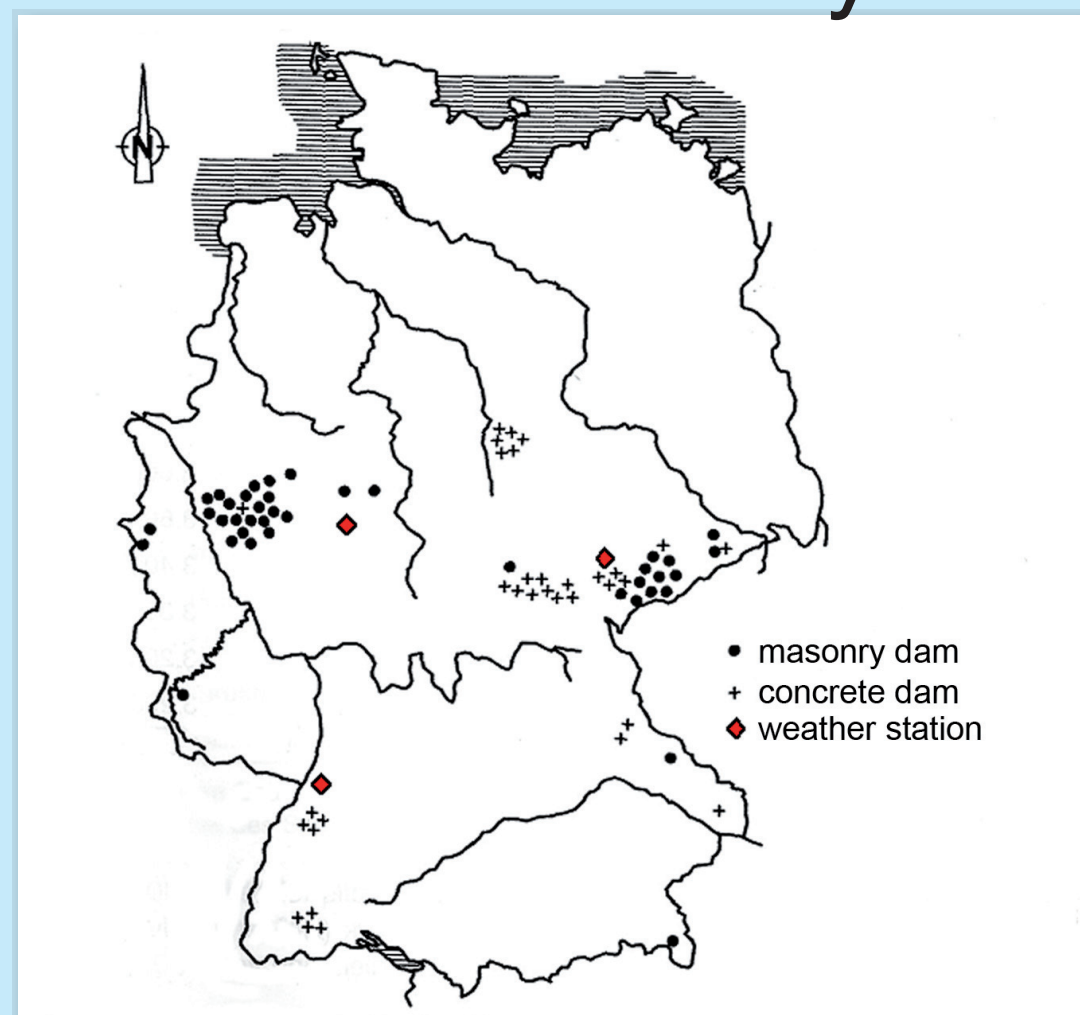


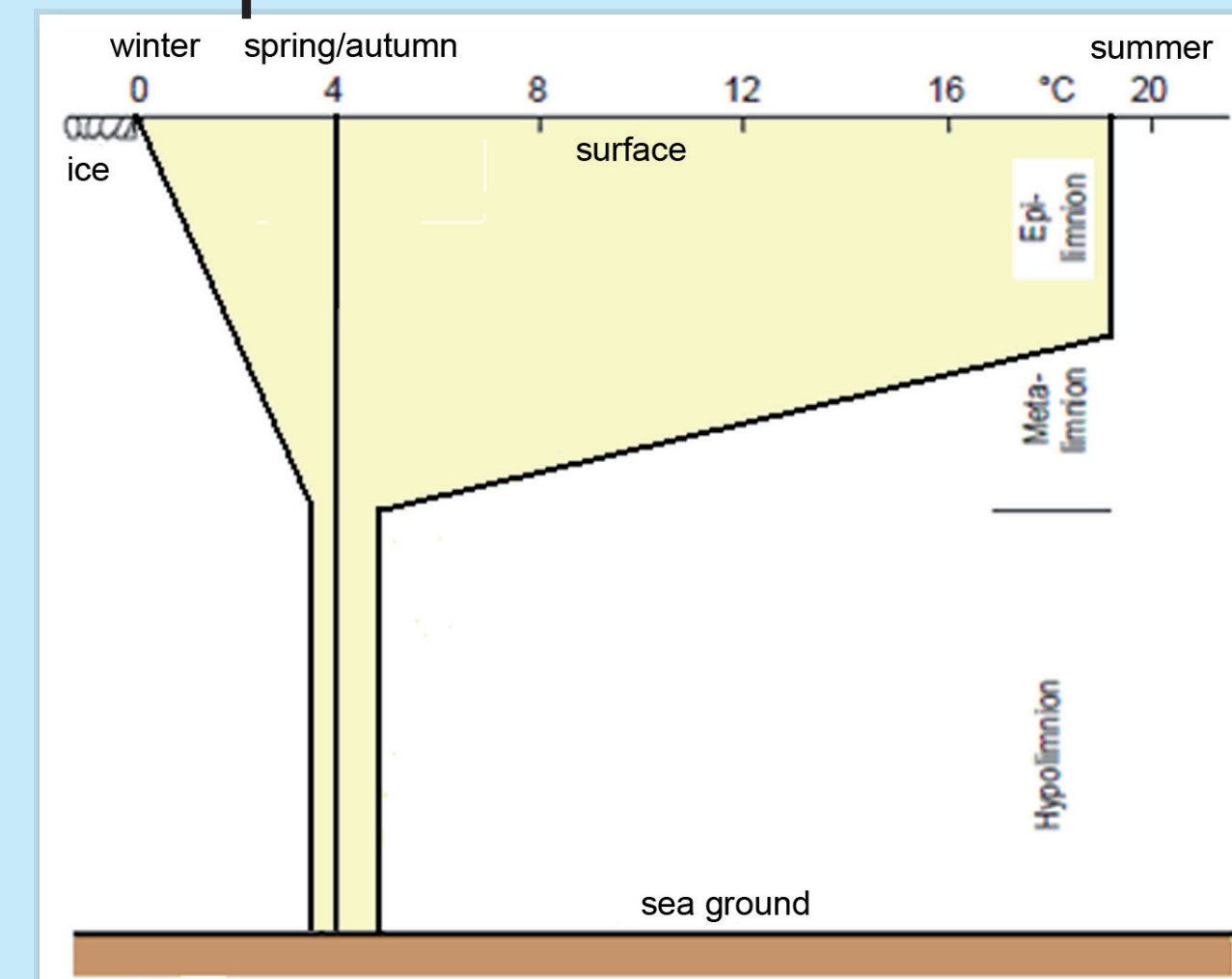
Diploma Thesis: Positioning of Temperature Transmitter to validate Plumblin Movement

The aim of this paper is to find reasonable positions for temperature transmitters in gravity dams, in order to get information about the temperature distribution. Further, the temperature data can be used to evaluate the plumblin movement, which in turn can help to recognize possible failure mechanisms at an early stage and thus, increasing the overall safety of dams.

Dams in Germany



Temperature in dam reservoir



Thermal effect:

