Hydropower in the Era of Climate Change: The Case of the Sabbione Storage Plant in Italy

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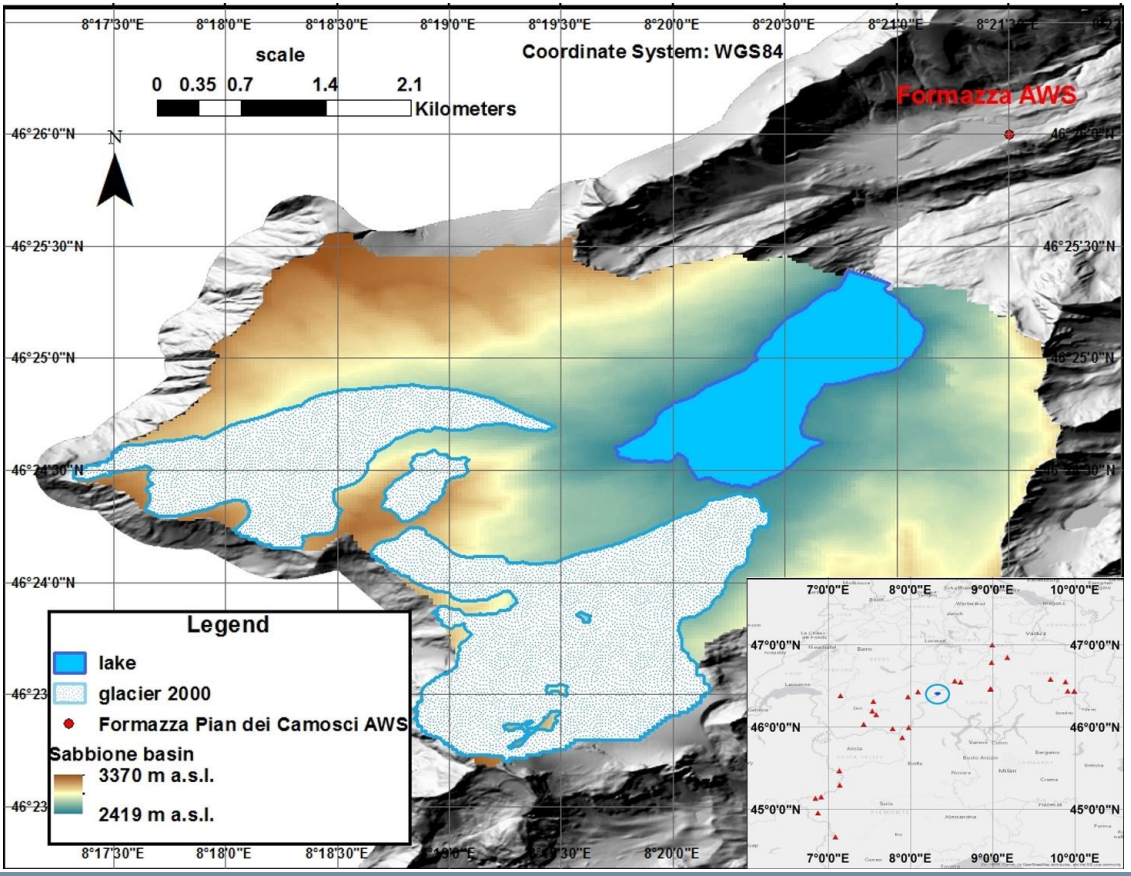
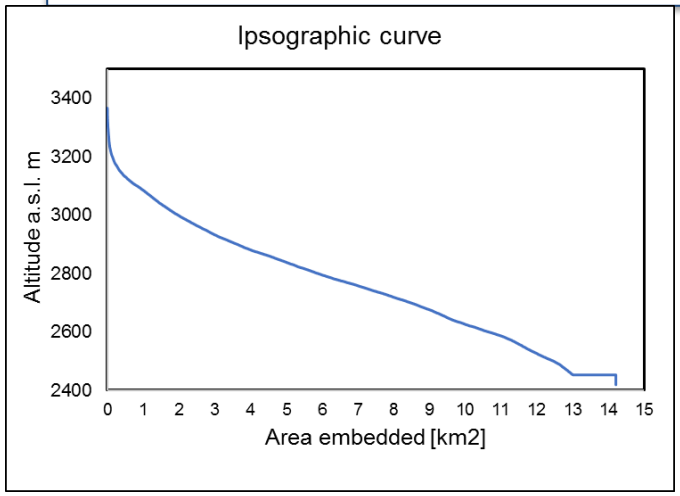
1. Case study: Sabbione dam

