Calibration of back-analysed model parameters for landslides using classification statistics

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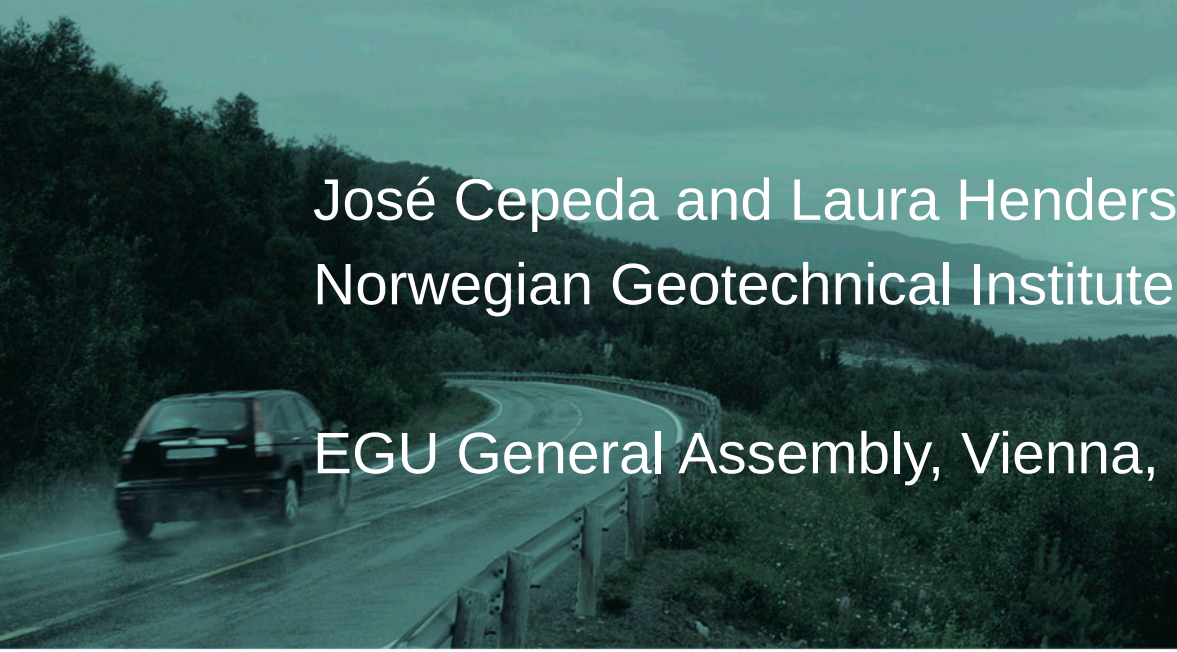

