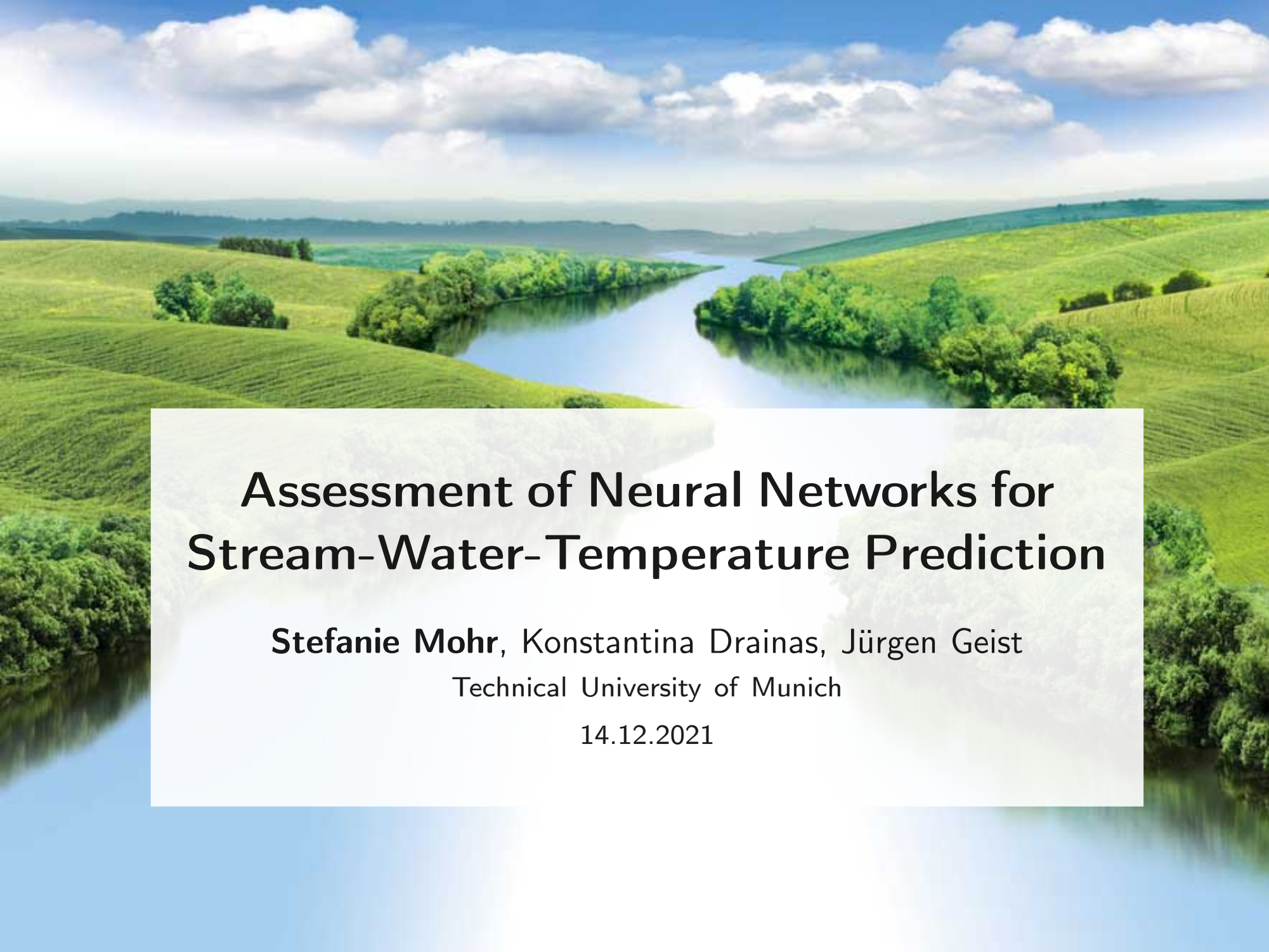

Assessment of Neural Networks for Stream-Water-Temperature Prediction

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14.12.2021

Motivation

Climate change

$\Downarrow$

Increase in (water) temperature

$\Downarrow$

Difficult living conditions

$\Downarrow$

Potential species extinction

$\Rightarrow$ We must act now and introduce mechanisms to prevent a dangerous rise in the temperature.

