Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

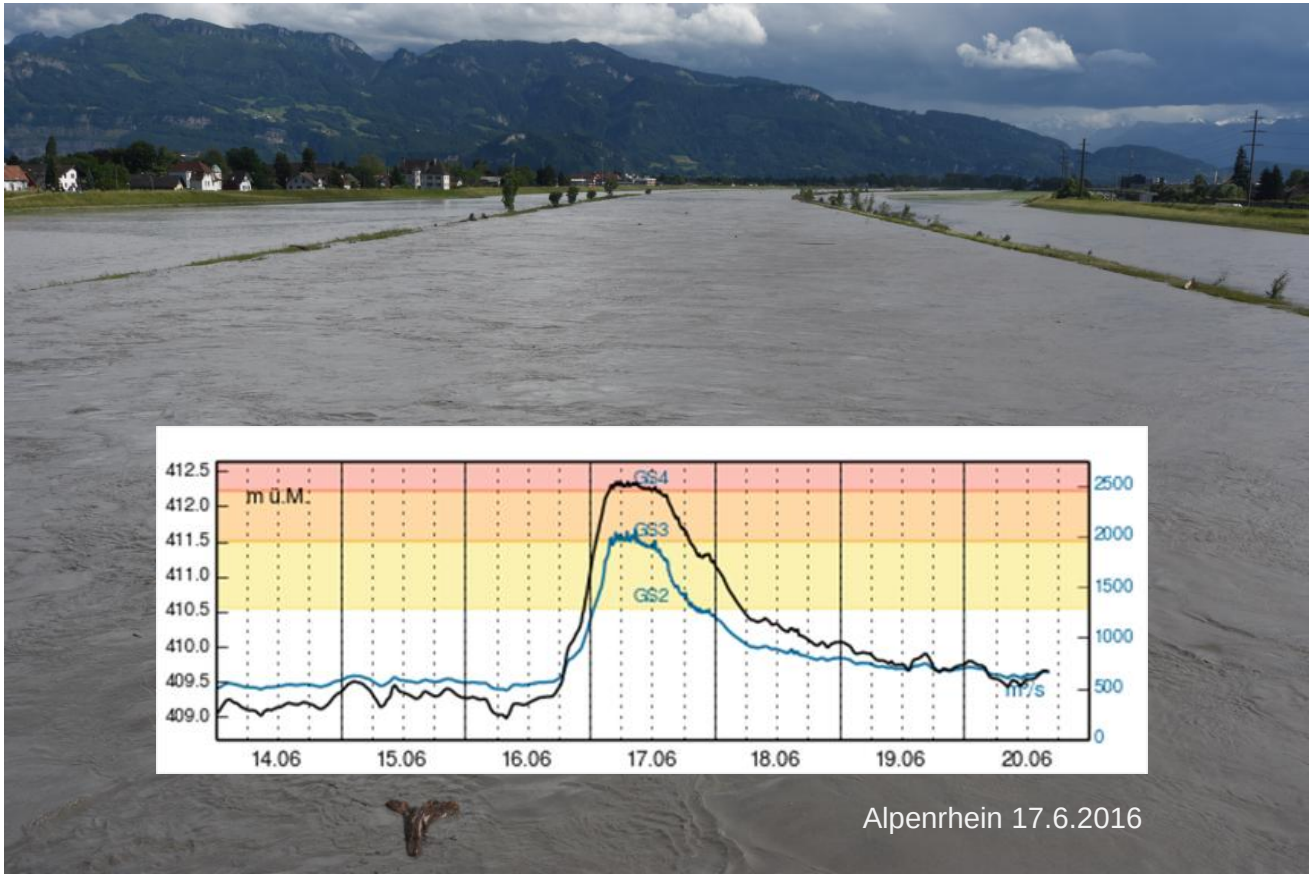
Swiss Confederation

Federal Department of the Environment,
Transport, Energy and Communications DETEC