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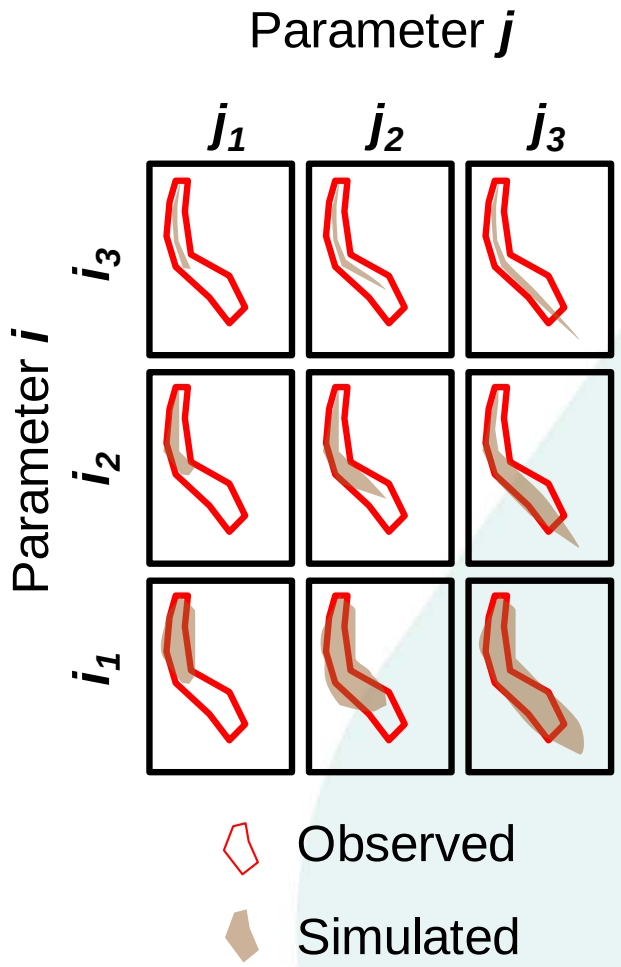
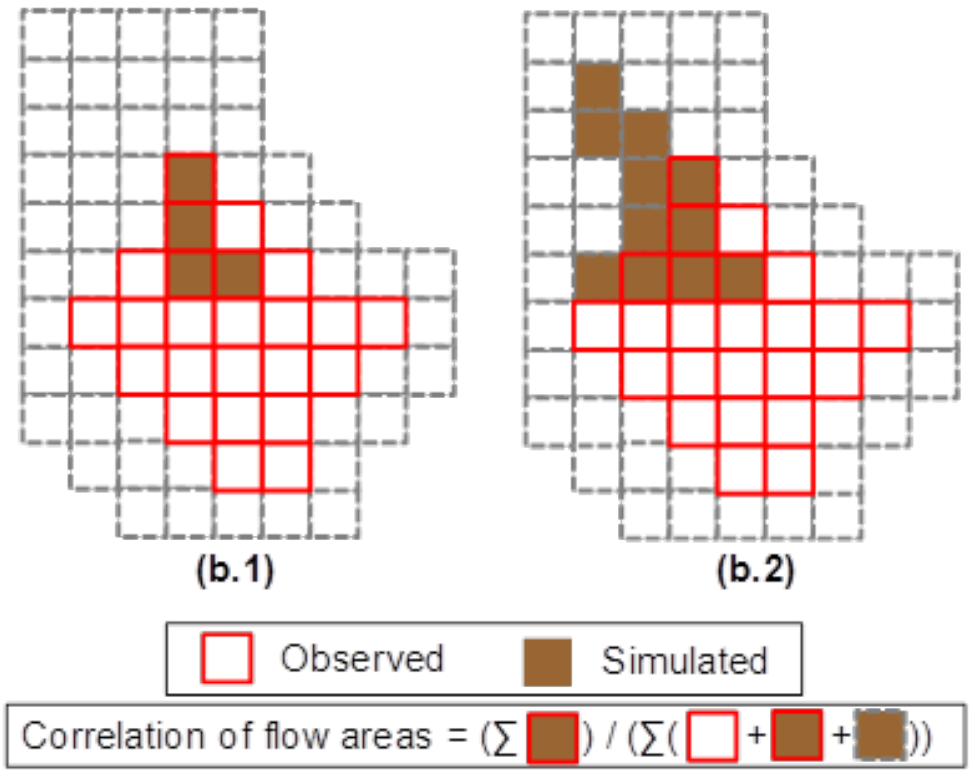
- Backanalysis of landslides:
  - Observations of historical event
  - Simulation using a model + input parameters
  - Compare observations vs simulations
  - Repeat for other models and other input parameters
  - Select best match (callibration or measure of performance)
- Why backanalyses?

  Models & parameters for forecasting
- Approaches for callibration:
  - Visual
  - Quantitative





- Example of a quantitative method (Galas et al., 2007)
- b.1. = 4 / 24
- b.2. = 5 / 30
- Problem: non-uniqueness measure of performance
- Could we reuse and adapt some existing approaches already employed in risk assessment?

