FY19 Update on Modeling Activities for Crystalline Work Package

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Sandia national laboratories

SFWD

Spent Fuel & Waste Disposition

Annual Working Group Meeting
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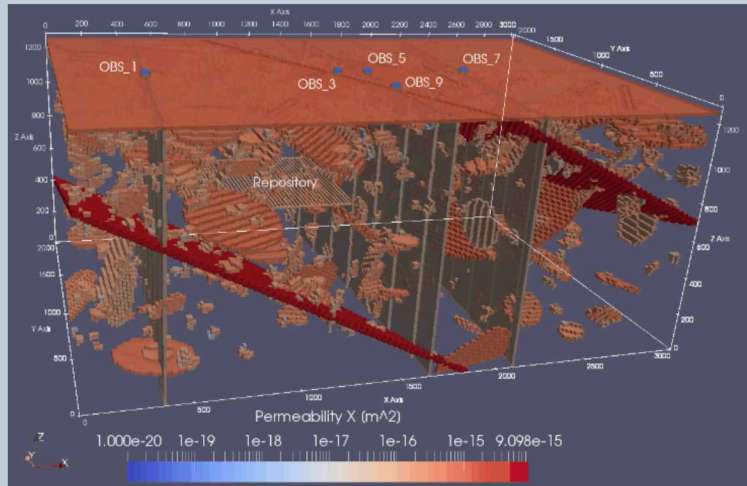
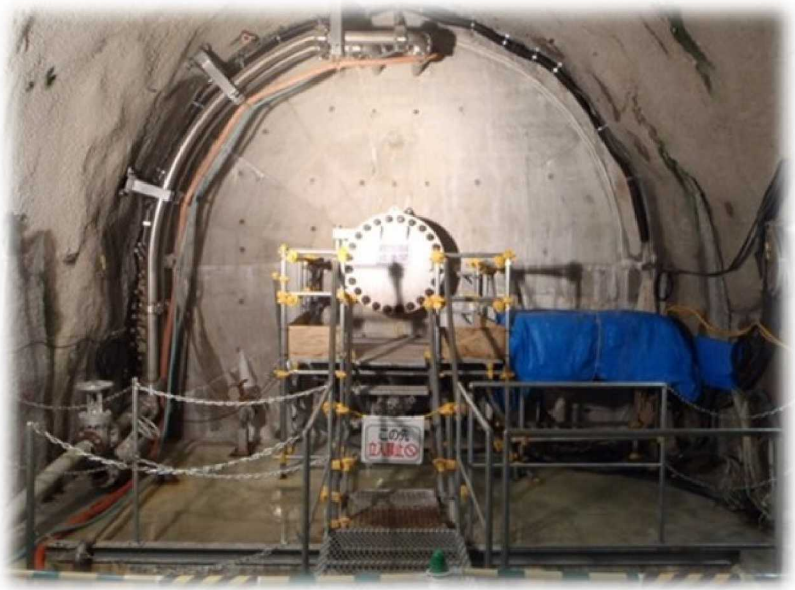
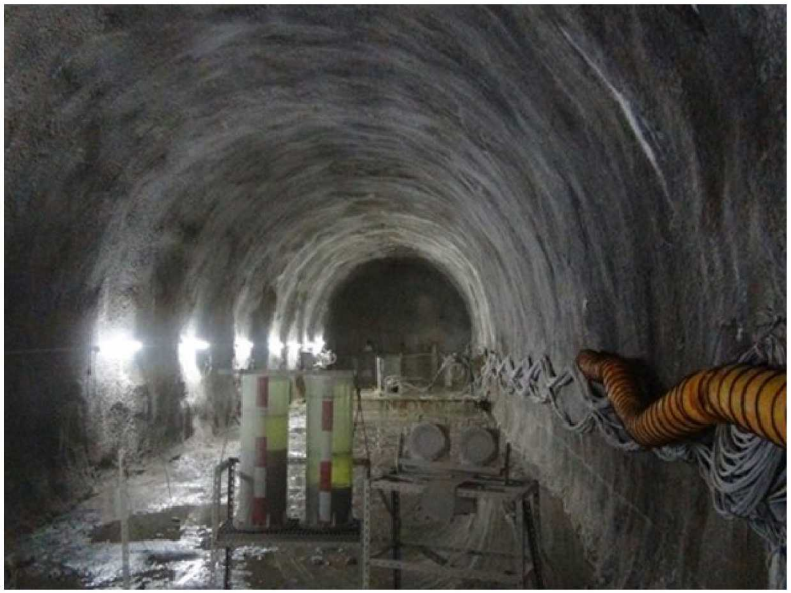