Federal Office for the Environment FOEN

Delft-FEWS in der hydrologischen Vorhersage der Schweiz

Martin Ebel, Bundesamt für Umwelt



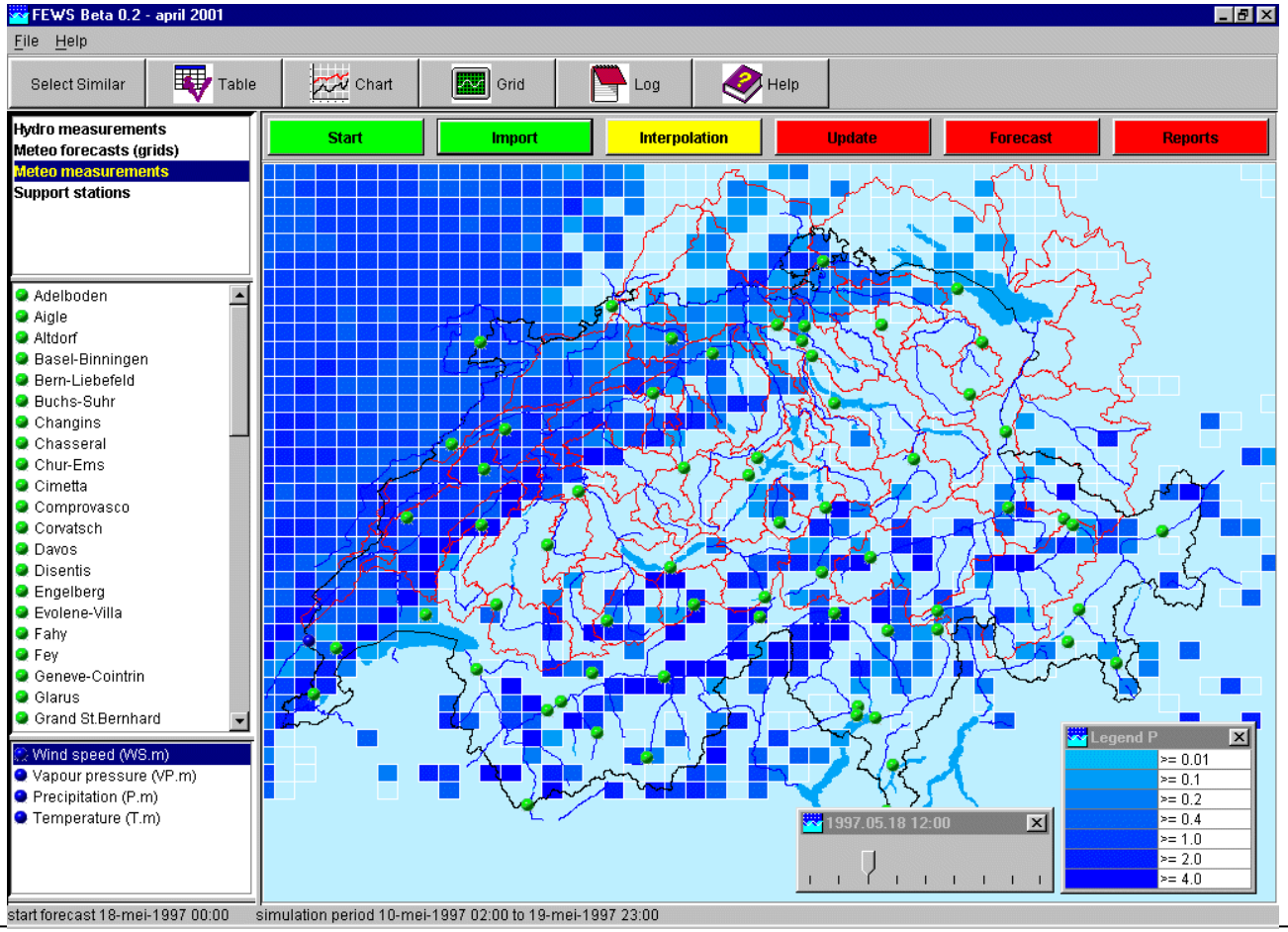
Alpenrhein 17.6.2016

Übersicht

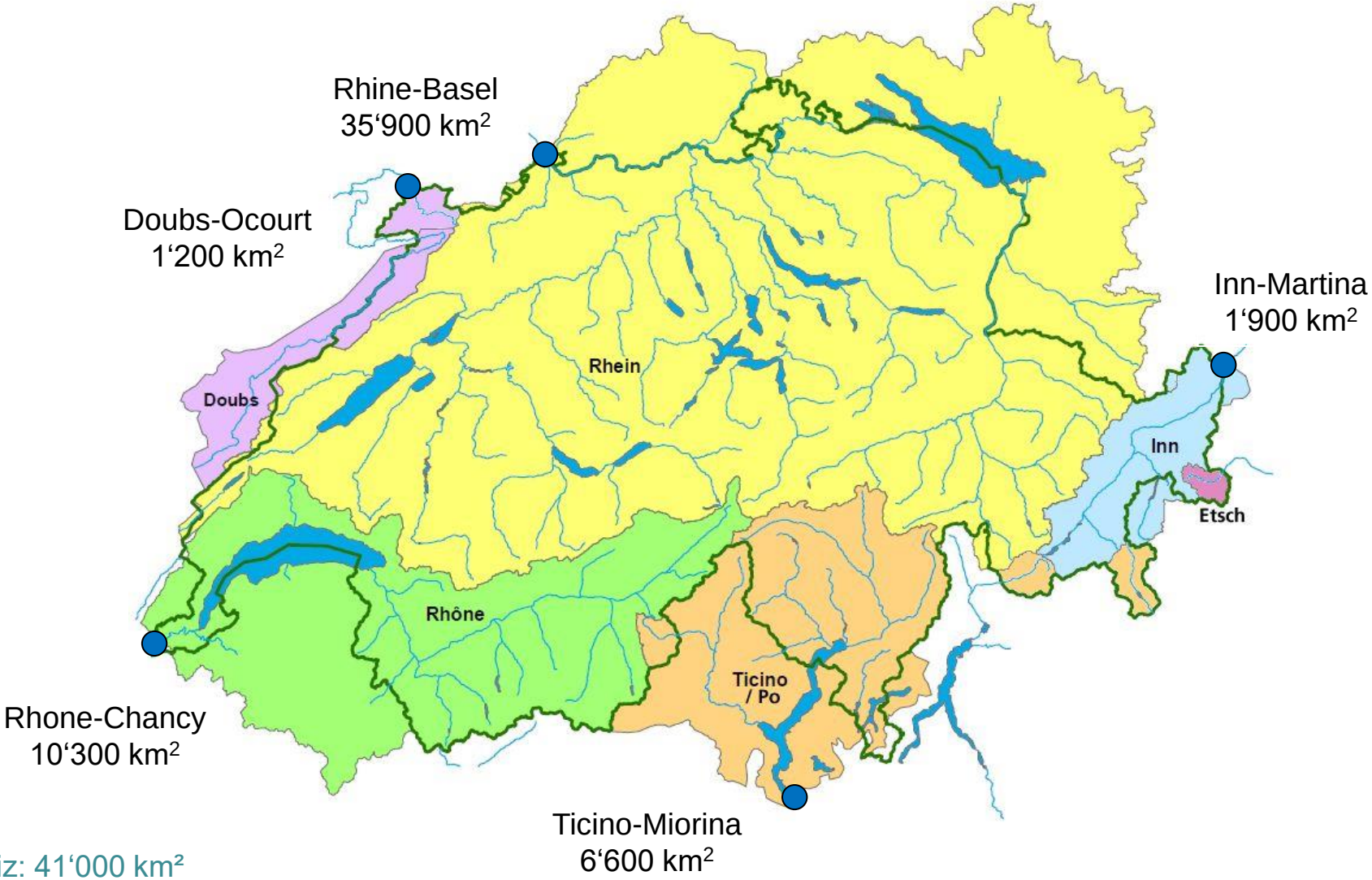
- Ein bisschen Historie
- Die Vorhersage-Herausforderungen in der Schweiz
- Integrierter Multi-Modellansatz des BAFU
- Aktuelle Weiterentwicklungen & «Visionen»
- *FEWS FOEN live*

FEWS-Switzerland: Historisches

Der erste Prototyp von Delft-FEWS wurde 1999-2000 (!) entwickelt für die Schweiz, den Rhein, und ein EU Projekt