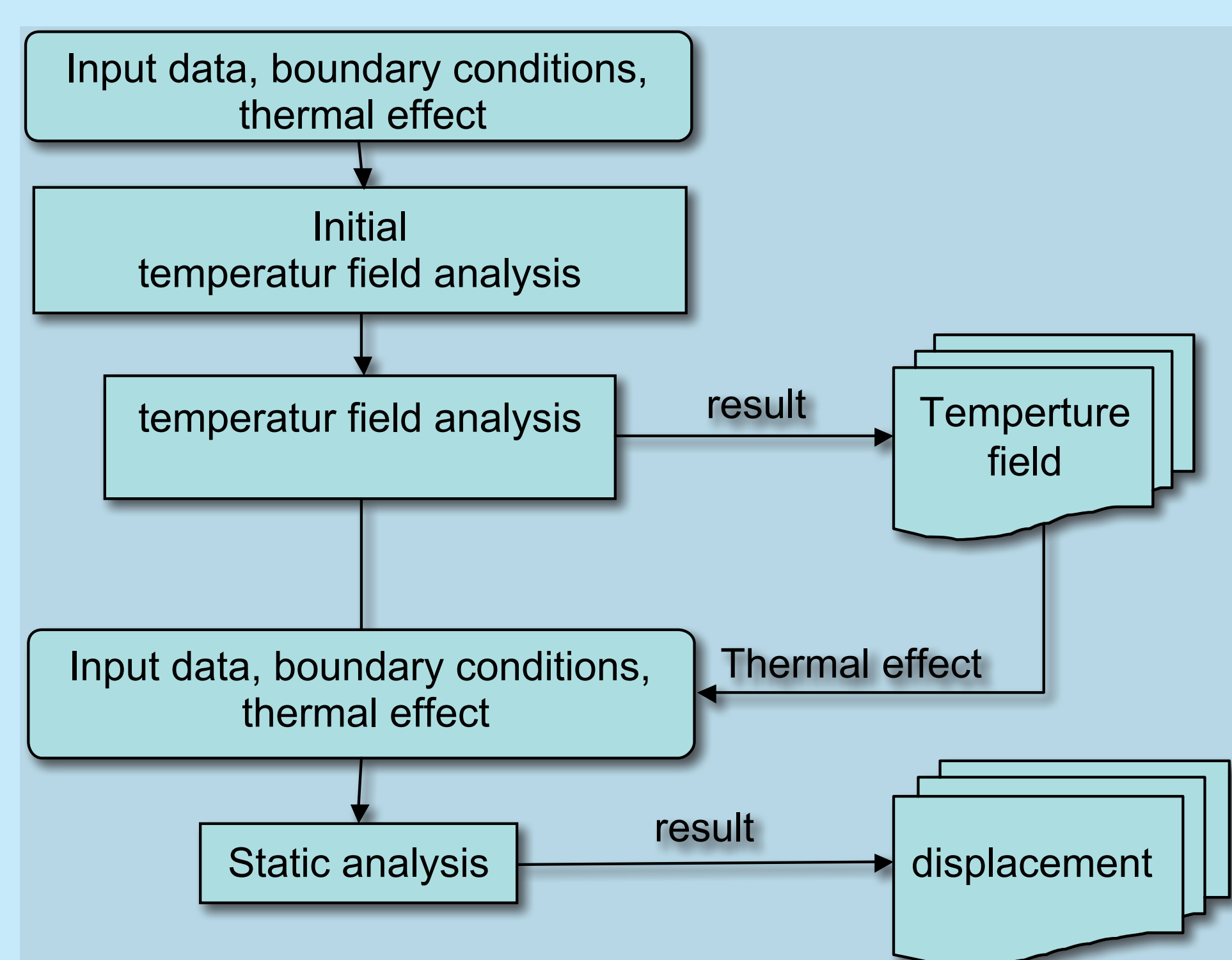
Air:

- Average air temperature of 3 Temperature Stations close to the area with high dam density in Germany.

Water:

- Linear Interpolation of the water temperature between the four seasons.
- Dam reservoir temperature field divided in three sections

Finite Element Analyses Program run



Linear Regression:

- Connection between the plumblin movement and temperature of the nodes by linear regression