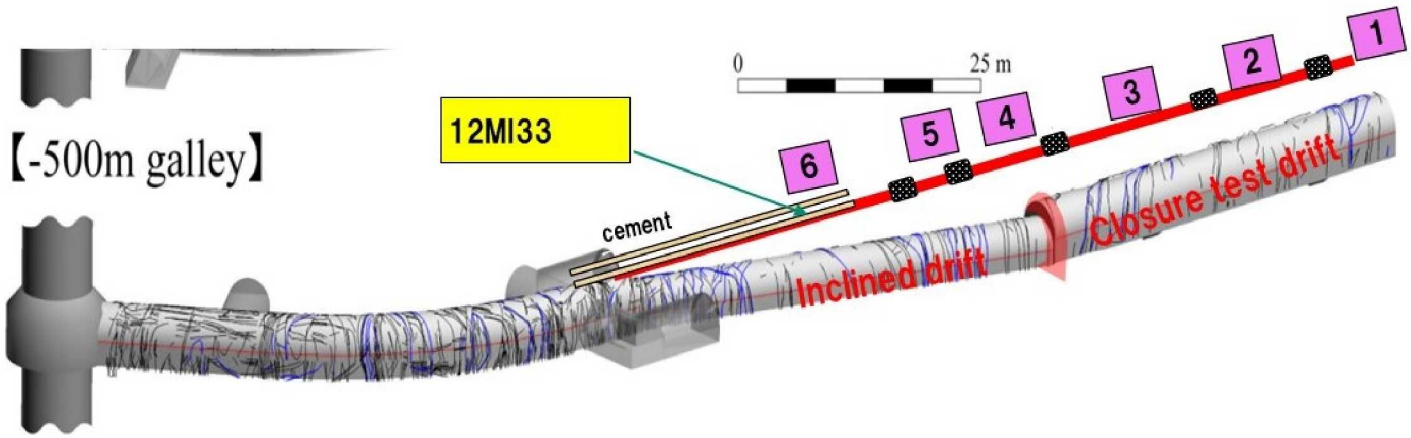
SUMMARY OF FY18-FY19 WORK

- Developing and Testing of fracture models using experimental field data: DECOVALEX-19 Task C
- In-depth study of factors that affect flow and transport
- International Participation: DECOVALEX-19
  - Task A: Modeling advective gas flow through low permeability materials
  - Task C: Hydro-mechanical-chemical-biological processes during groundwater recovery
  - Task F: Fluid inclusion and movement in tight rock
- Reports and Publications:
  - Evaluation of Spent Fuel Disposition in Crystalline Rocks: FY18 Progress report
  - Presentations at 6th and 7th DECOVALEX-19 Workshops
  - DFNE-2018 Conference, Seattle, WA, June 20-22, 2018
  - CouFrac-2018 Conference, Wuhan, China, Nov. 12-14, 2018
  - IHLRWM Conference, Knoxville, TN, April 14-19, 2019
  - NWTRB Workshop, San Francisco, CA, April 23-24, 2019

