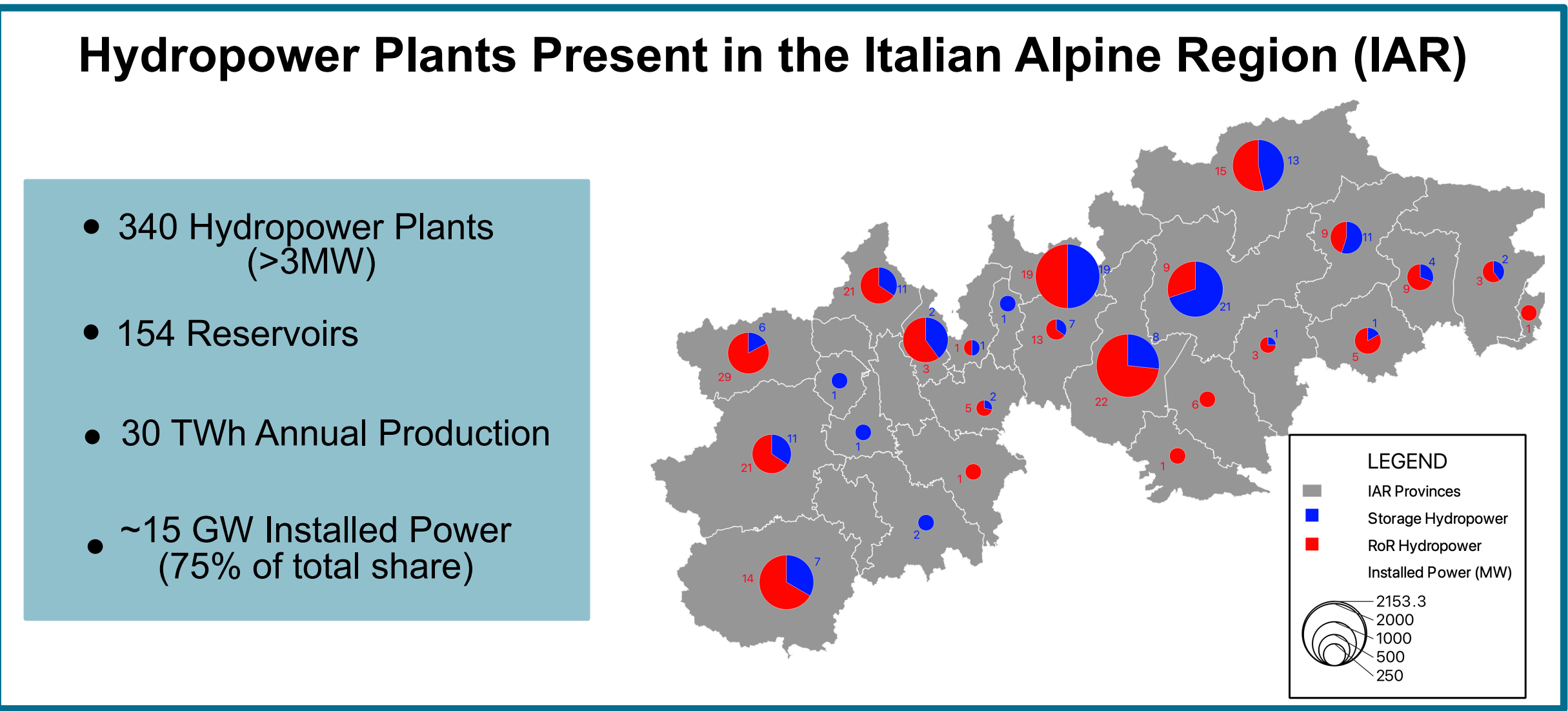