Die *hydrologische* Schweiz



Schweiz: 41‘000 km²
„hydrologische Schweiz“: 56‘000 km²

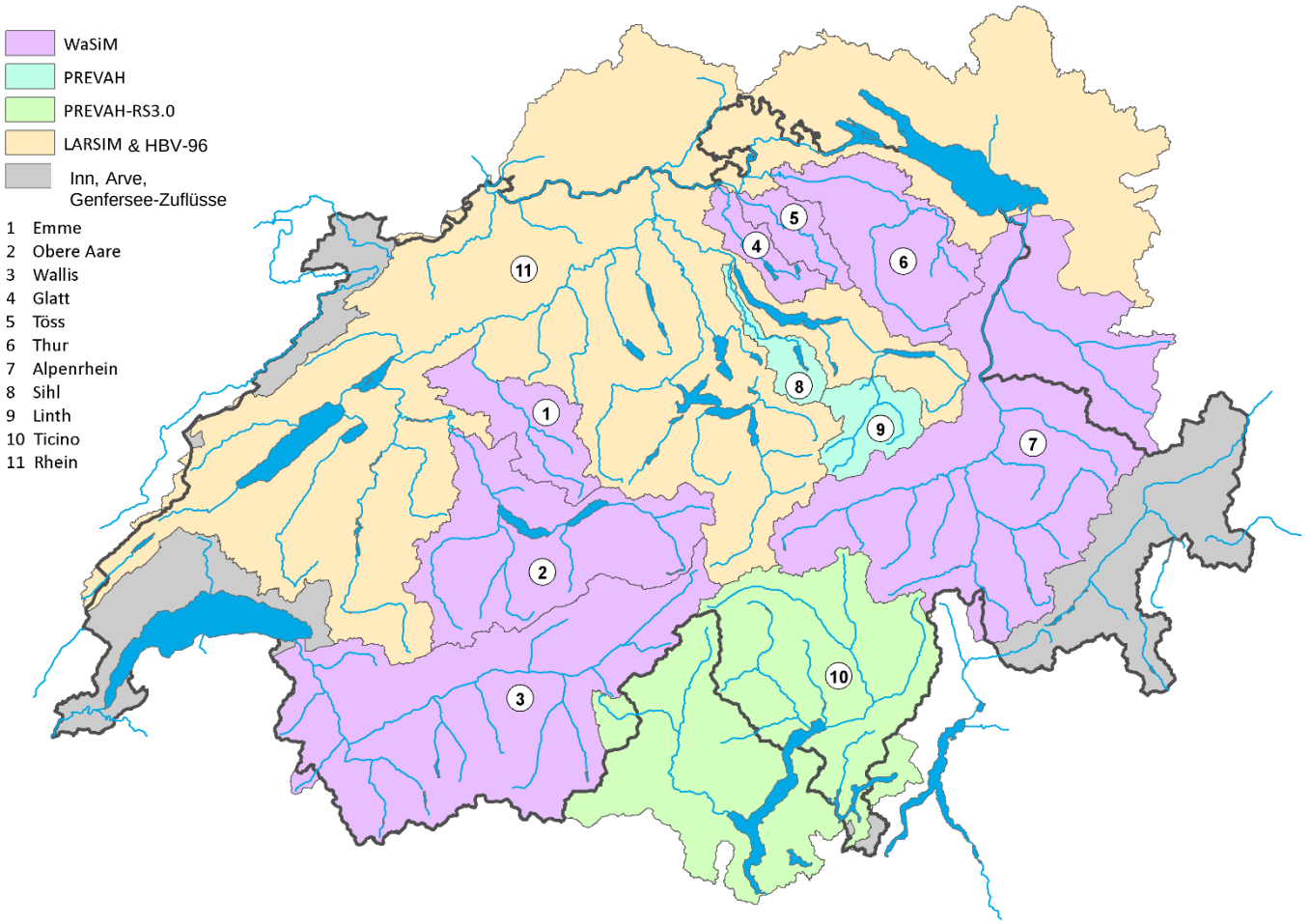
Flood event August 2005



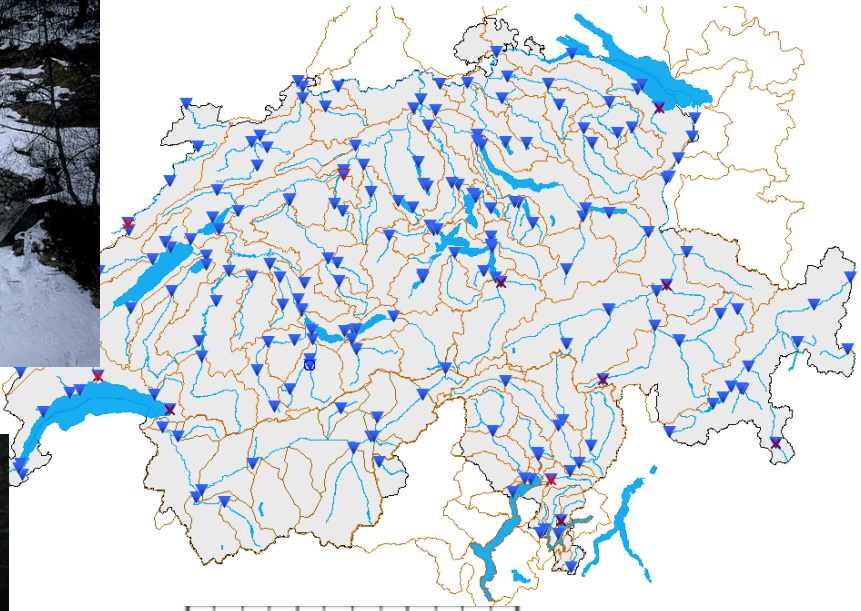

Flood event in August 2005 with 6 fatalities
and economic damage of more than 3 billion Swiss Francs

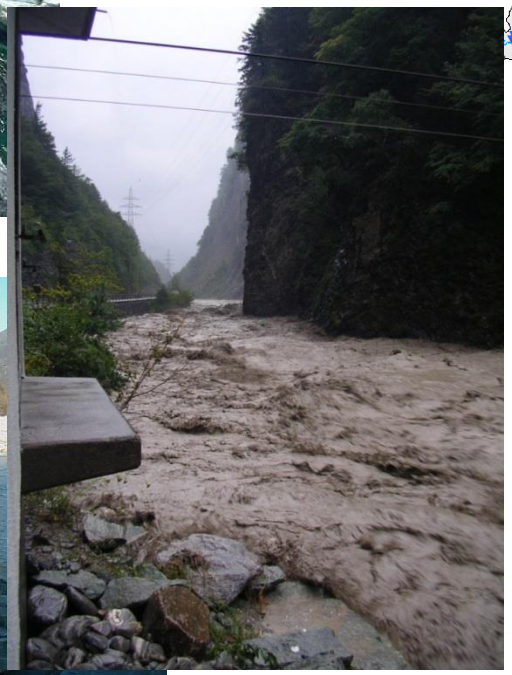
Ausbau der hydrologischen Modelle

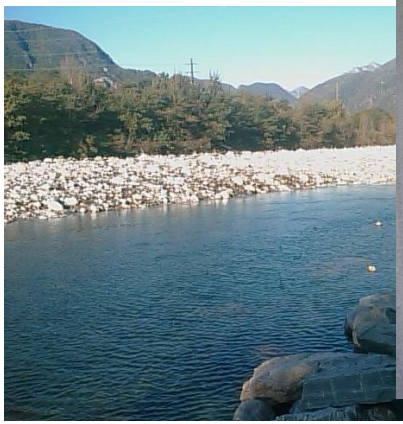
Multi-Modell Ansatz

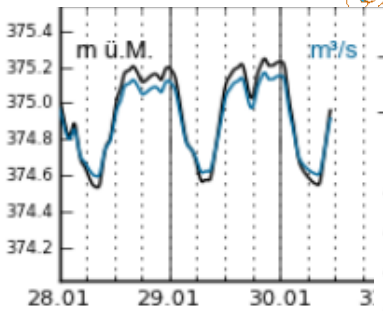


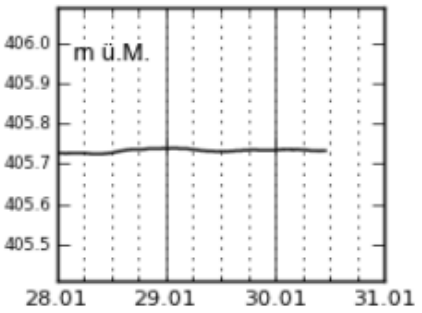
Hydrological Challenge – Runoff Measurements