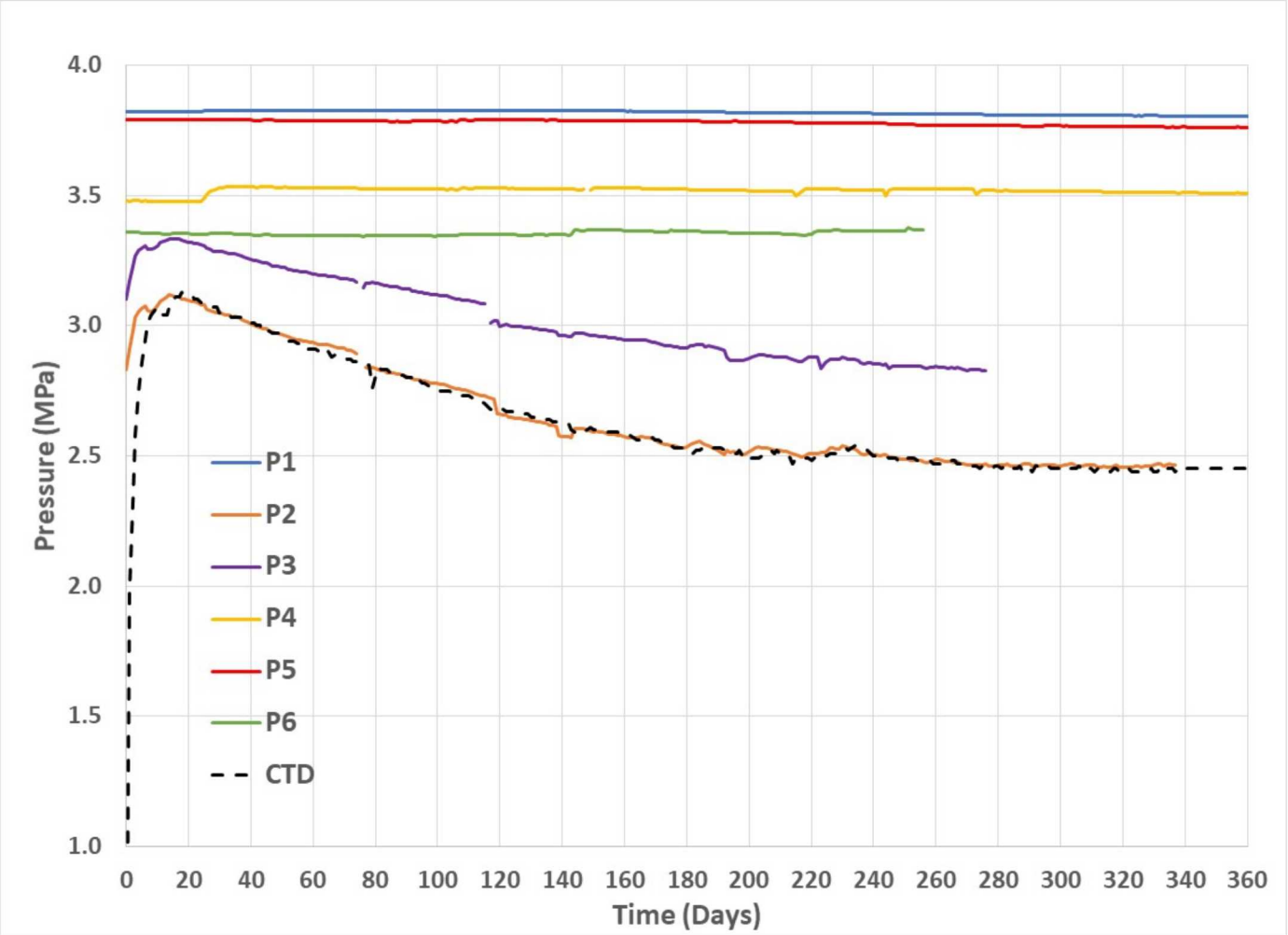
MIZUNAMI URL RECOVERY EXPERIMENTS





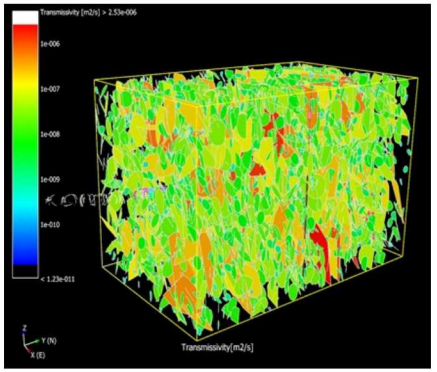


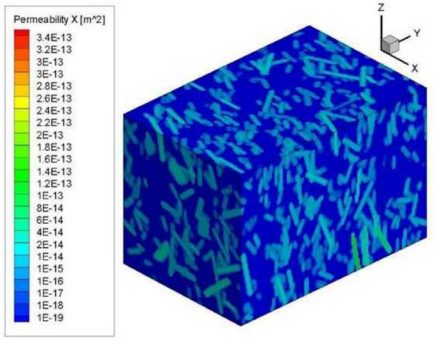
Experimental Pressure Data in CTD and at Observation Points in Well 12MI33

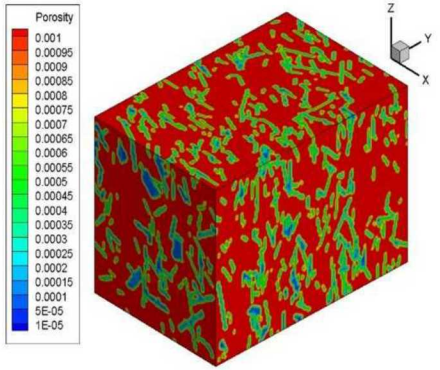


PRESSURE RECOVERY MODELING

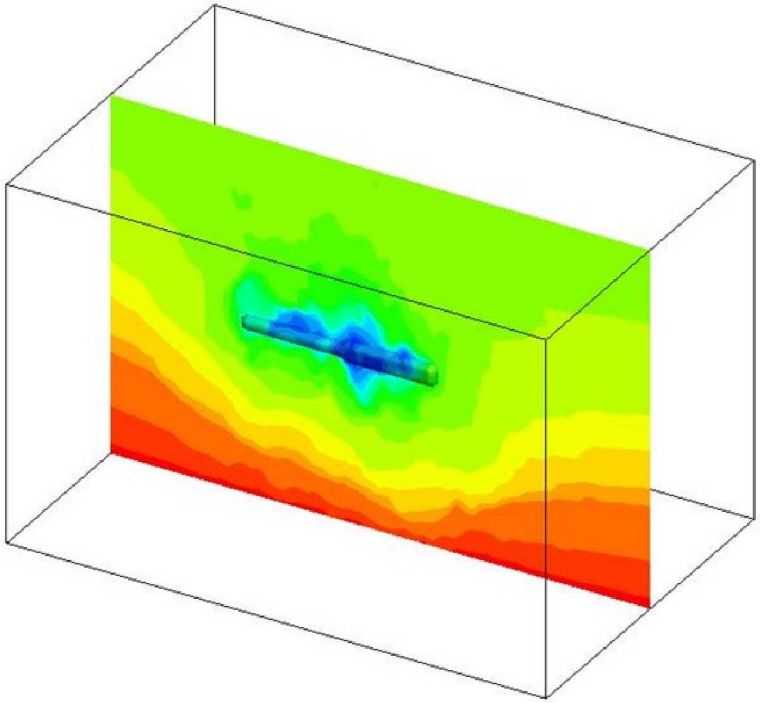
- Base case domain: 200 m x 300 m x 200 m
  - Mesh with 1,500,000 grid blocks (2 m x 2m x 2 m cells size)
- Fracture model used with 10 realizations
  - Upscaled permeability and porosity
- PFLOTRAN used for flow and transport
- Ran model to steady state with experimental pressure data set
- Simulated pressure recovery for a period of one year.