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4$$

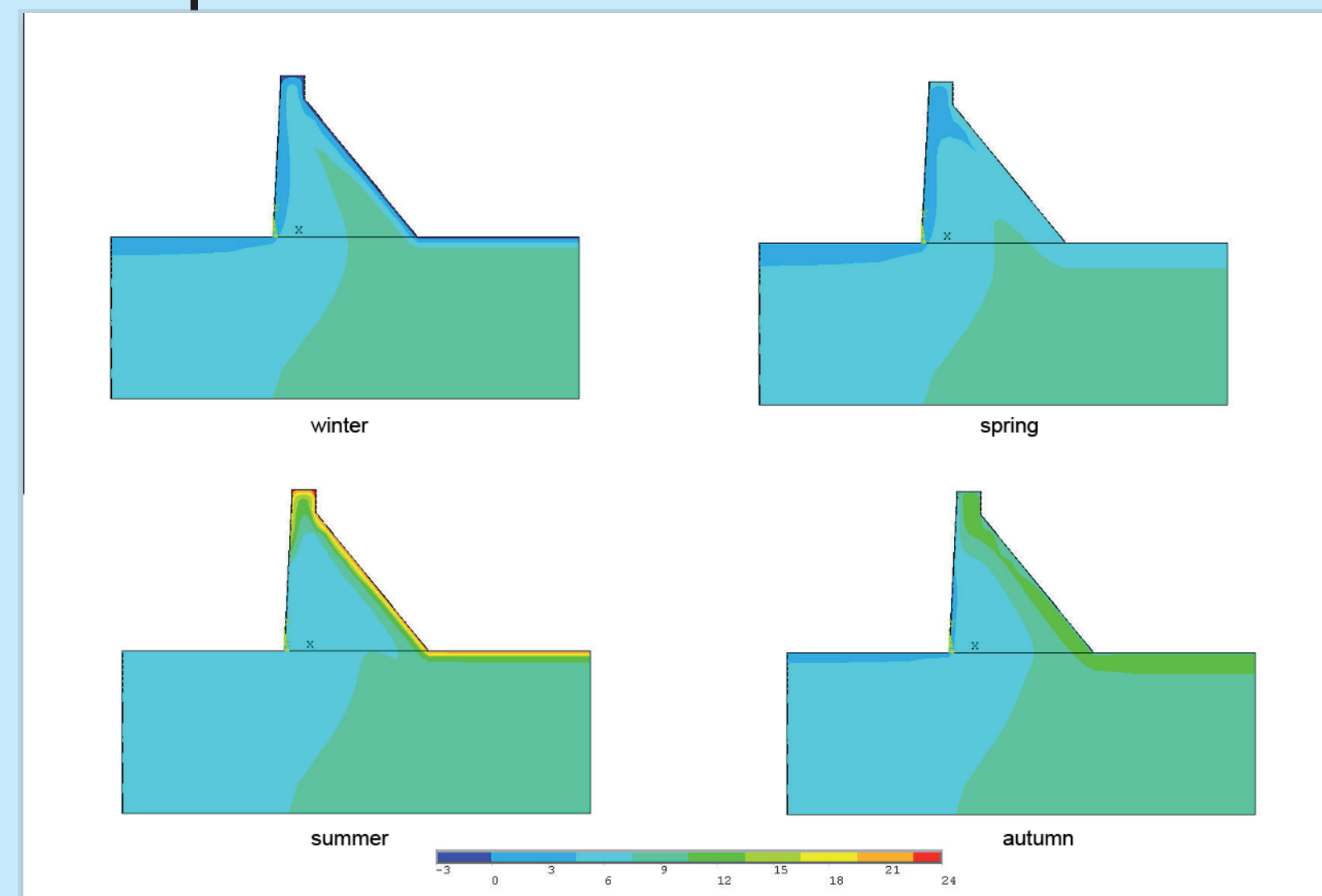
y Regression target (plumblin movement)

x Regression input (temperature field)