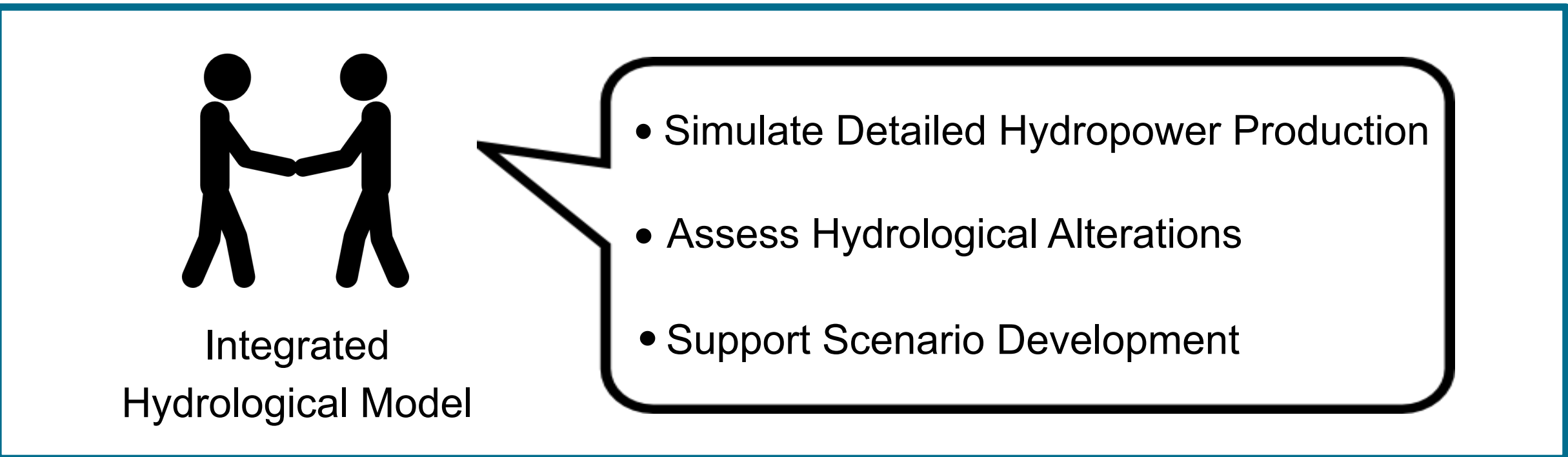
