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Estimating the Newtonian noise of groundwater at the KAGRA

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Changes due to gravitational waves are very small, so noise is generated due to various factors. KAGRA was built 300 meters underground to reduce ground vibrations. The groundwater generated underground is discharged through pipes. The gravity gradient generated by the universal gravitation force due to the oscillation of the water surface through the pipe may cause the mirror of KAGRA to shake and become a noise to the target sensitivity of KAGRA.
Our experiment was conducted using the simulation software Flow-3D in order to know the magnitude of Newtonian noise. The Newtonian noise was evaluated by calculating the waveform of the flowing water.

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