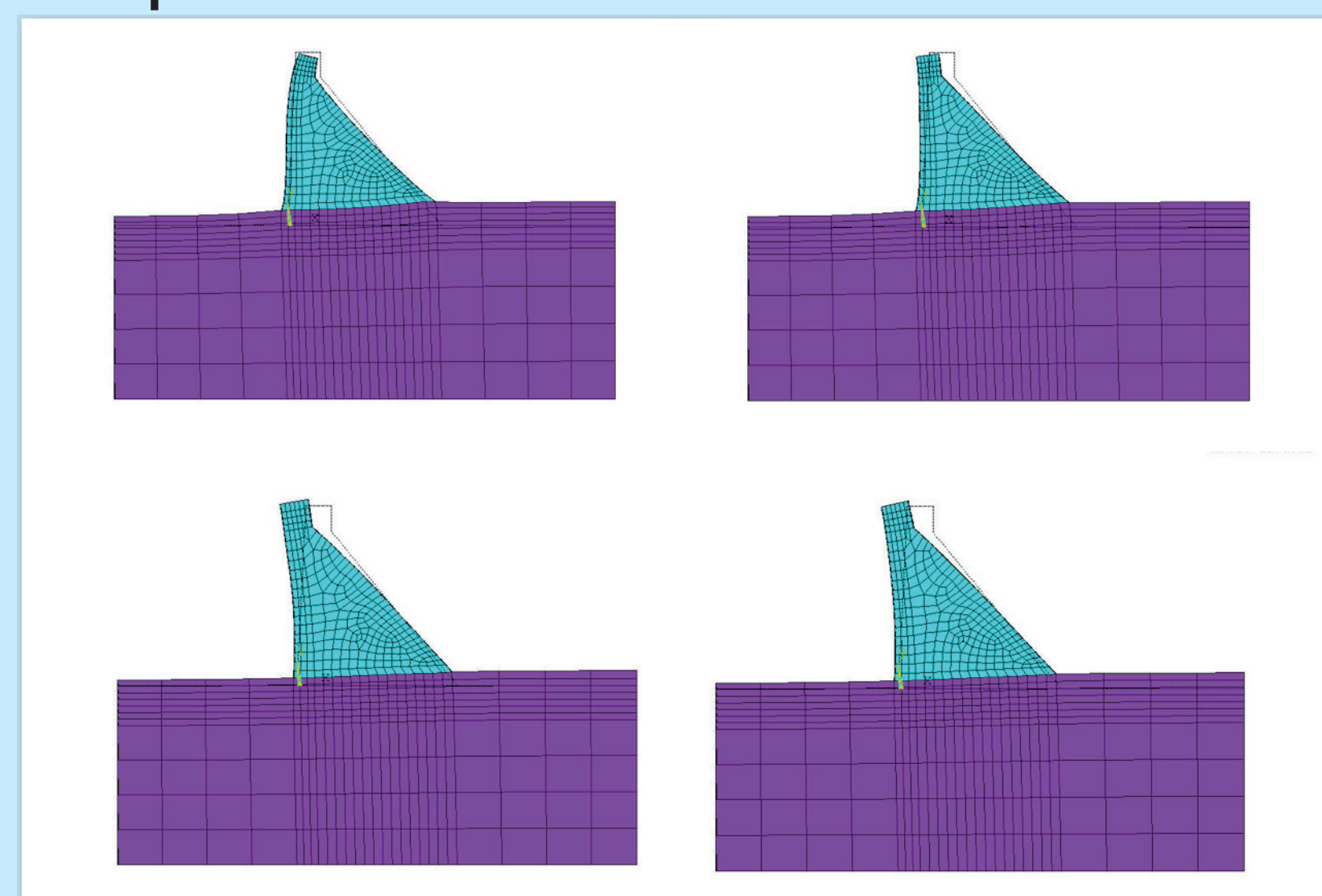
β Regression coefficient

- Choice of measure points with the F-test
- Possible positions for temperature transmitters are all nodes of the finite element mesh