Proposed approach

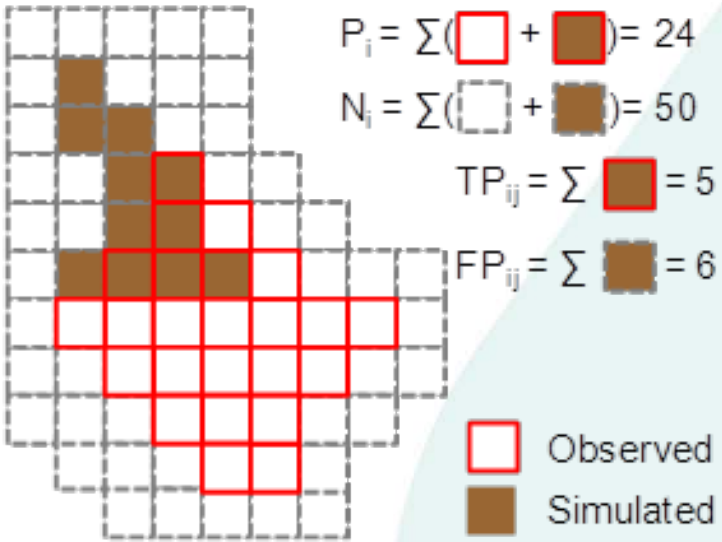
- Based on the Receiver Operating Characteristic - ROC space

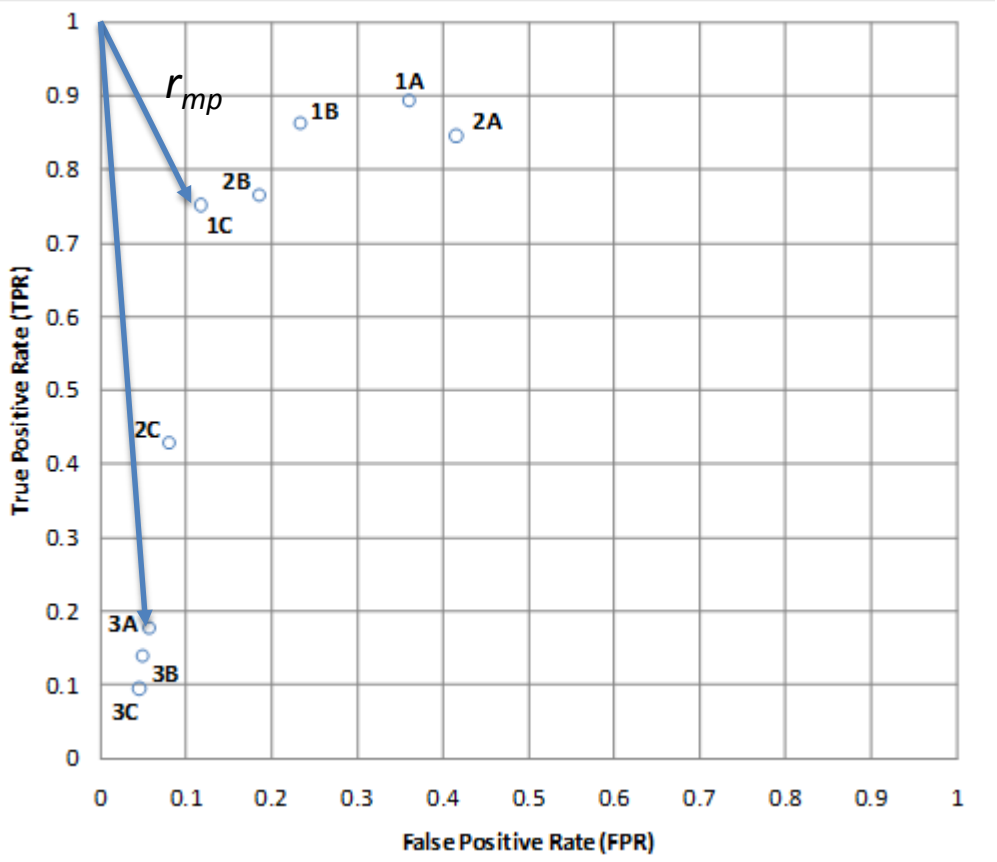
- Points in ROC space: classifiers (TPR, FPR)

1. Each classifier calculated based on landslide variables:
   observed
   vs.
   simulated (a model and set of parameters)

(cont.)