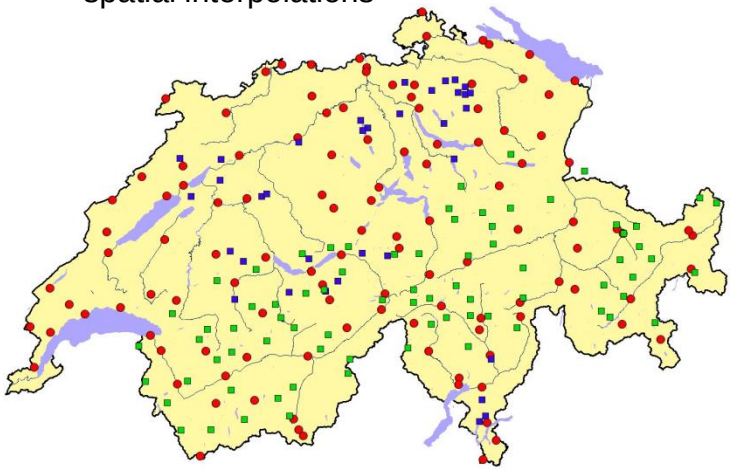




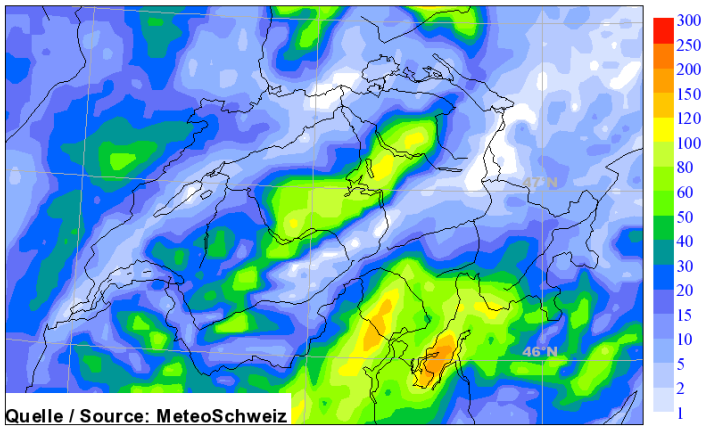


Hydrological Challenge – Operational Meteo-Data

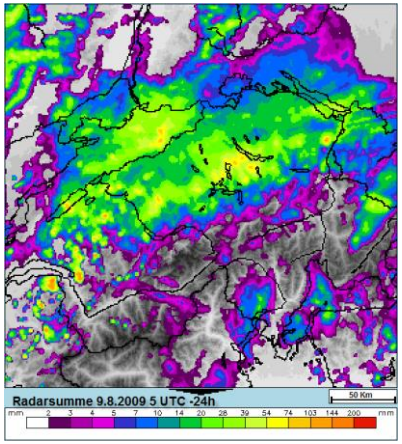
spatial interpolations



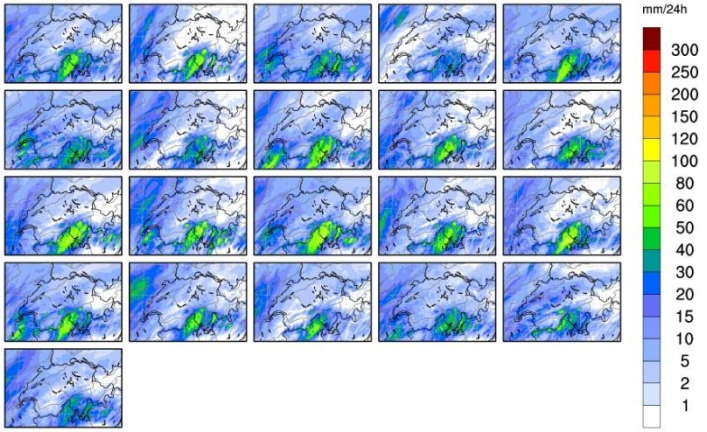
COSMO-2, COSMO-E, ECMWF



Spatial radar data



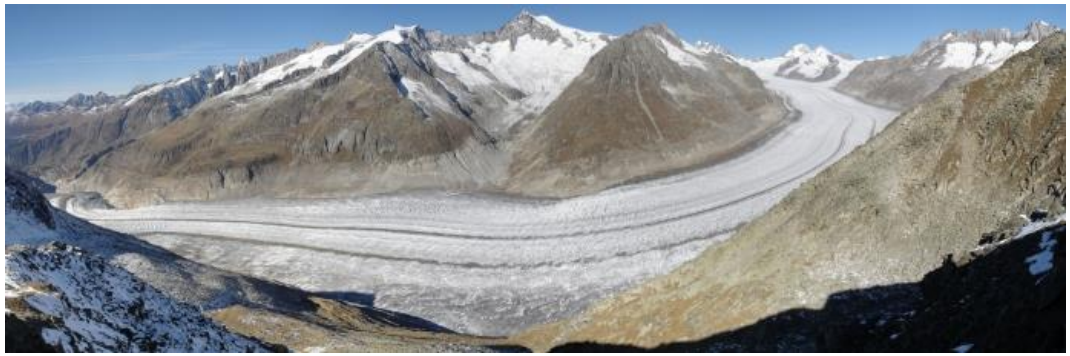
COSMO-E

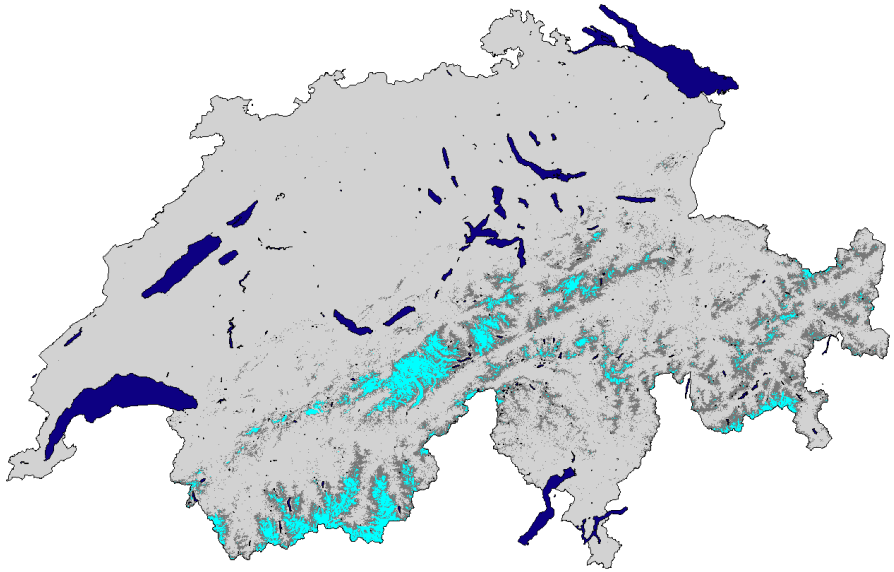