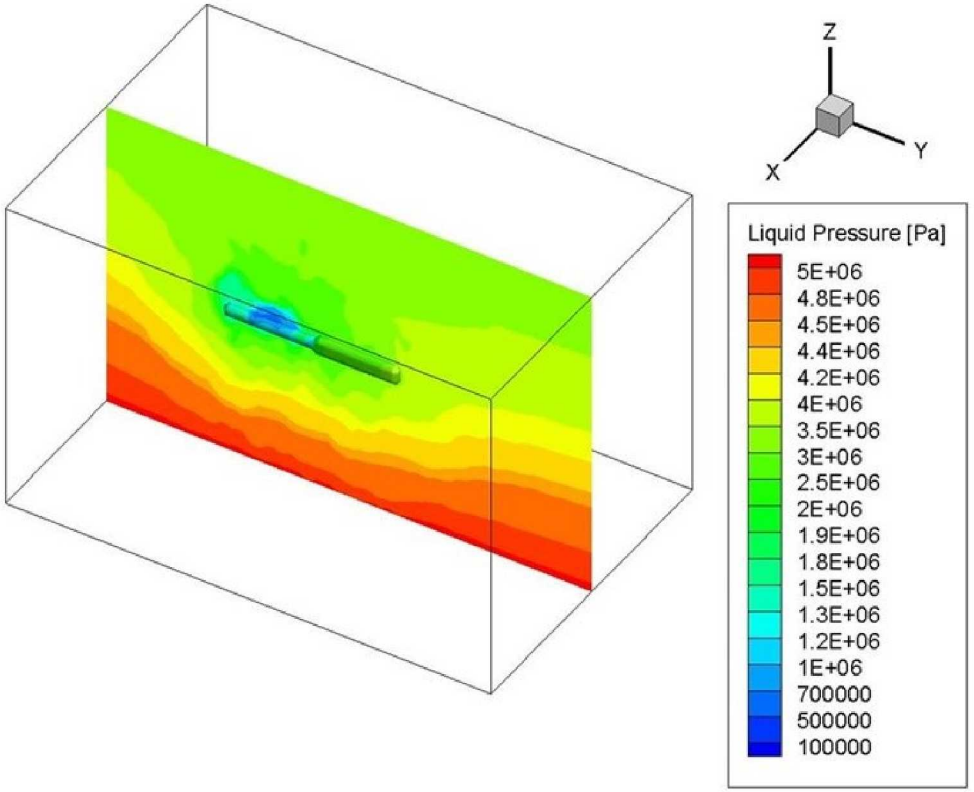




Predicted Pressure Distributions



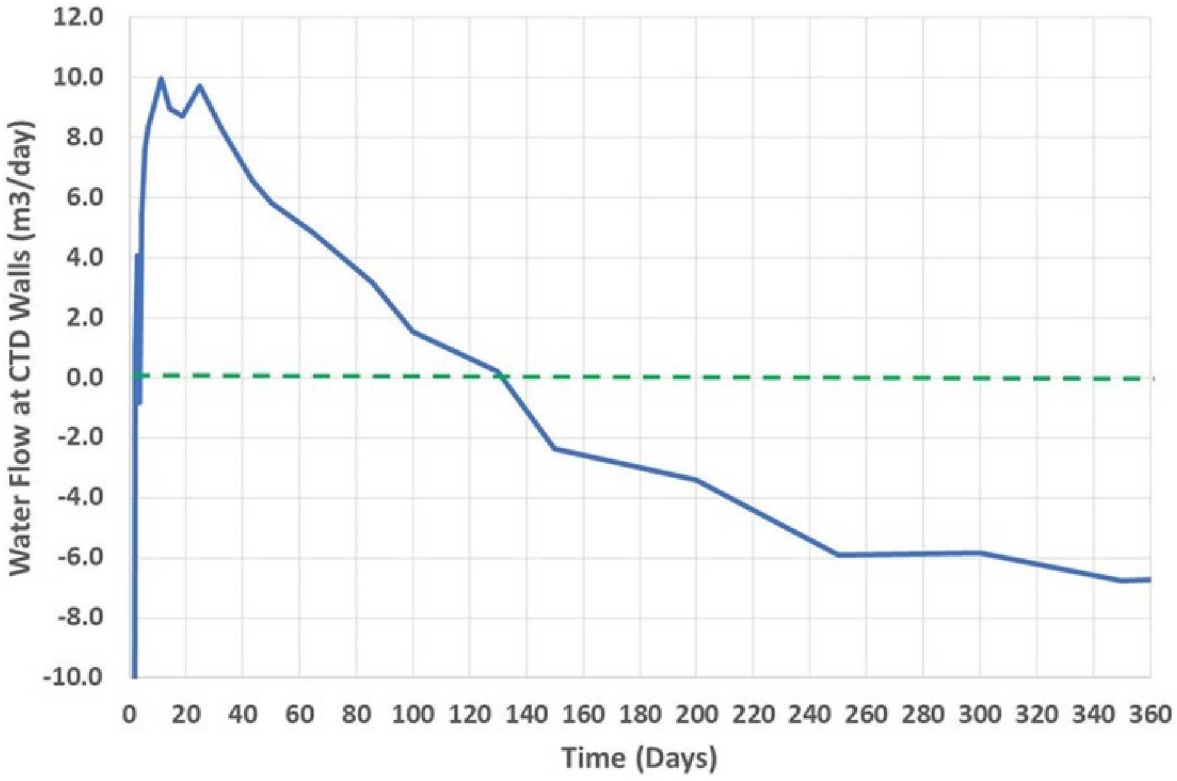
Realization 2:
Predicted pressure at t = 0 days



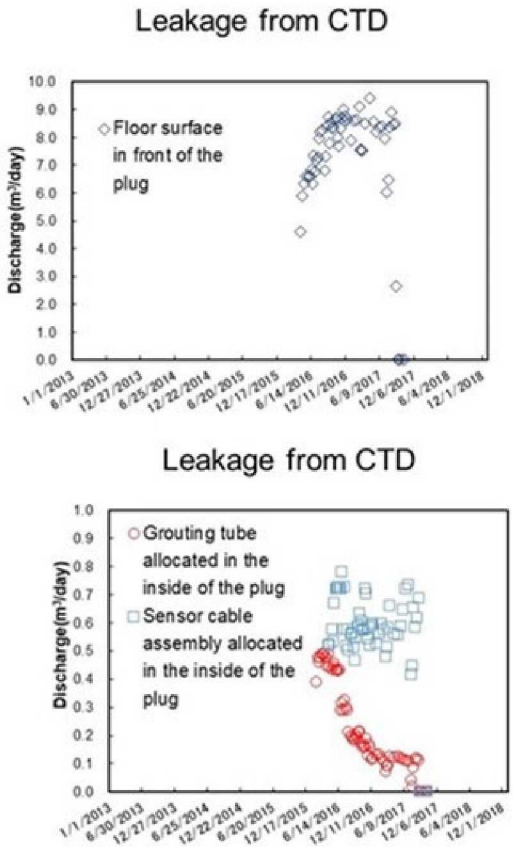
Realization 2:
Predicted pressure at t = 360 days