For areal variables (e.g., scarp area, footprint, final deposit, etc.):





(cont.)

2. Weighted sum of classifiers for all available observed variables

3. Plot classifiers for all the sets of parameters that were simulated

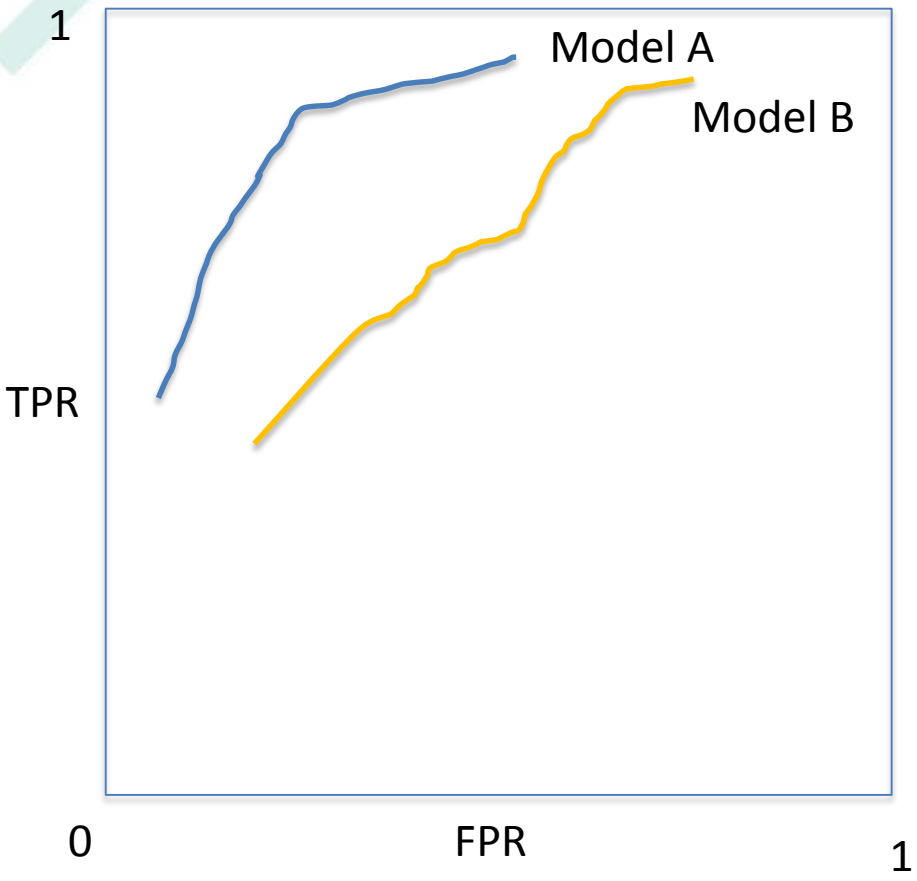
4. Select the set of parameters which produces the best prediction: shortest distance r_{mp} to the point of perfect classification (0,1)

But instead of making point-wise comparisons between observations and several simulations with deterministic input parameters, we might find more useful to compare observations vs:

- Several different models
- Models with input parameters modeled as random variables
- Several landslides, etc.