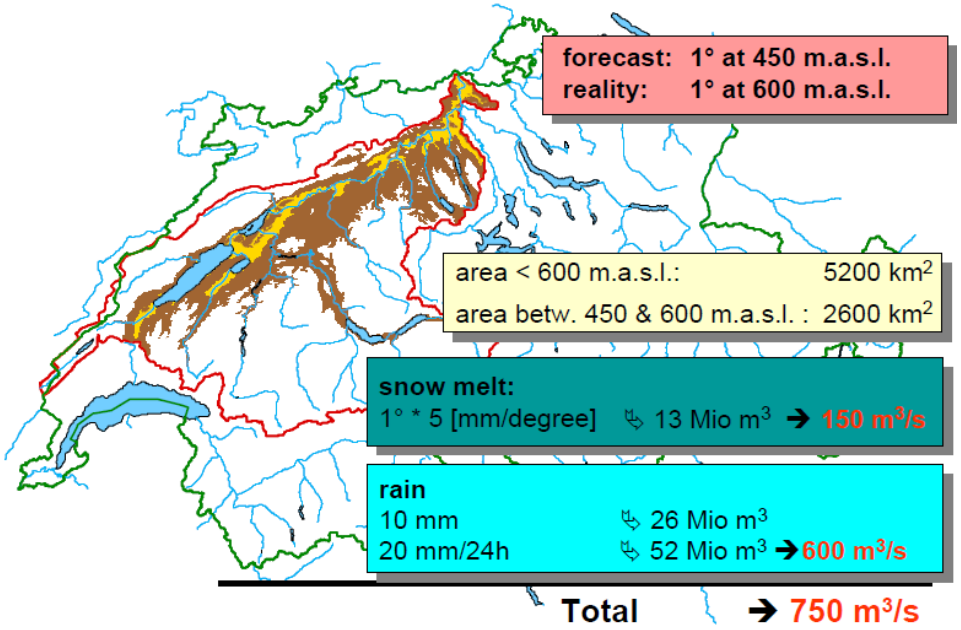
Meteo-Measurement

Meteo-Forecasts

Hydrological Challenge – Snow and Glaciers



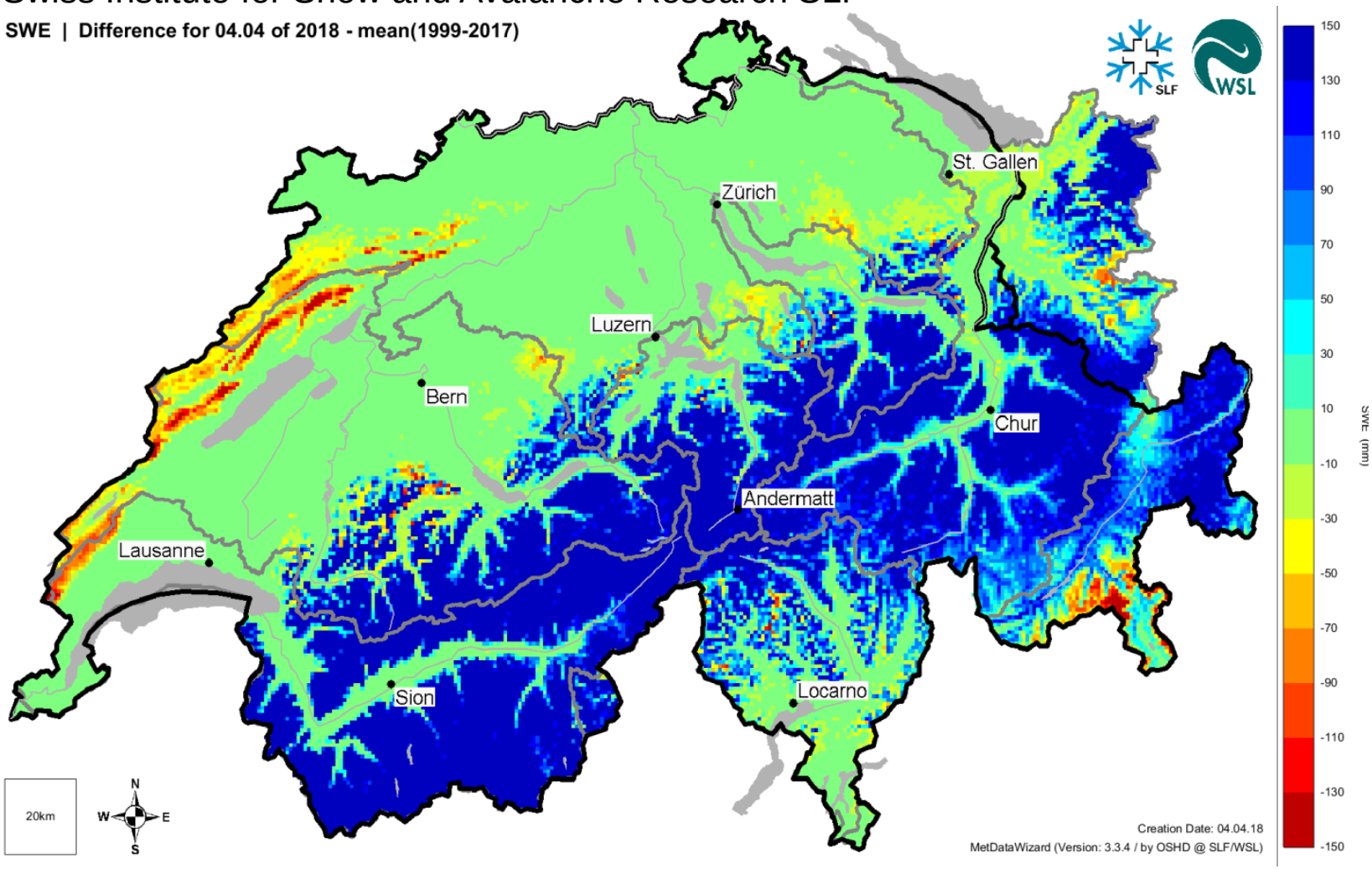




> 40 % of yearly Swiss runoff volumes are from glacier and snow melt

Hydrological Challenge – Snow and Glaciers

SWE and Snow Melt Calculations by the
Swiss Institute for Snow and Avalanche Research SLF