RECOVERY: PREDICTED FLOW AT CTD

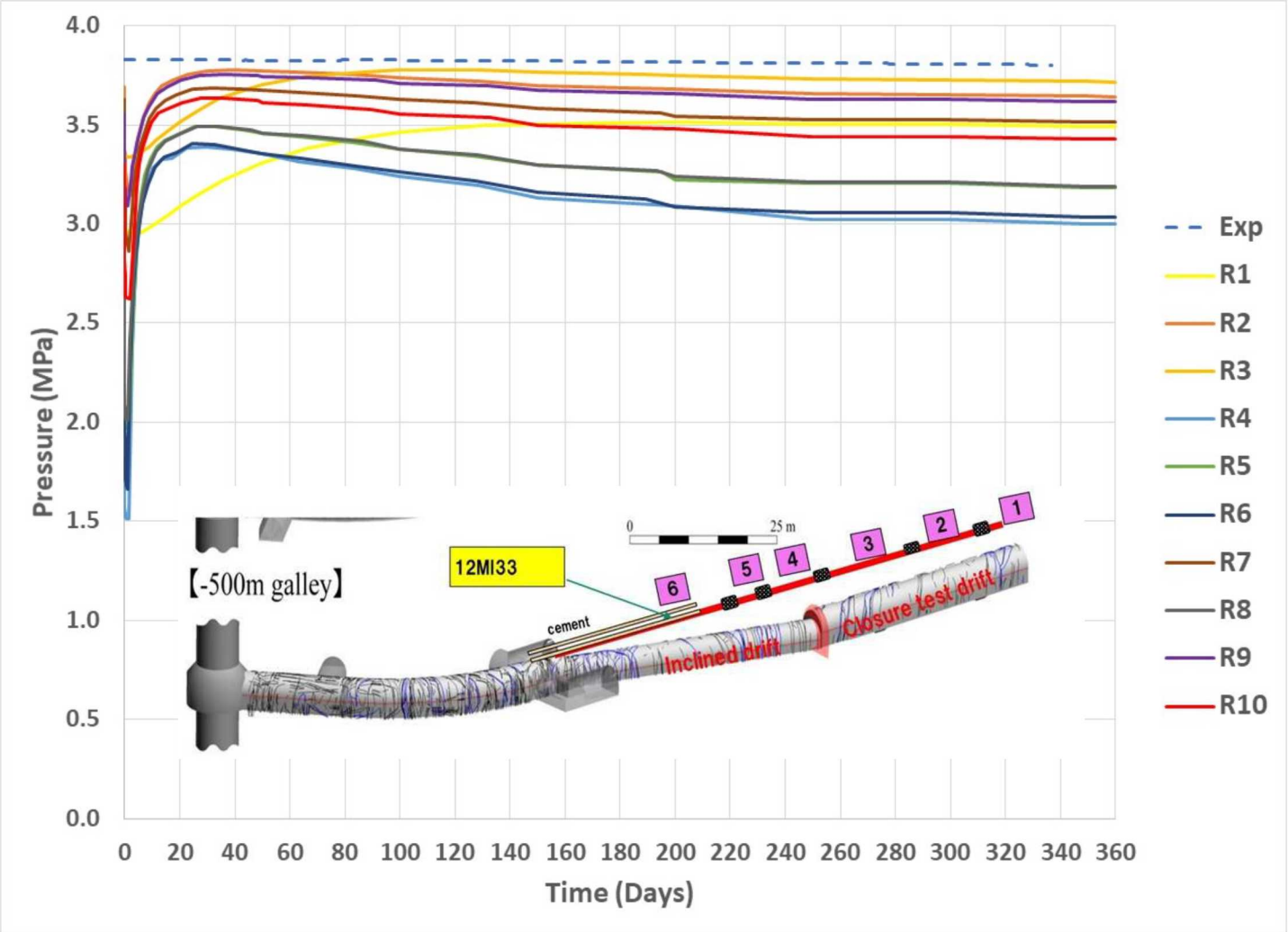
Predicted water flow at CTD



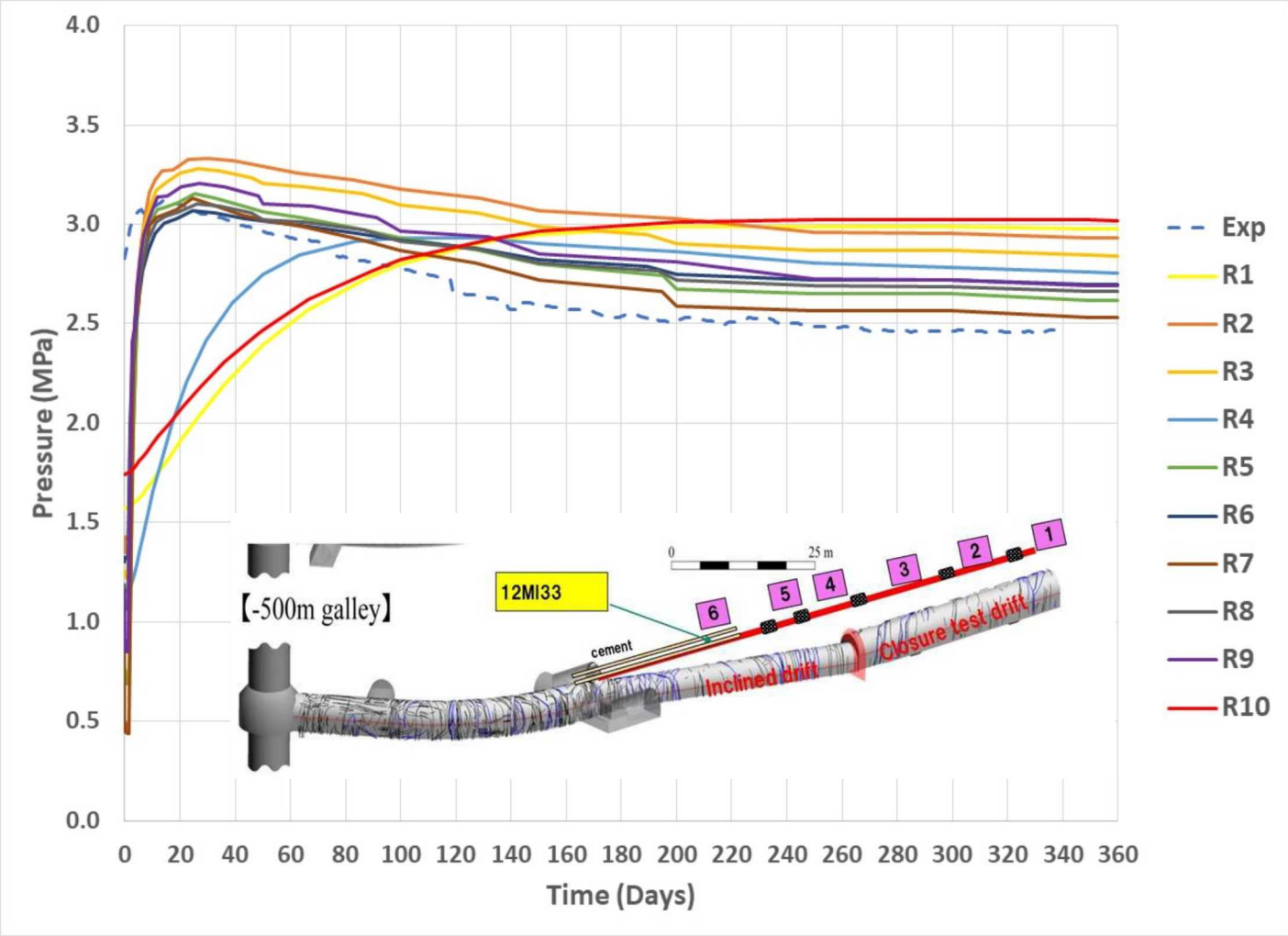