Then the previous method needs to be expanded …

Source: NGI



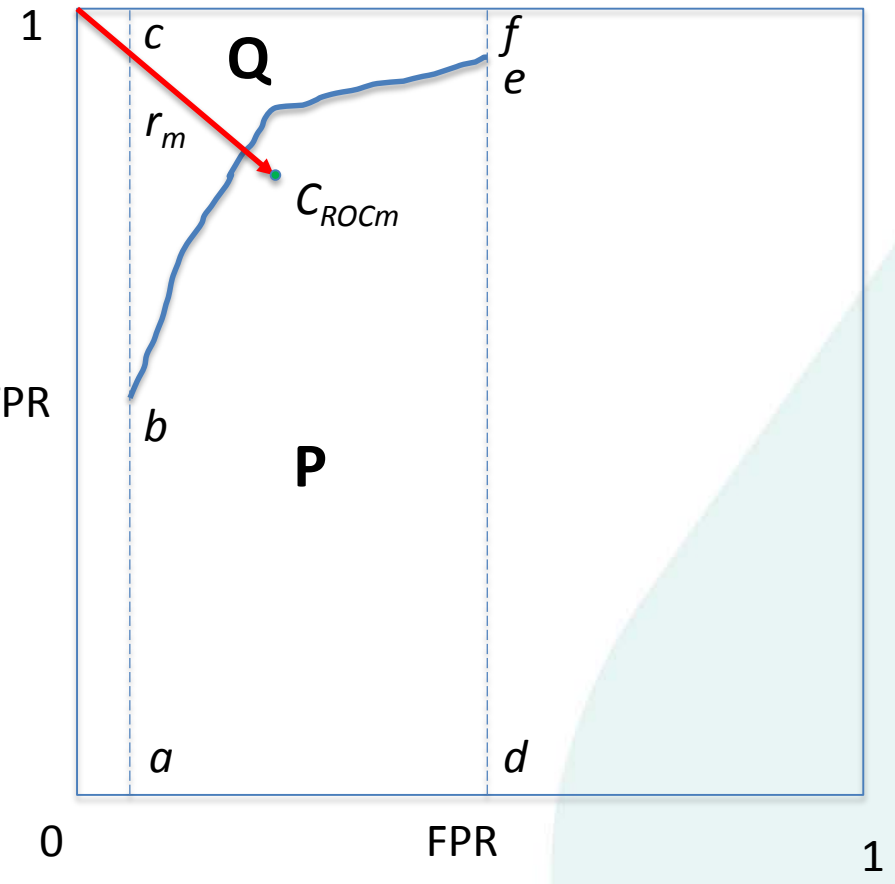
- Then, the comparison in the ROC space will be made between ROC curves
- Each curve corresponds to one model with a range of input parameters (e.g. modeled as pdf)
- Each curve will be obtained as:
  - Envelope of classifiers (deterministic input)
  - Mean line of pdf of classifiers (probabilistic input)

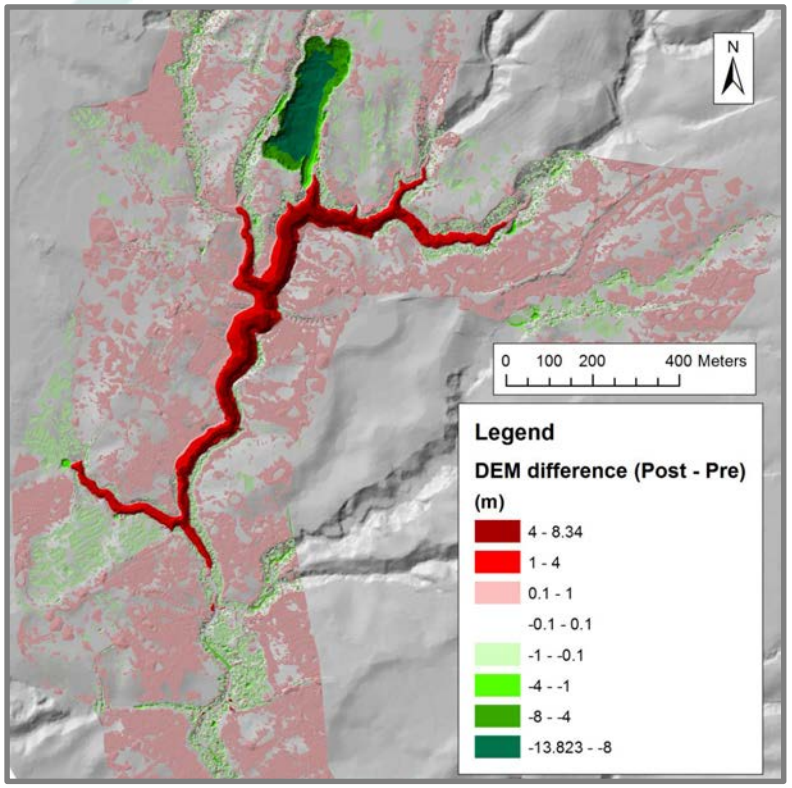
How can we compare these «incomplete» ROC curves?