Sabbione dam (44 mil m^3) is located in Val Formazza, in north of Piedmont region of Italy, and it collects water from Sabbione glacier from 1954



Water is used for hydropower plant with 620 m hydraulic head (44 GWh/y)



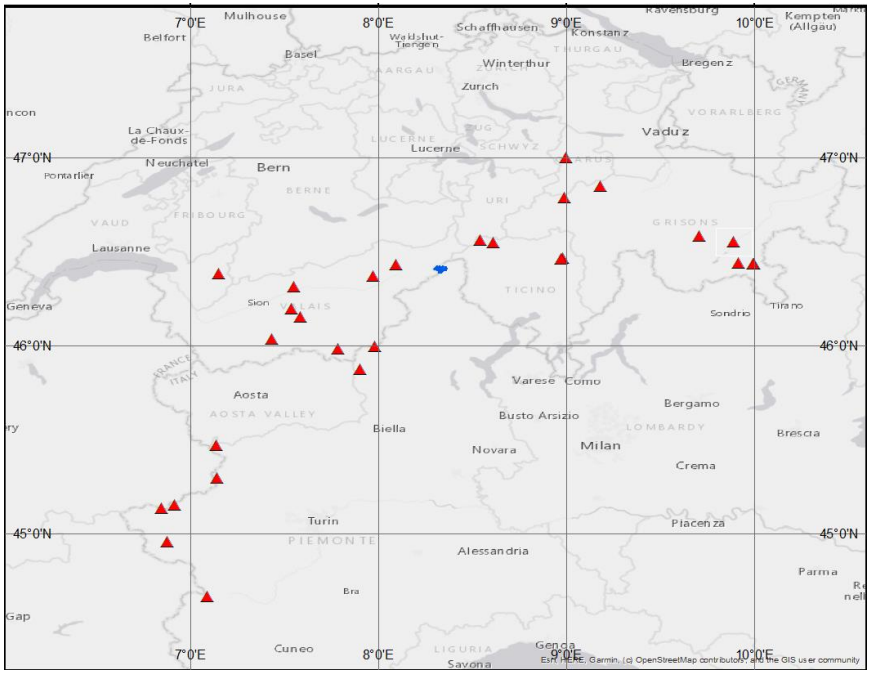
2. Dataset and method

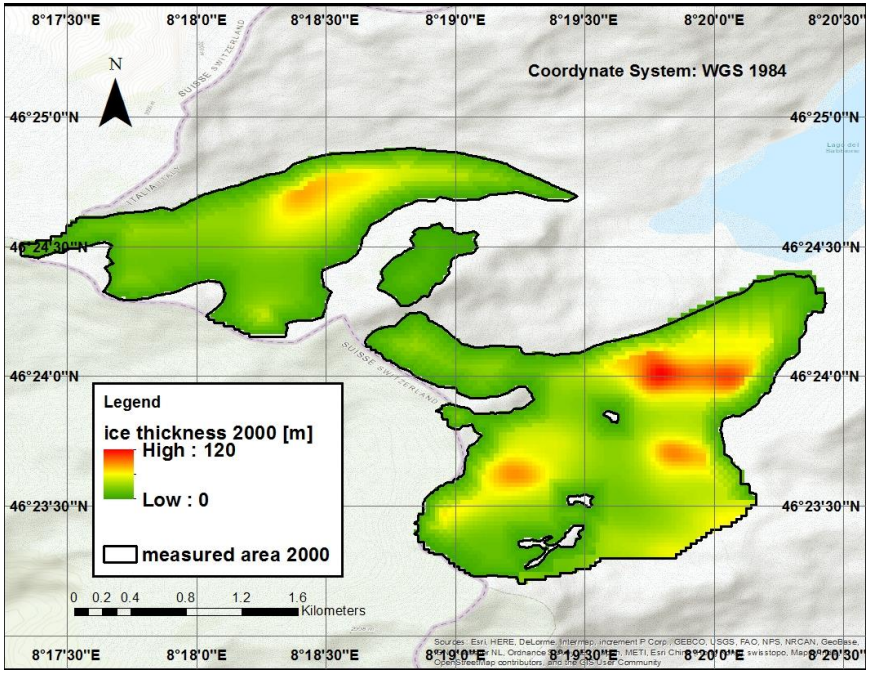
Dataset:

- Meteorological data from 27 station (temperature, precipitation, radiation)
- 25 m resolution Digital Terrain Model
- Ice cover from ortophoto for several years (2000, 2007, 2015, 2017)
- 9 GCM downscaled data for future scenario (2018-2100)

Method:

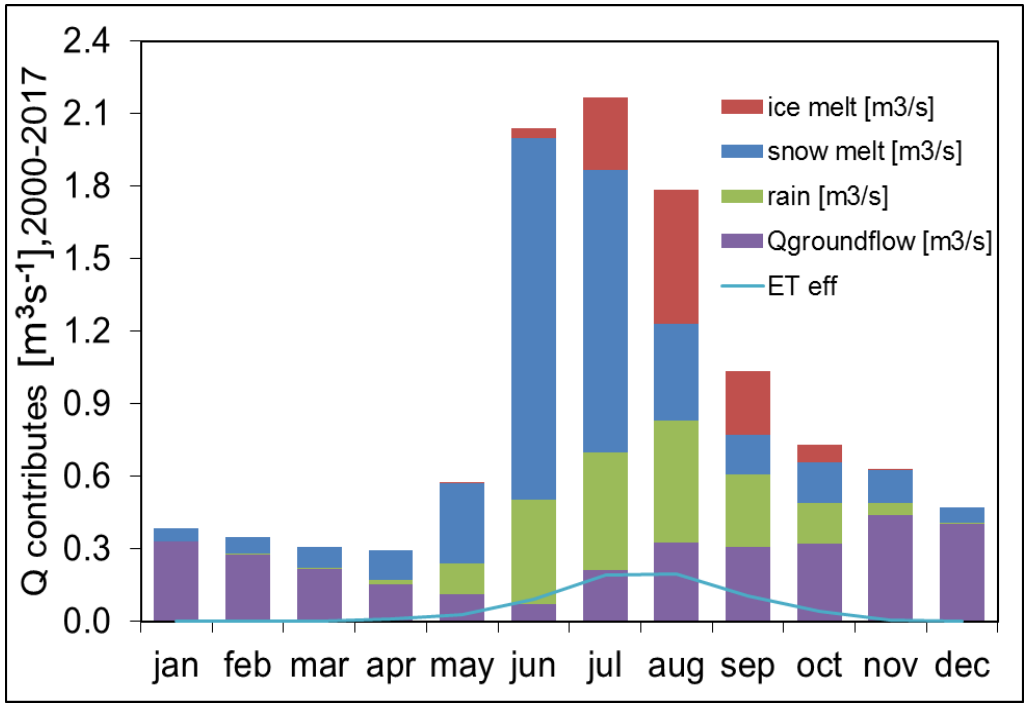
- Distributed hydrological model to evaluate discharge and ice melt for control run (2000-17) and future scenarios (2018-2100)
- Model based on literature (Haeberli et al.,1995) formula to evaluate ice thickness in 2000