Experimental leakage Data



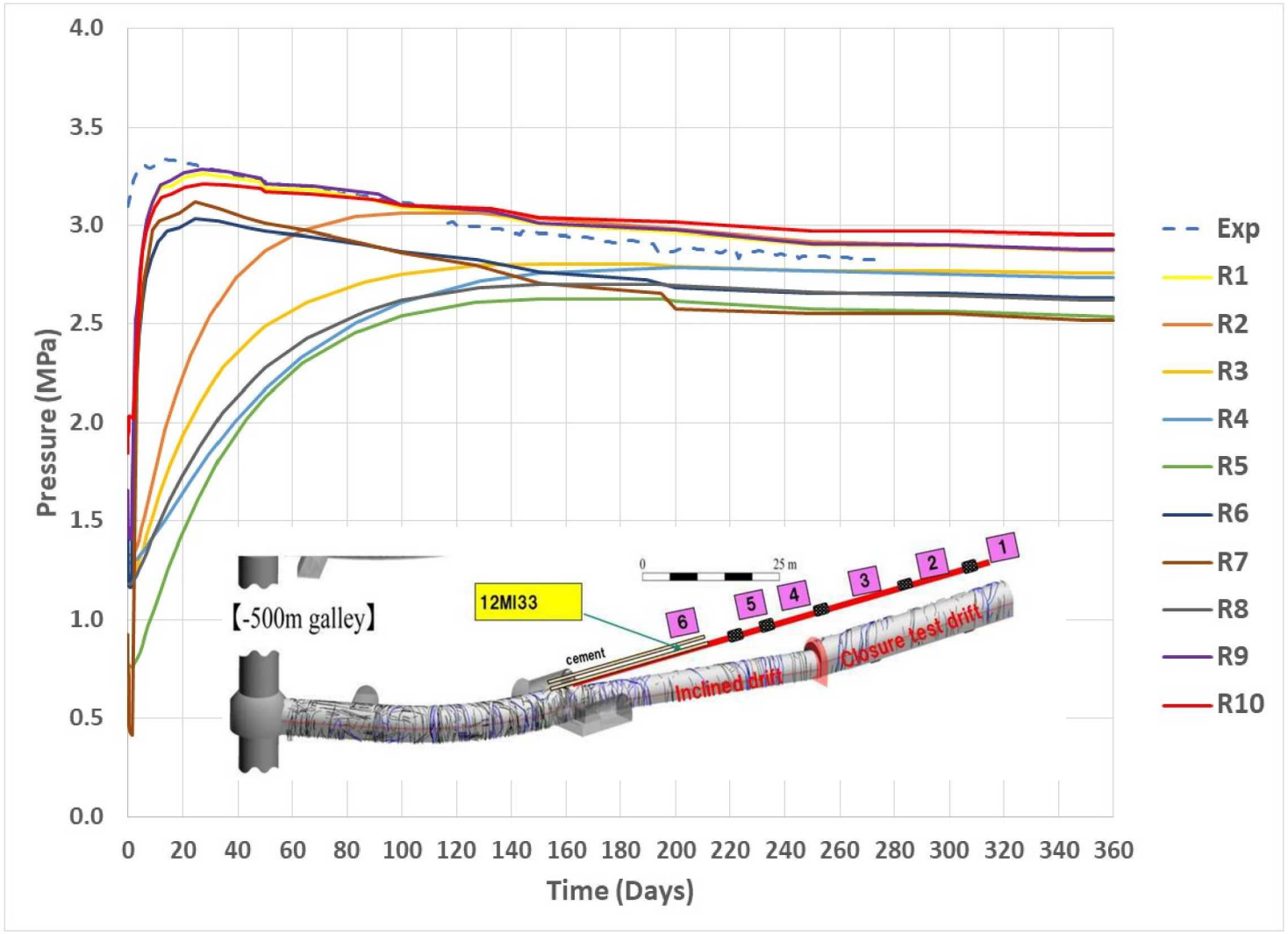
Prediction of Pressure at Observation Point P1