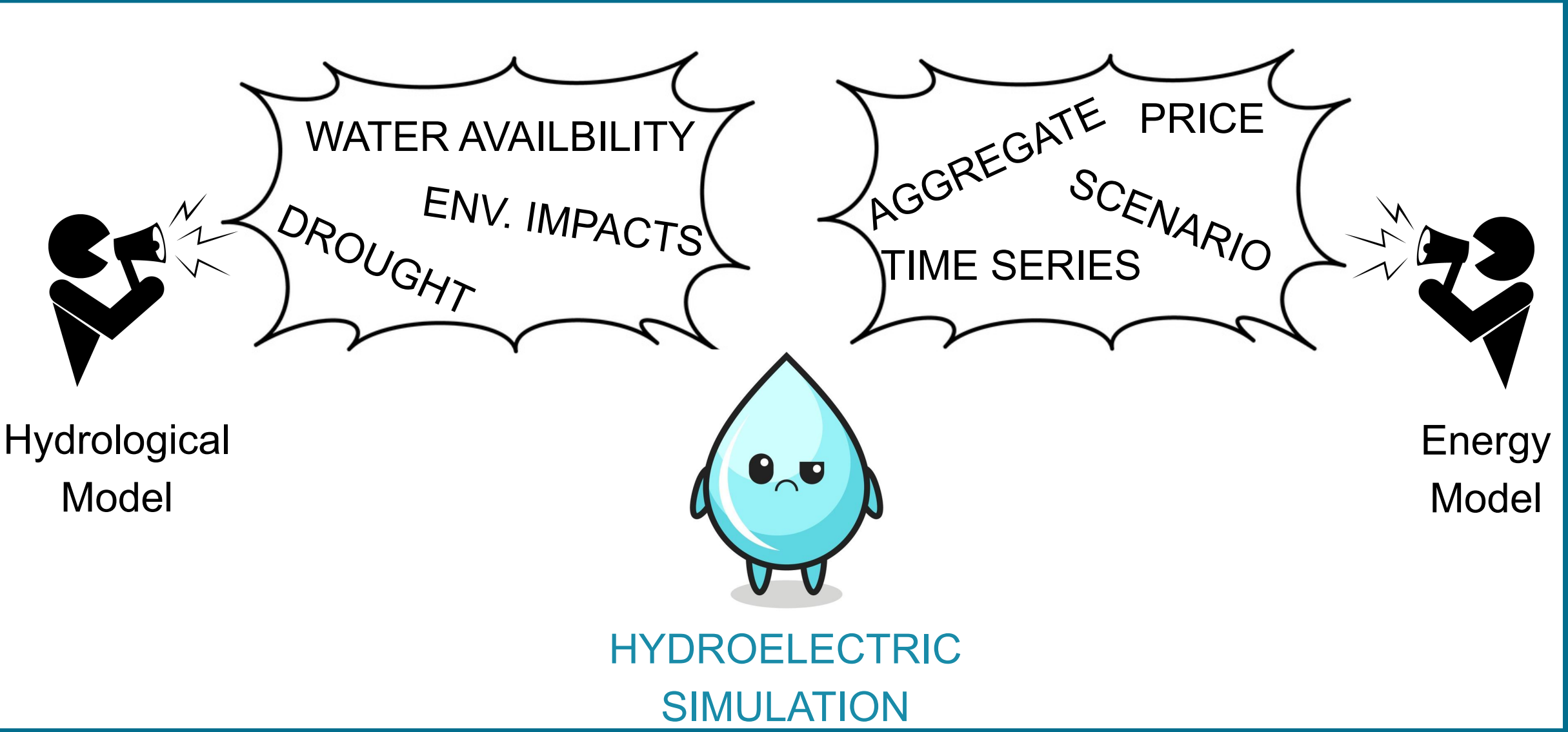