Hydrological Challenge – Snow and Glaciers

SWE and Snow Melt Calculations by the
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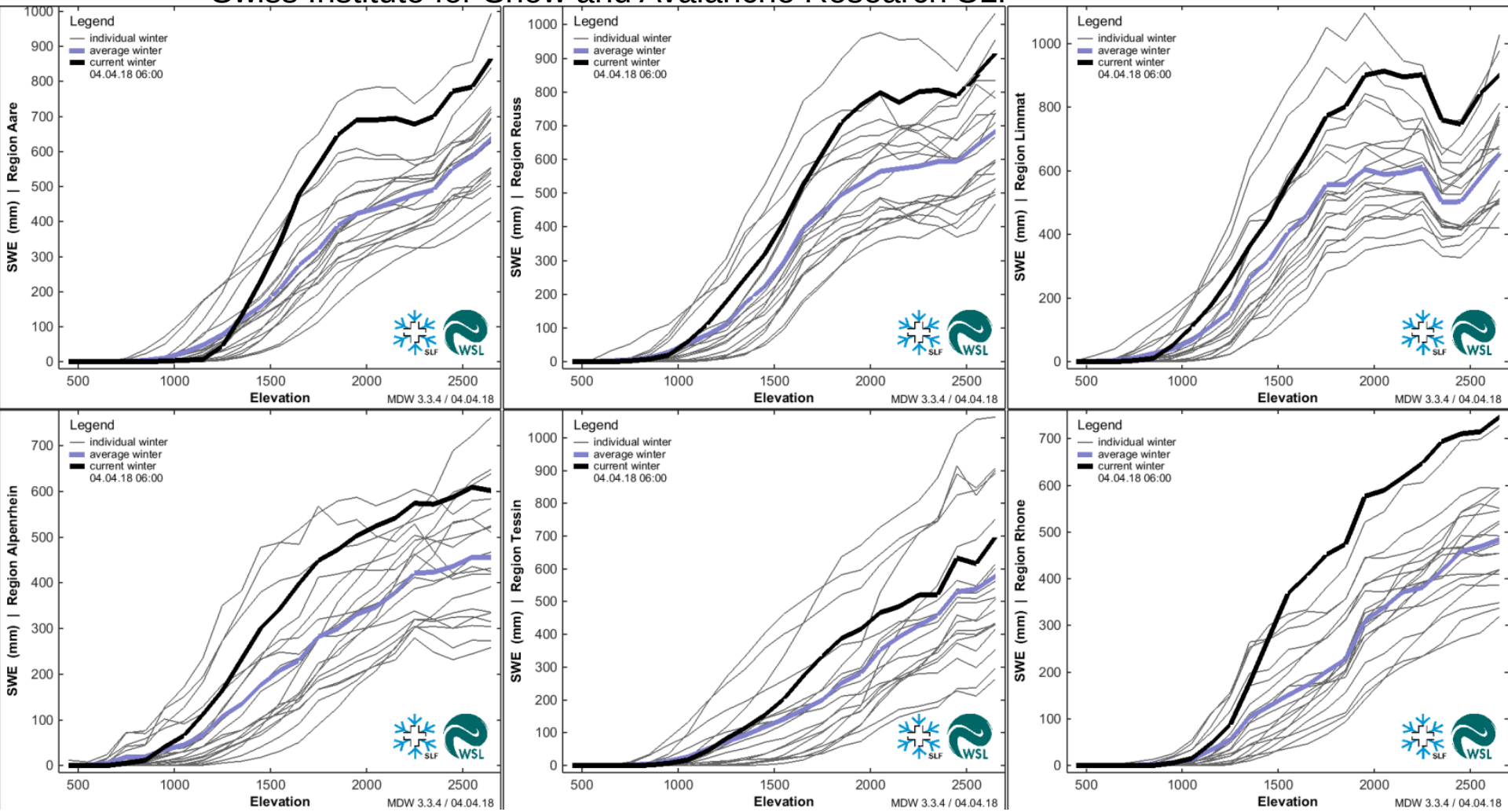
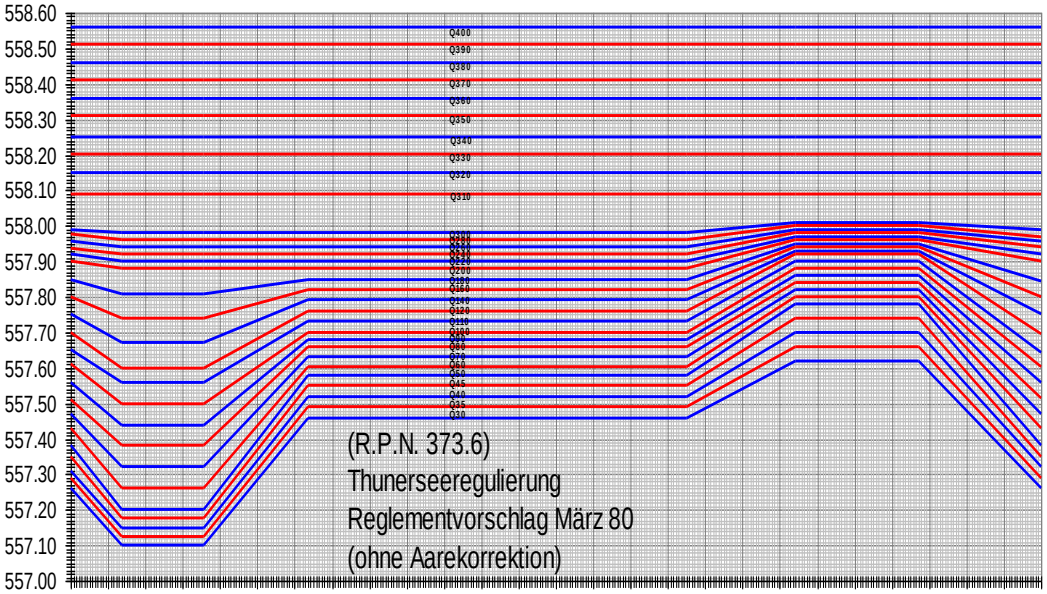