Prediction of Pressure at Observation Point P2

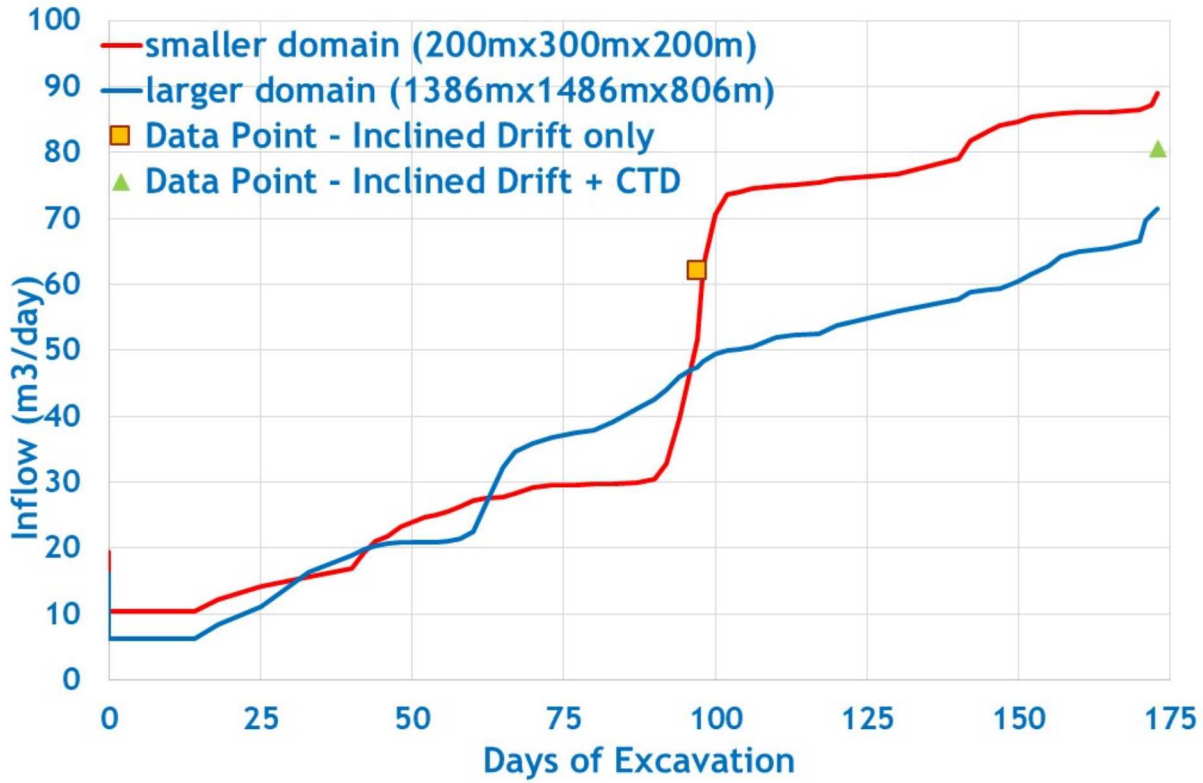


Prediction of Pressure at Observation Point P3



Factors that Influence Flow and Transport in Fractured Crystalline Rock

- Conducted sensitivity study to quantify the effect of:
  - Domain size (boundary condition)
  - Upscaling from DFN to Continuum representation



Summary of DECOVALEX-19 Task C Modeling Work (FY18-19)

- Modeling was conducted to predict recovery experiments at the Mizunami URL.
- Simulations were made to understand the effect of domain size and upscaling on flow and transport (on going).
- Work on DECOVALEX-19 will be completed in 2019.
- Participation in DECOVALEX-19, Task C:
  - Interpretation of measured fracture data from tunnel walls and from packer tests in wells.
  - Development of a fracture model and fracture data for the Mizunami Site.
  - Development of modeling tools for flow, reactive and non-reactive transport, and geochemistry.
  - Comparison of modeling results with international teams (data interpretation, modeling tools).