Large-Scale Integrated Hydrological Modelling for Hydroelectric Generation in the Italian Alpine Region

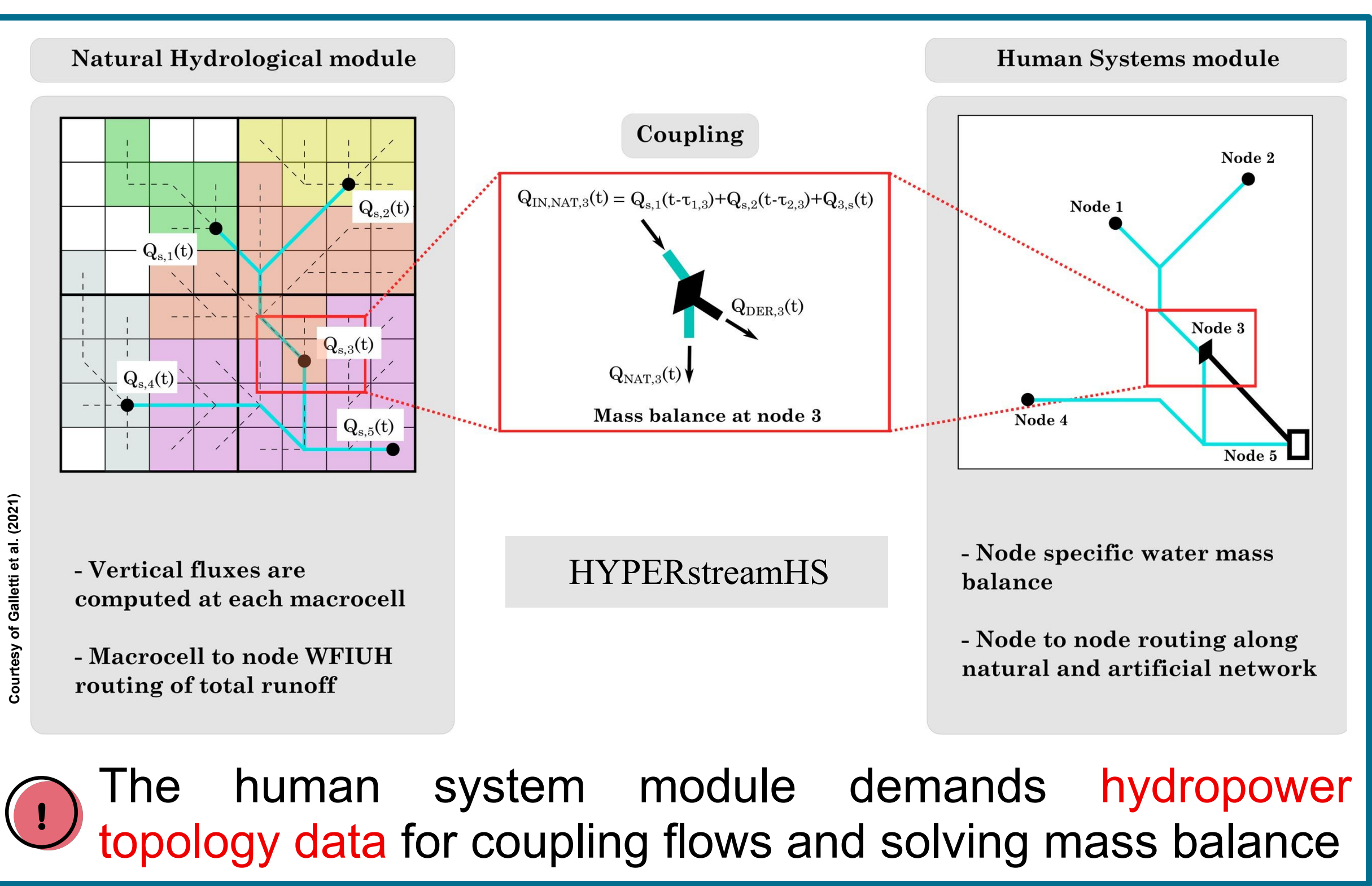
Soroush Zarghami Dastjerdi^{1,2}, Diego Avesani², Andrea Galletti^{2,3} and Bruno Majone²
1 University School for Advanced Studies IUSS Pavia, Pavia, Italy
2 University of Trento, DICAM, Trento, Italy
3 EURAC Research, Center for Climate Change and Transformation, Bolzano, Italy