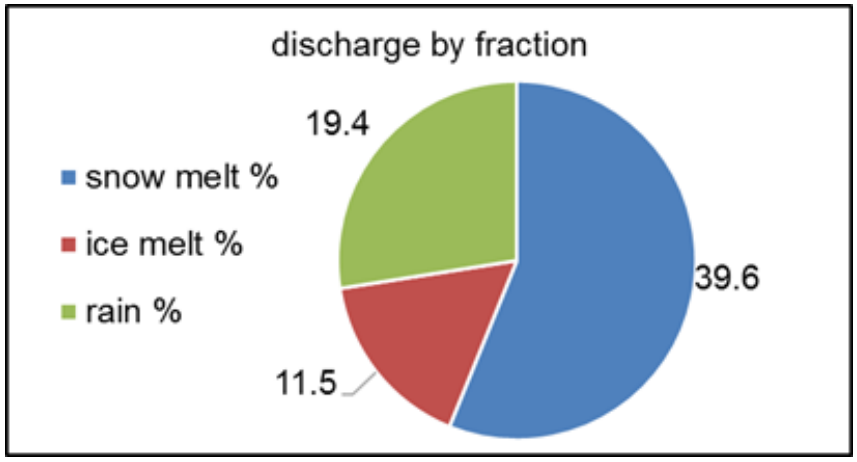




3. Results on Control Run (2000-2017)

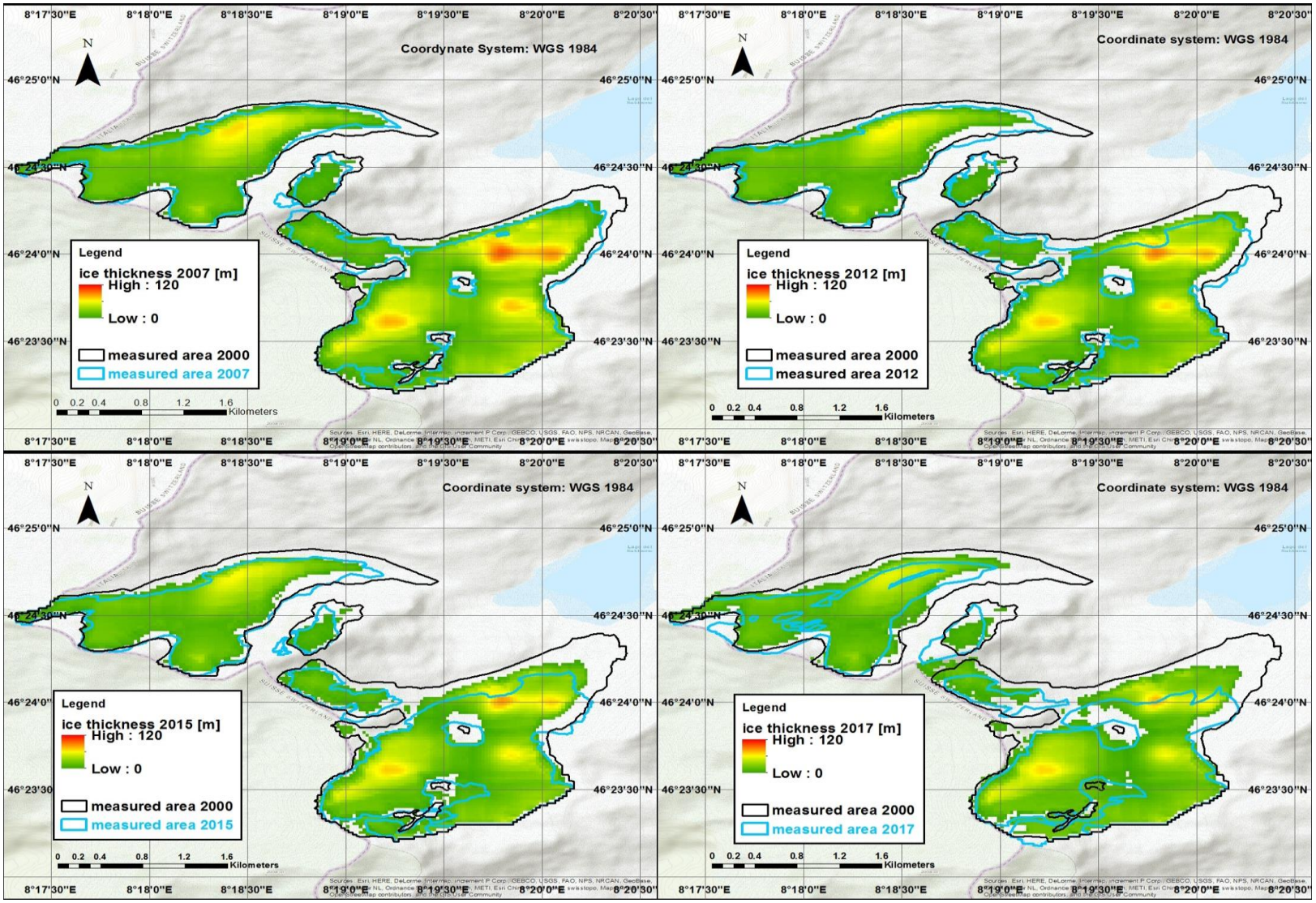
- Average discharge is 0.90 m^3/s, consistent with average energy production data
- Estimated glacier contribute is about 11 % and ice cover area passes from 4.23 a 2.71 km^2.





