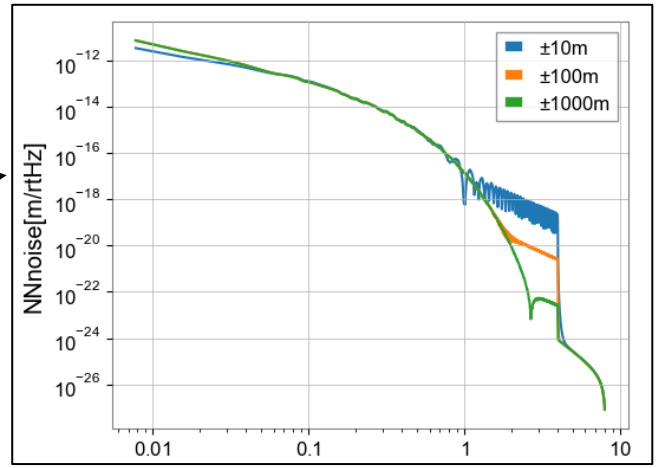
$$z(x,y,t) = b\sin(kx - \omega t + \phi)$$

water current $J(t)$ [m^3/s]

geometry

Step 1. Can we perform the appropriate treatment?

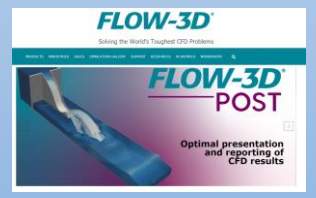
- ☐ Sampling time
- ☐ Grid (*x*,*y* mesh)
- ☐ Edges of the canal
- ☐ numerical integration
- ☐ processing time
- ☐ other bugs?



Strategy of the water fluid NN study in KAGRA

water level $z(x, y, t)$ [m]

Water fluid simulation



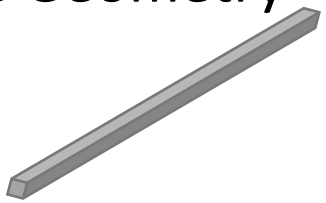
water current $J(t)$ [m^3/s]

Constant value

$J(t) =$ ■ m^3/s

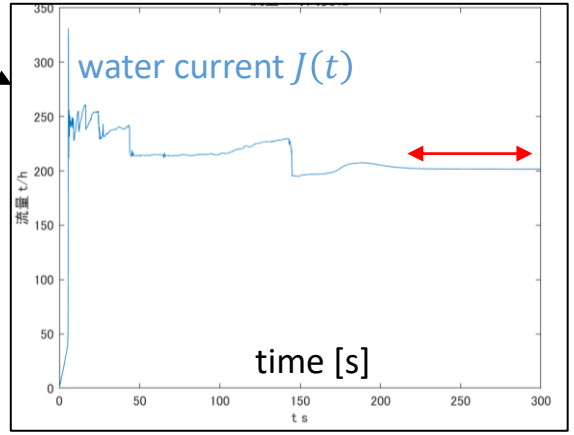
geometry

Simple Geometry



Step 2. Understandings of the water simulation

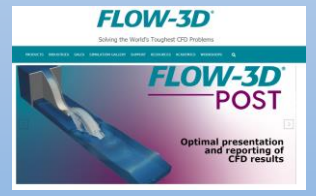
- ☐ Stability, convergence
- ☐ Boundary condition
- ☐ Turbulence/Laminar flow
- ☐ Sampling time
- ☐ Grid (*x*,*y* mesh)
- ☐ processing time
- ☐ Cross check with other software



Strategy of the water fluid NN study in KAGRA

water level $z(x, y, t)$ [m]

Water fluid simulation

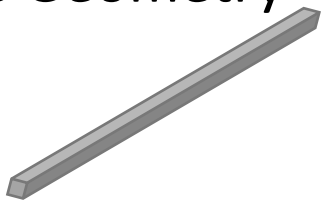


water current $J(t)$ [m^3/s]

Water fluid monitor

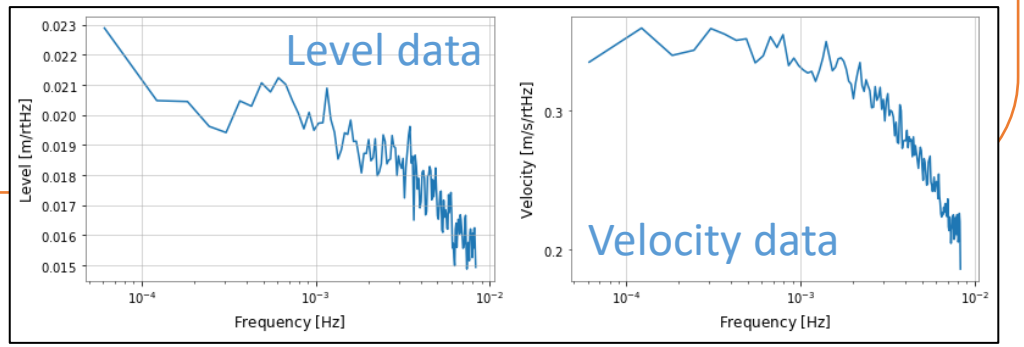
geometry

Simple Geometry



Step 3. Can the water simulation be consistent with the measurement for the simple canal?

- ☐ Frequency spectrum of the velocity
- ☐ Frequency spectrum of the water level
- ☐ Wave-number spectrum of the water level
- ☐ other values?



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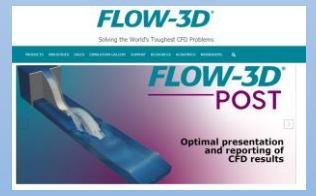
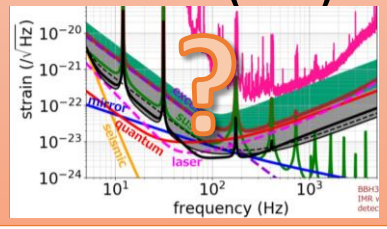
Water fluid simulation



water current $J(t)$ [m^3/s]

Water fluid monitor

KAGRA data (O4)



Step 4. Compare with the O4 (commissioning) data

- ☐ Is it limiting the sensitivity?
- ☐ Change the water amount (valve operation)
  - ➢ Enhance the NN.

geometry

KAGRA Geometry