Introduction



Tools - Hydrological Model



The human system module demands **hydropower topology data** for coupling flows and solving mass balance

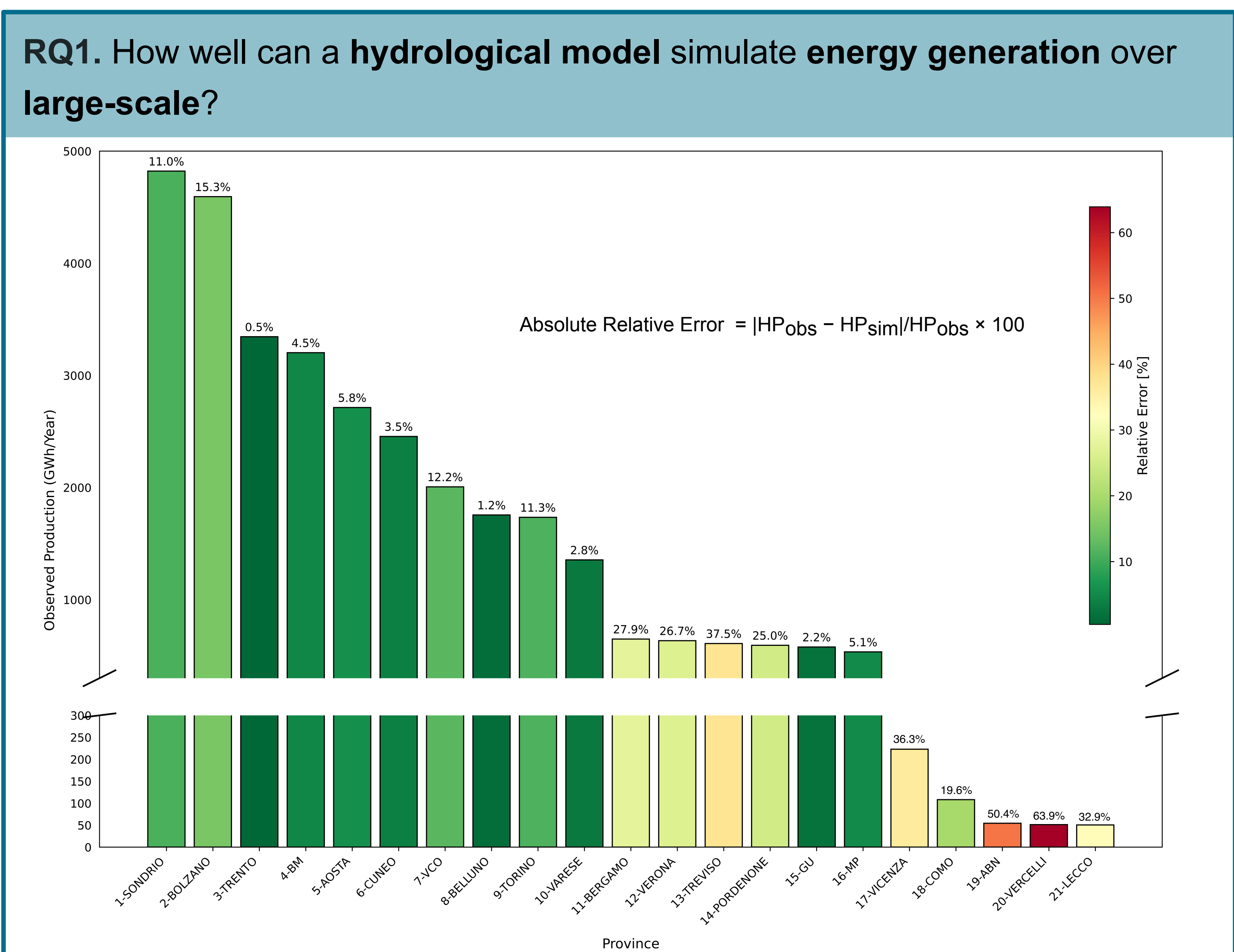
Tools - Large Hydropower Systems Topology

Comprehensive dataset containing detailed infrastructural characteristics of hydroelectric systems across the IAR.

CHECK OUT! OUR LATEST DATASET RELEASE

Galletti, A., Zarghami Dastjerdi, S., and Majone, B.: Comprehensive inventory of large hydropower systems in the Italian Alpine Region, Earth Syst. Sci. Data Discuss. (preprint), <https://doi.org/10.5194/essd-2024-521>, in review(Accepted for final publication), 2025.