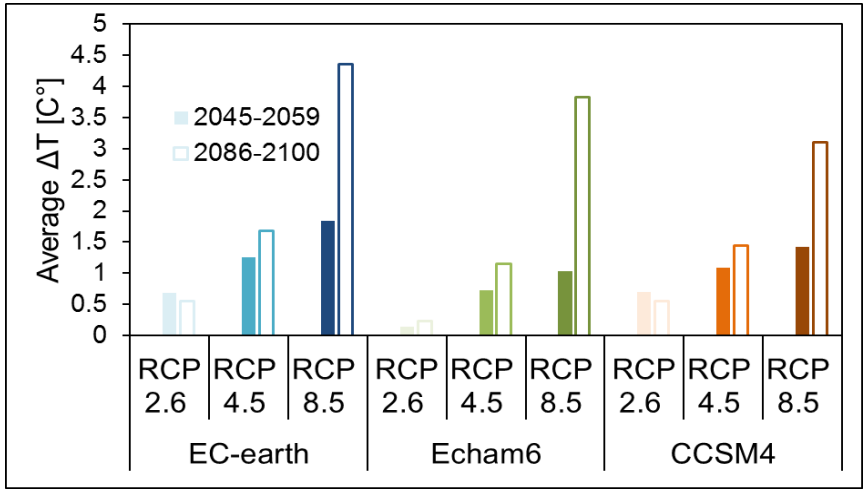
4. Results on Control Run (2000-2017)

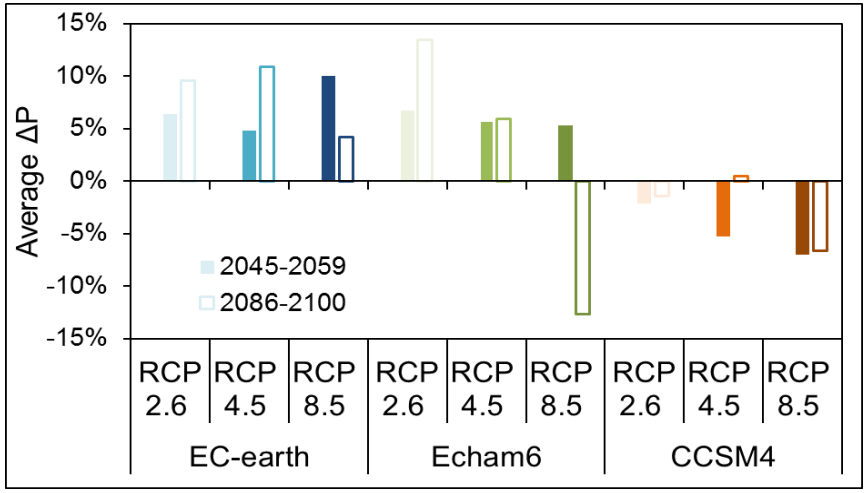
Ice cover area is well estimated through CR with 8% error in 2017



5. Climate change scenarios (2018-2100) results

- Temperature increases for each scenario while precipitation is variable





- Glacier area becomes irrelevant or null
- Discharge and power production decrease for each scenario due to lack of ice melt and evapotranspiration increase