Our approach

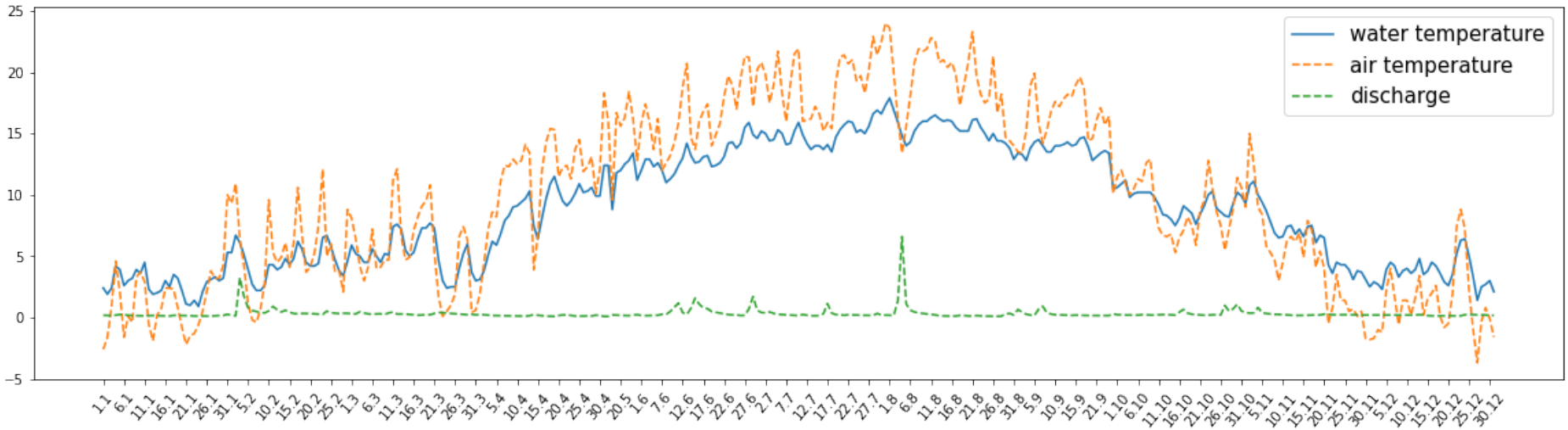
Neural Network as a model

- Input data
- Hyperparameter
- Empirical evaluation

Evaluation of its behavior

- Robustness analysis
- Analysis of minimal and maximal values
- Impact analysis of input features

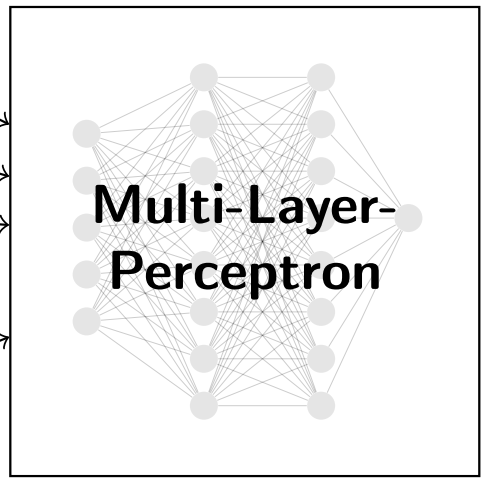
Data and Architecture



(today, yesterday, day before yesterday)

3×

- Day in year
- Runoff
- Air temperature station 1
- ...
- Air temperature station n



Evaluation

Empirical: RMSE ranges from **0.44** to **1.54** on different models and different rivers

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Evaluation

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Robustness-Analysis

Perturbation of the input values and evaluation of possible output changes

$\Rightarrow$ **0.7** to **3.12** on different models and different rivers

Min-Max-Analysis

Optimize the input via gradient descent to create minimal resp. maximal output values

$\Rightarrow$ -**19.7**°C to **50.14**°C on different models and different rivers

Impact-Analysis

Sensitivity analysis of the output value respective to the input features

$\Rightarrow$ Different impact of the input features for each river

Conclusion

Be careful when using Neural Networks!

- Neural Networks work generally as a model for temperature prediction
- They still show unexpected behavior
  $\Rightarrow$ Consider easier machine learning models with higher reliability
  $\Rightarrow$ Include physical properties in the learning procedure
- Investigation of difference in impact of the input features from hydrologists