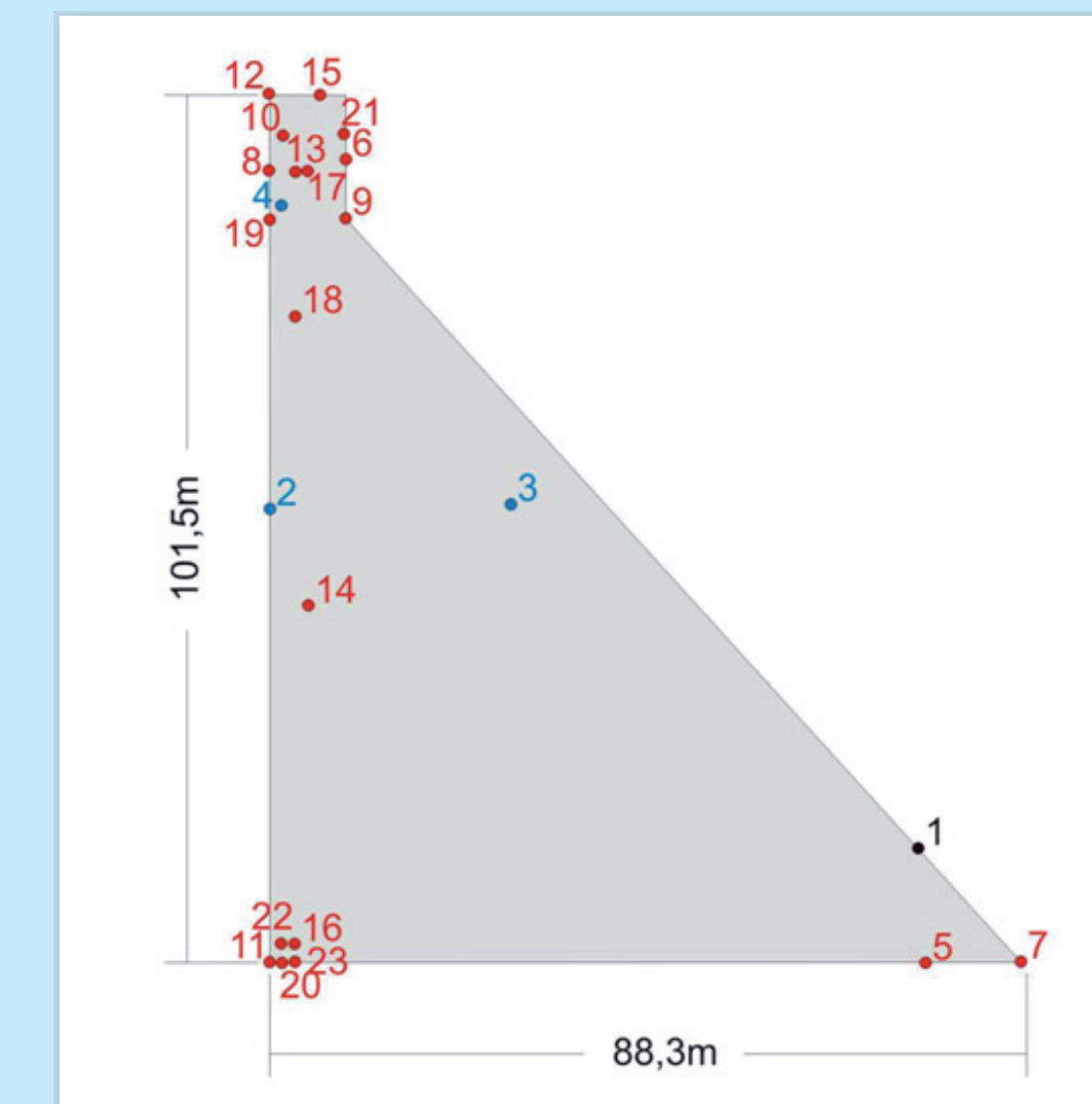
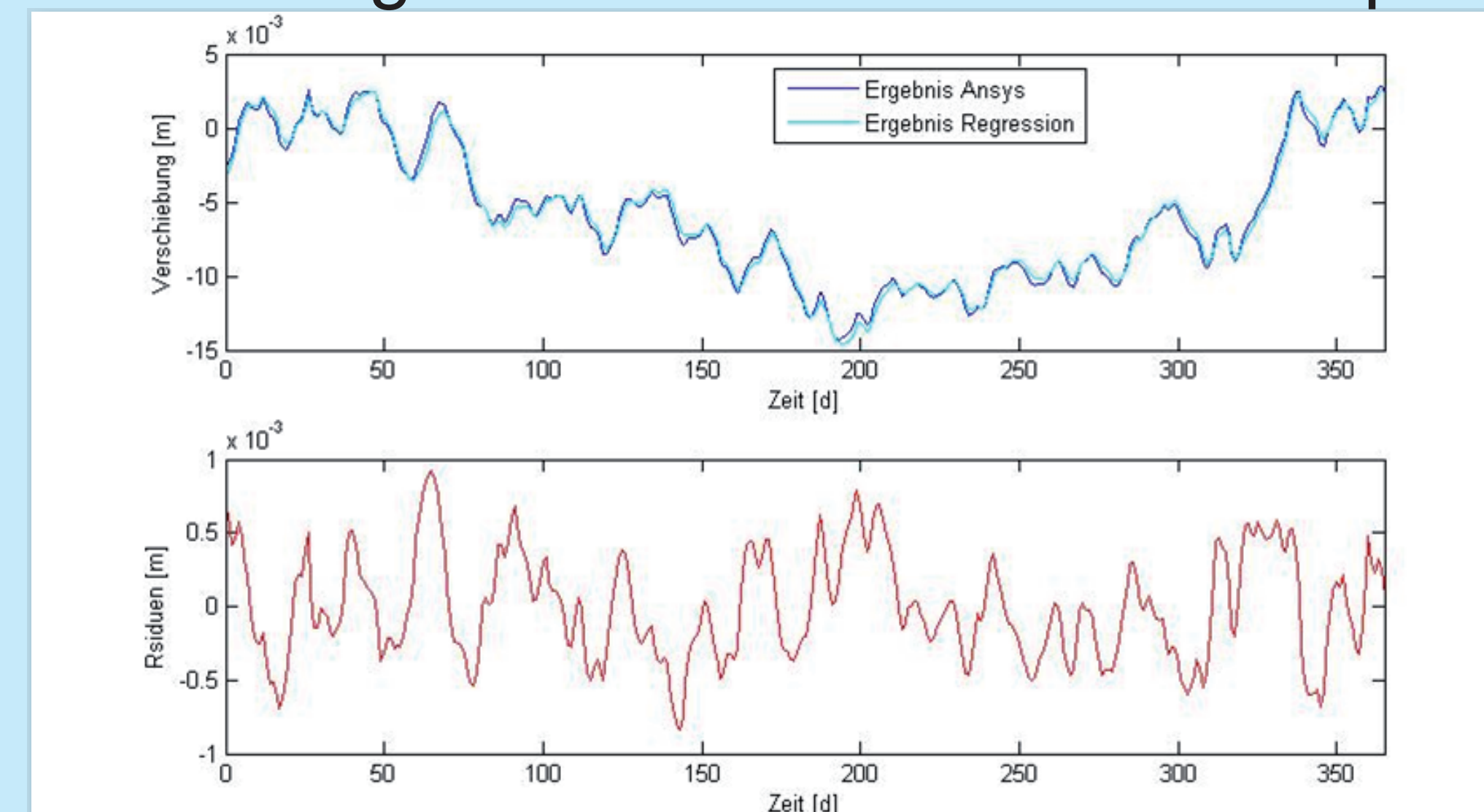
Temperature Field