Need to introduce some metrics for comparison:

- r_m : distance of centroid of ROC curve (C_{ROCm}) of model m to (0,1)
- $AUROC_{psm} = A_{abed} / A_{acfd}$

$= P / (P + Q)$





Source: NGI/NIFS

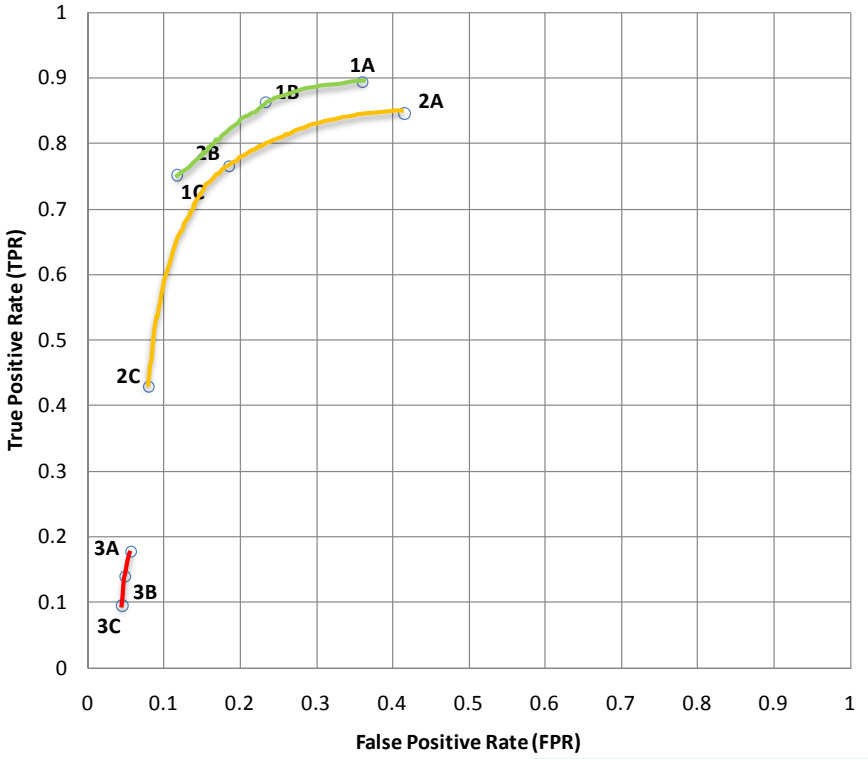
Finally, in addition to point and areal variables, we introduce spatially distributed variables into the method, for example:

- Initial depth distribution of released material on the scarp (landslide body at t=0)
- Final distribution of deposits (including depths)
- Etc.

Use:

- Coordinates of centre of gravity (lat, lon, height)
- Moment of inertia around conventional vertical axis

- Landslide runout analyses
- Backanalyses of slope stability
- Selection/callibration of shear strength models using geotechnical site investigations and laboratory tests
- Other problems that require additional objective criteria for selection of models/parameters



Source: NGI

- Backanalyses of initiation, disintegration and runout of landslides provide a learning opportunity to our models (modellers), numerical schemes and databases.
- Methods of callibration of models and parameters need to add objective elements to their procedures.
- A general semi-objective procedure has been introduced for use in research activities.

Thank you for your attention!

KLIMA 2050 contributions in EGU:

Monday 18 April, PICO spot 1, 08:50, Jessica Ka Yi Chiu (NGI):
"Surveying perceptions of landslide risk management in Norway"

Monday 18 April, Room L3, 17:45, Jose Cepeda (NGI):
"Calibration of back-analysed model parameters for landslides using classification statistics"

Wednesday 20 April, Hall D, 17:30, Anders Solheim (NGI):
"KLIMA 2050: a research-based innovation centre for risk reduction through climate adaptation of infrastructure and buildings"

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www.klima2050.no ← More information, including PhD and PostDoc opportunities

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