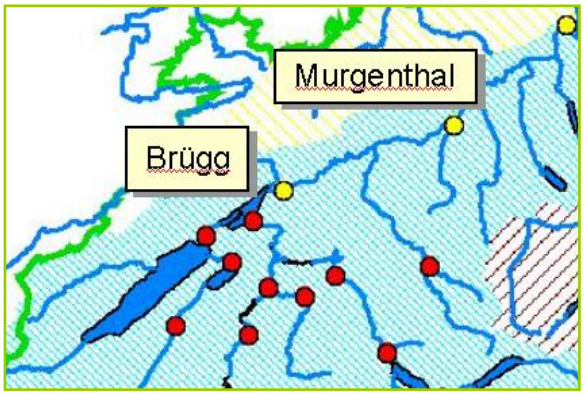
Hydrological Challenge – Lake regulation



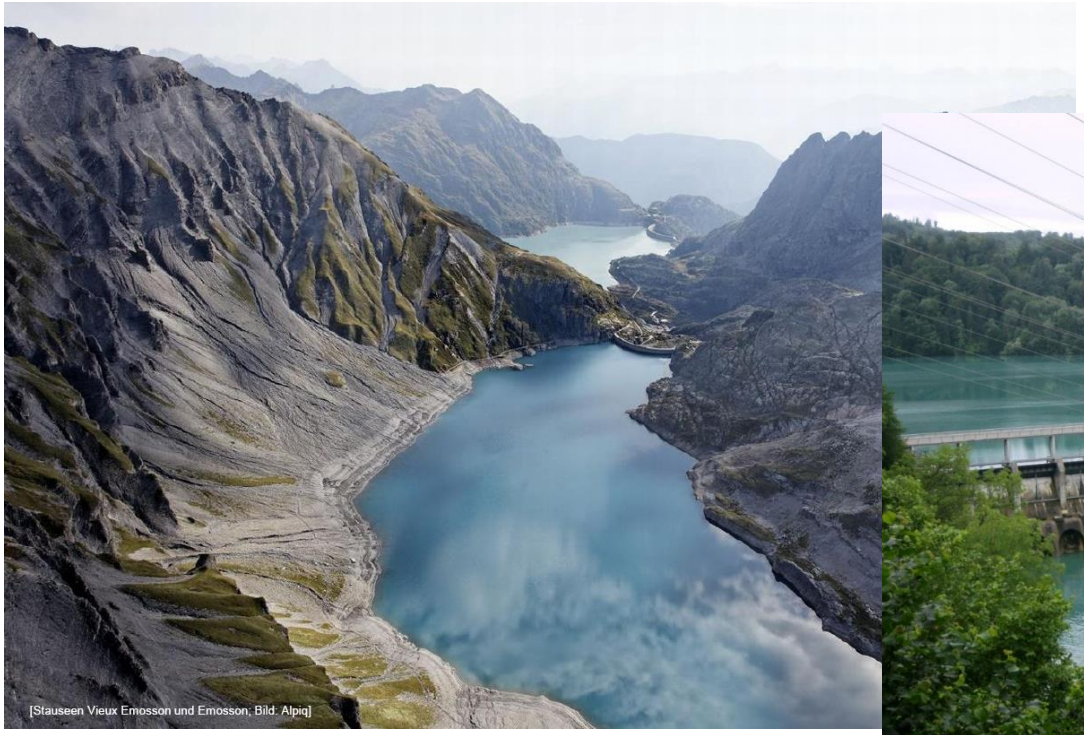
Almost all major lakes
in Switzerland are regulated

Runoff dependent on
season of year and
lake level

- Lake regulation offical schemes implemented in the models
- *Regulation (by Swiss Cantonal Authorities), not in all situations according to scheme*



Hydrological Challenge – Hydropower



55 % of Swiss energy from hydroelectrical power

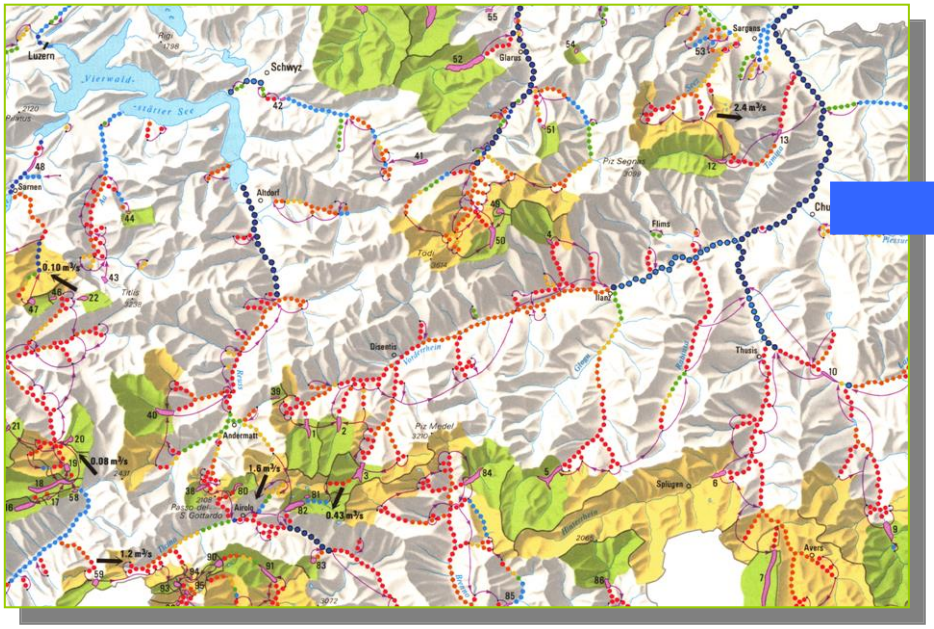
- convential hydroelectric dams (reservoirs)
- pumped-storage hydroelectric power stations
- run-of-the-river hydroelectric stations

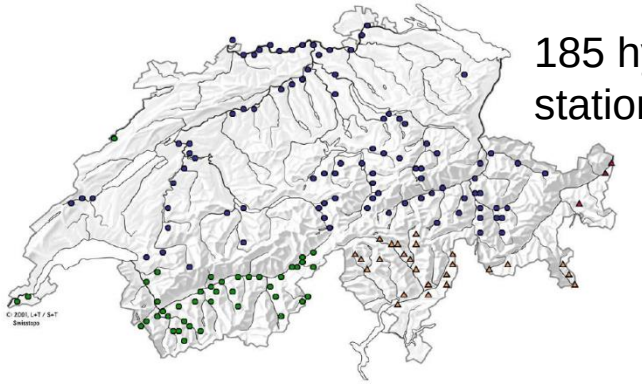
- currently reservoir operator only have to consider energy needs