From Questions to Validations

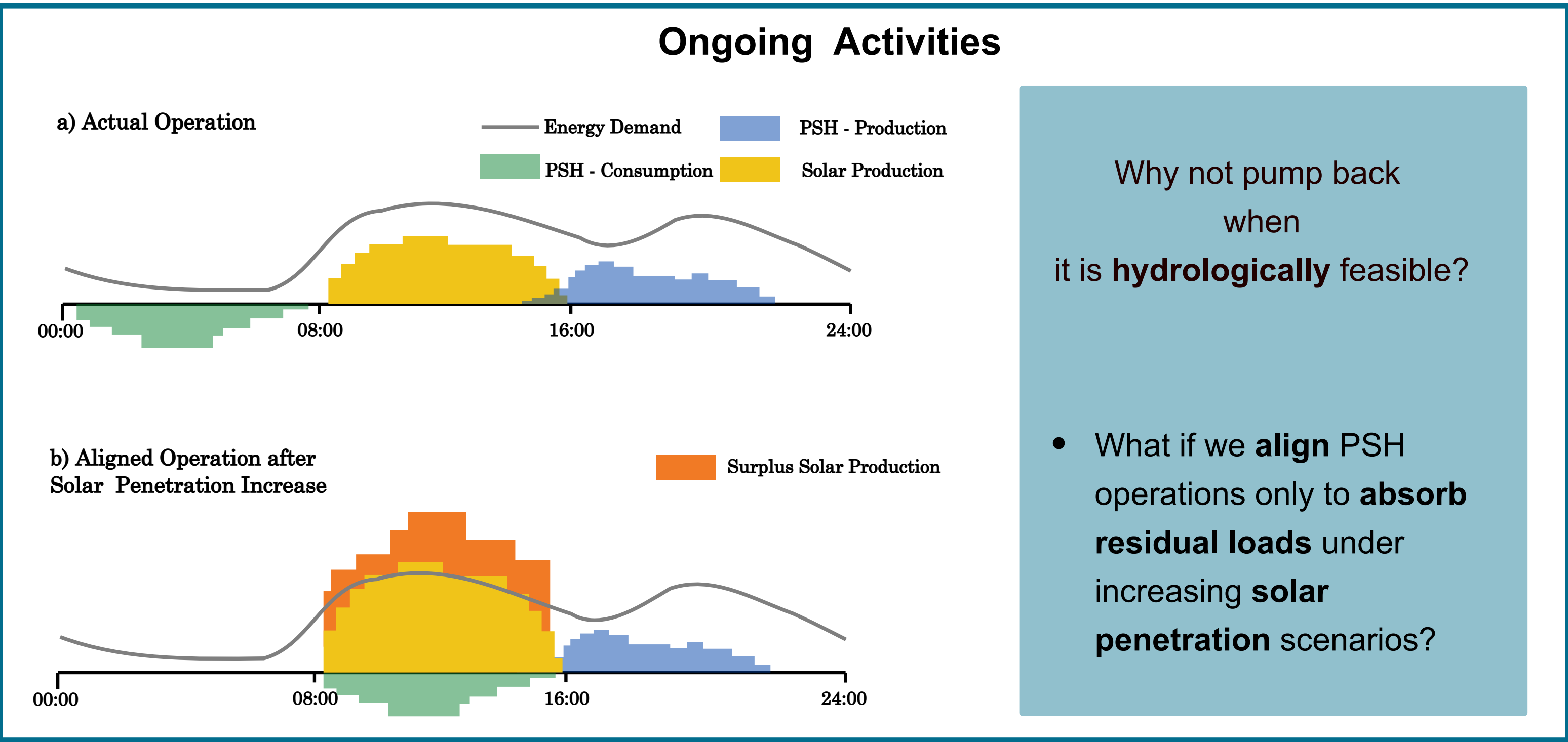
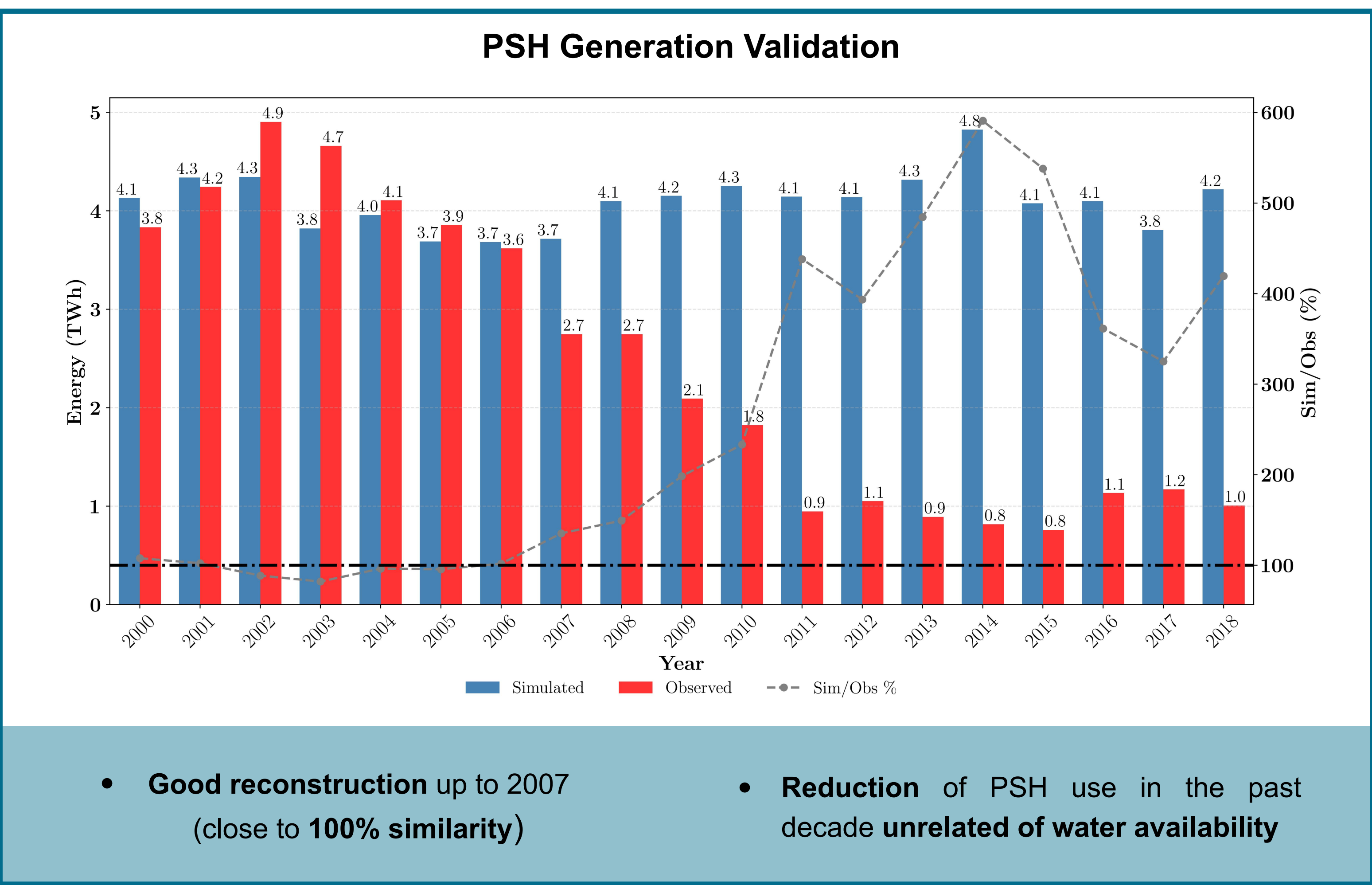
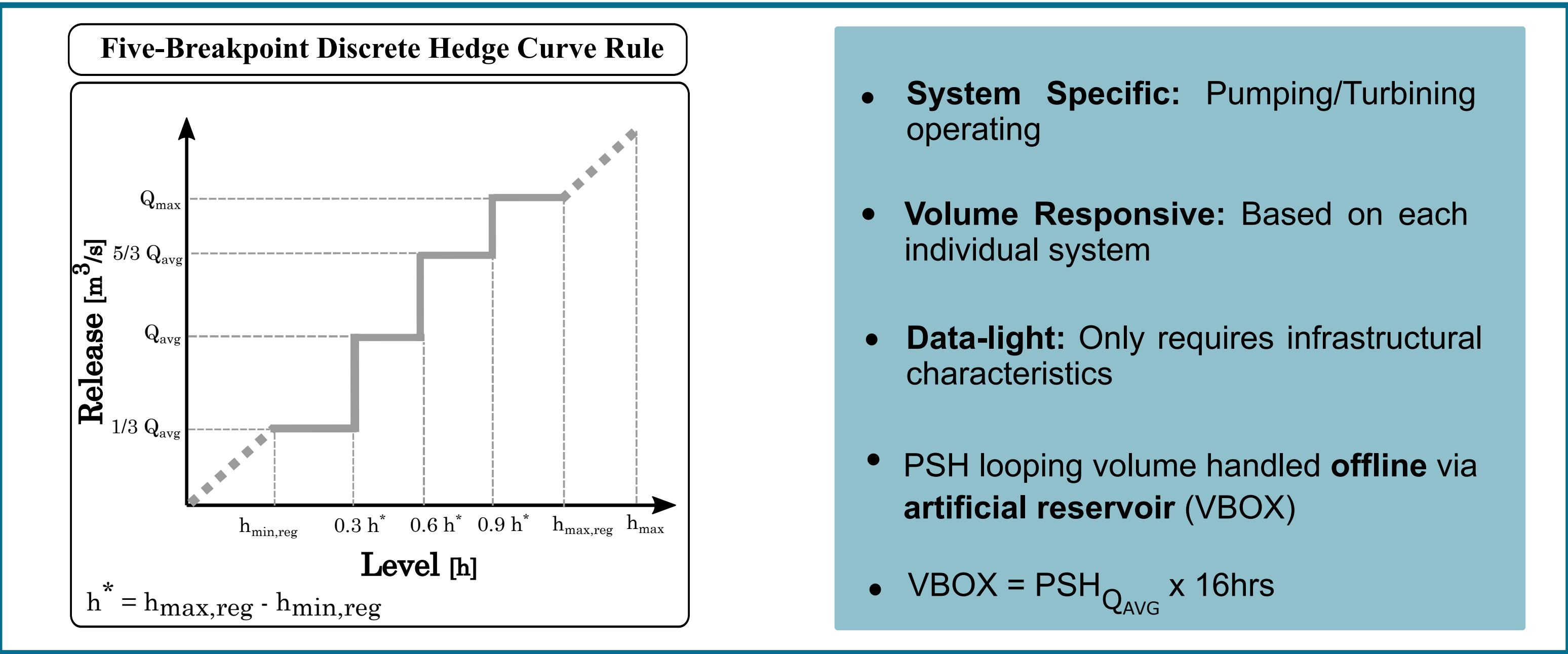


~96% match with historical data shows strong model performance in simulating energy generation at both large-scale and detailed levels.

RQ2. Can we effectively estimate the Pumped-Storage Hydropower (PSH) potential for green transition and energy balancing despite operational complexity?

A more realistic yet simplified rule was needed to model PSH at large scale, driving the approaches in the **PSH Outlook**.

PSH Simulation Outlooks



References:

[1] Piccolroaz, S., Calamita, E., Majone, B., Gallice, A., Siviglia, A., & Toffolon, M. (2016). Prediction of river water temperature: A comparison between a new family of hybrid models and statistical approaches. *Hydrological Processes*, 30(21), 3901-3917.

[2] Avesani, D., Galletti, A., Pianosi, F., Bellin, A., & Majone, B. (2022). A dual-layer MPI continuous large-scale hydrological model including Human Systems. *Environmental Modelling & Software*, 139, 105003.

[3] Galletti, A., Avesani, D., Majone, B., & Bellin, A. (2021). Detailed simulation of storage hydropower systems in large Alpine watersheds. *Journal of Hydrology*, 603, 127125.