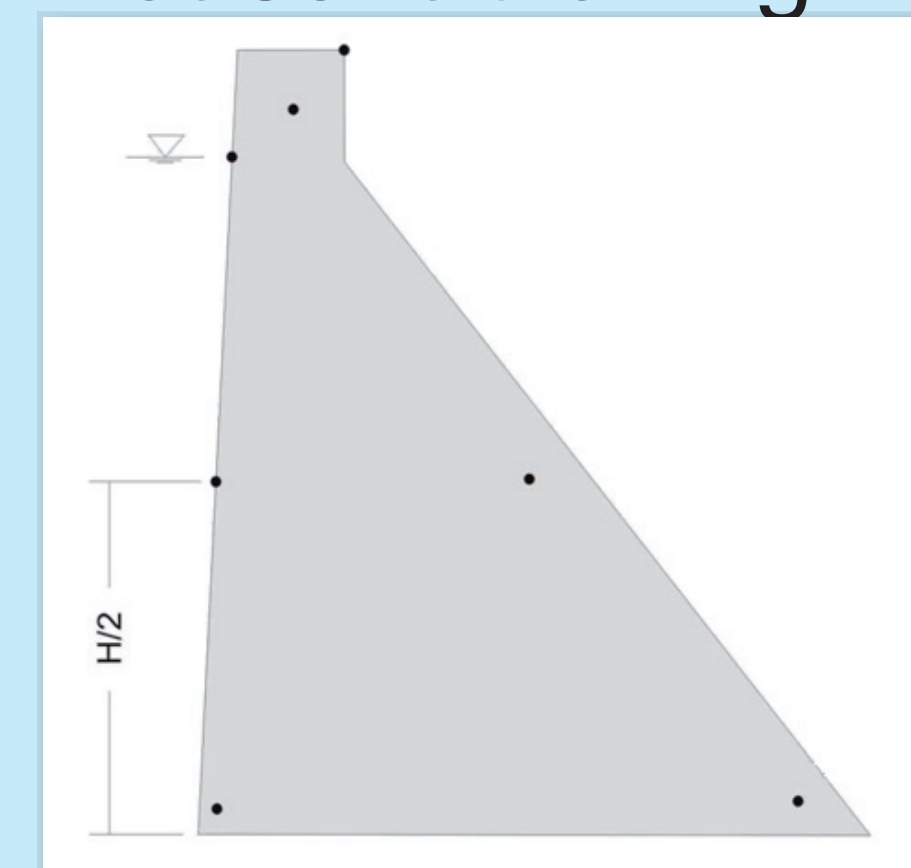
Displacement



Linear Regression with four measure points



Reasonable Alignment



Recommendation

- Accurate results with only four measure points
- Measure Points best placed close to the surface
- High density of measure points in dam crest