  -> no reliable discharge forecasts

Hydrological Challenge – Hydropower

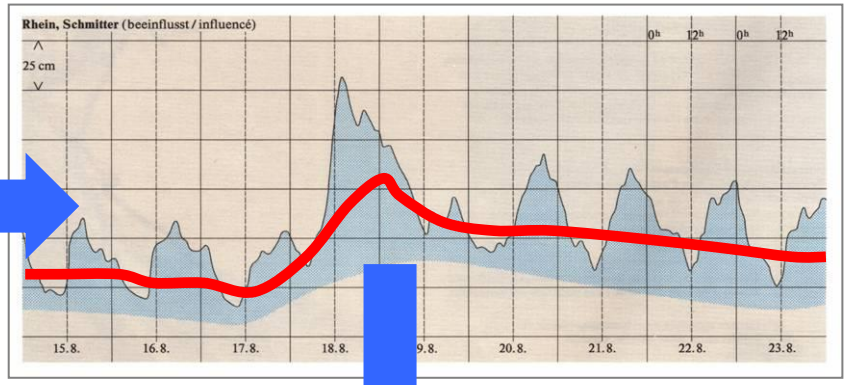
Hydropower



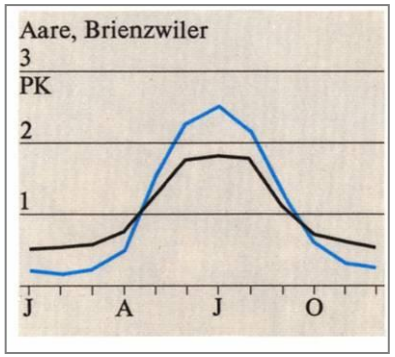


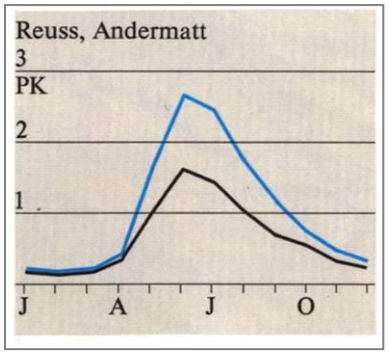
185 hydropower stations > 10 MW

Daily fluctuation



Water regime





→ *Challenge for model calibration and forecast*

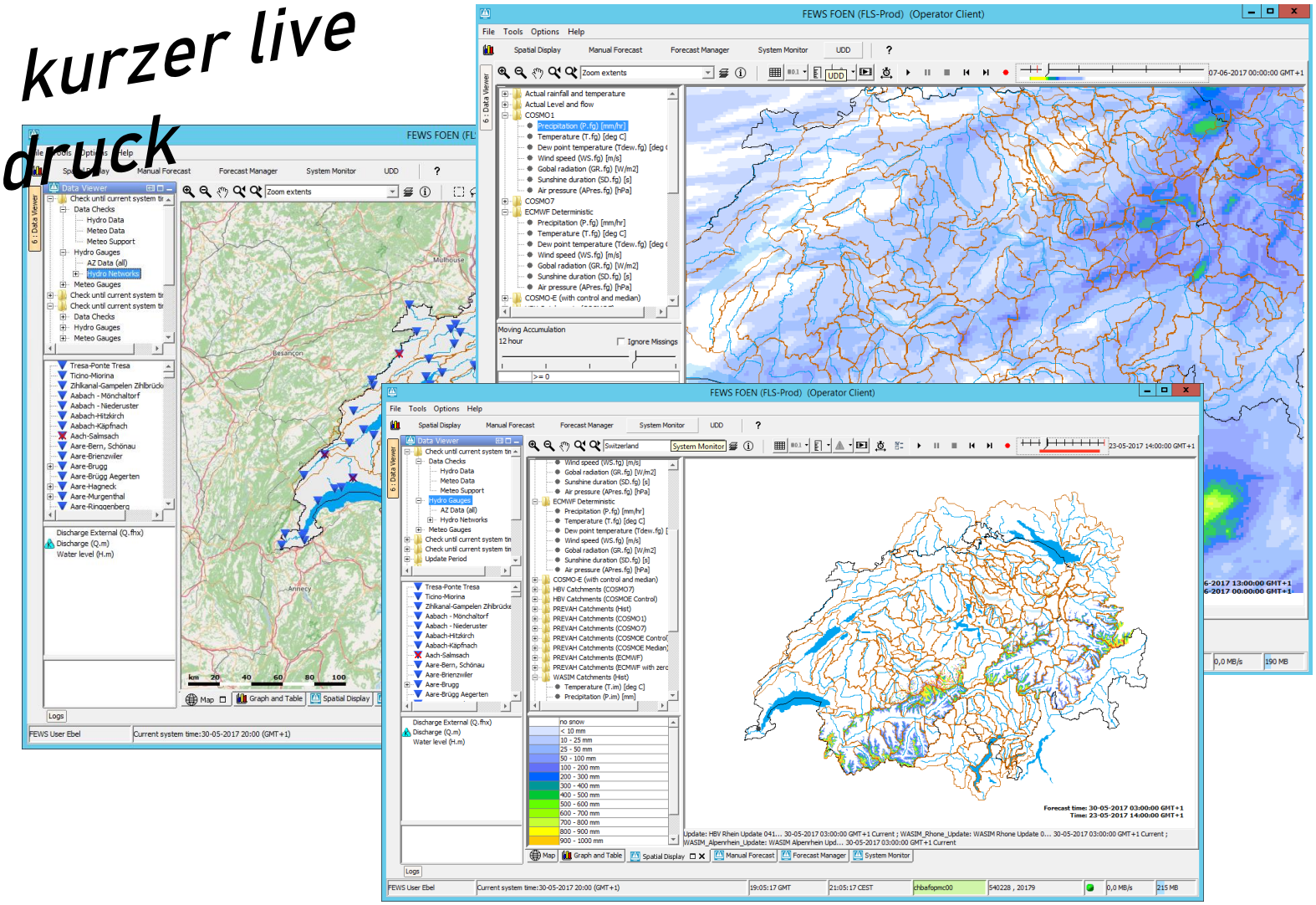
Aktuelle Fragen und Herausforderungen

- Daten-Assimilation
  (insbesondere Schnee-Messungen)
- Prozessierung von mehreren hochaufgelösten

  Meteo-Ensemble Vorhersagen
- Verbesserte Meteo-Interpolation
- Erweiterte regionale Hochwasserwarnung
- Nowcasting in kleineren Einzugsgebieten
  (stündlich,10 min Zeitschritt)
- Trockenheits-Vorhersage und -Warnung
- Optimierung des hydrologischen Multi Model Ansatzes

Flood Early Warning System FEWS-FOEN

ein kurzer live Eindruck



FEWS in der hydrologischen Vorhersage der Schweiz
Regionales Delft-FEWS Anwendertreffen 2021

Fragen / Rückmeldungen ?

Danke. Und einen genussvollen hydrologischen Sommer!

martin.ebel@bafu.admin.ch