

Problems and opportunities of integrated basin management in mountains

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5th World Water Forum

**Suggestions for possible contribution to
RIOB session on
“River Basin Management and
Transboundary Cooperation”**

**Problems and Opportunities of Integrated
Basin Management in Mountains**

**Organisers: Mountain Institut (Carmen de Jong)
Gazi University (Ibrahim Gurer) and others**

Problems and Opportunities of Integrated Basin Management in Mountains

AIMS

- **Awareness raising** for climate and anthropogenic induced catchment problems in the Alps (moving away from perception of „whole“ catchment to „subcatchment“ scale)
- Development of pan-alpine **Stakeholder Interaction Forum** (moving through local to national and alpine scale)
- Monitoring and modelling, development of **Early Warning System against Water Scarcity**, suggestions for water management strategies

Useful background experience for preparing session

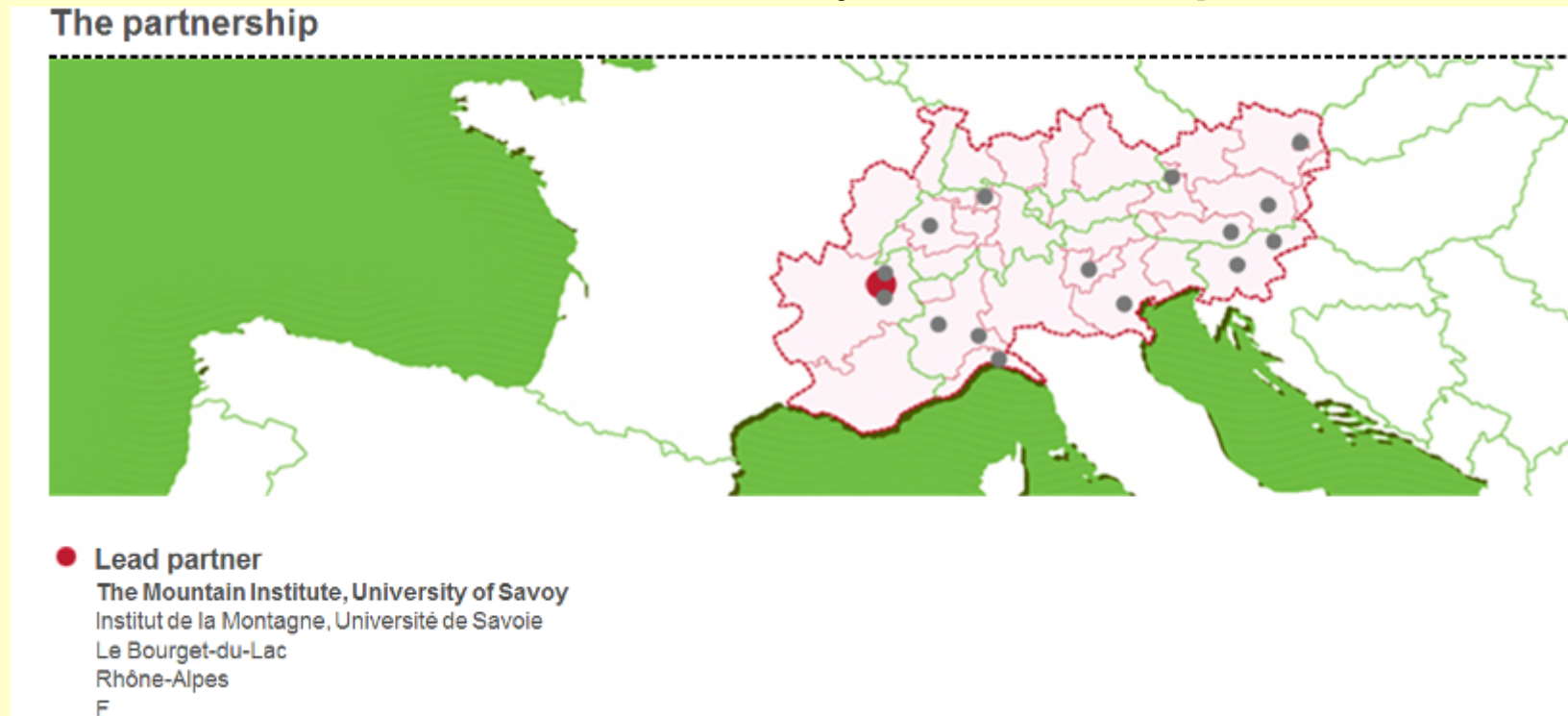
- Special Session “**Water in Mountains**” in September 2008 at WWC in Montpellier
- Interreg Alpine Space project **Alp-Water-Scarce** (Water Management Strategies against Water Scarcity in the Alps) with 17 partners



Interreg Alpine Space

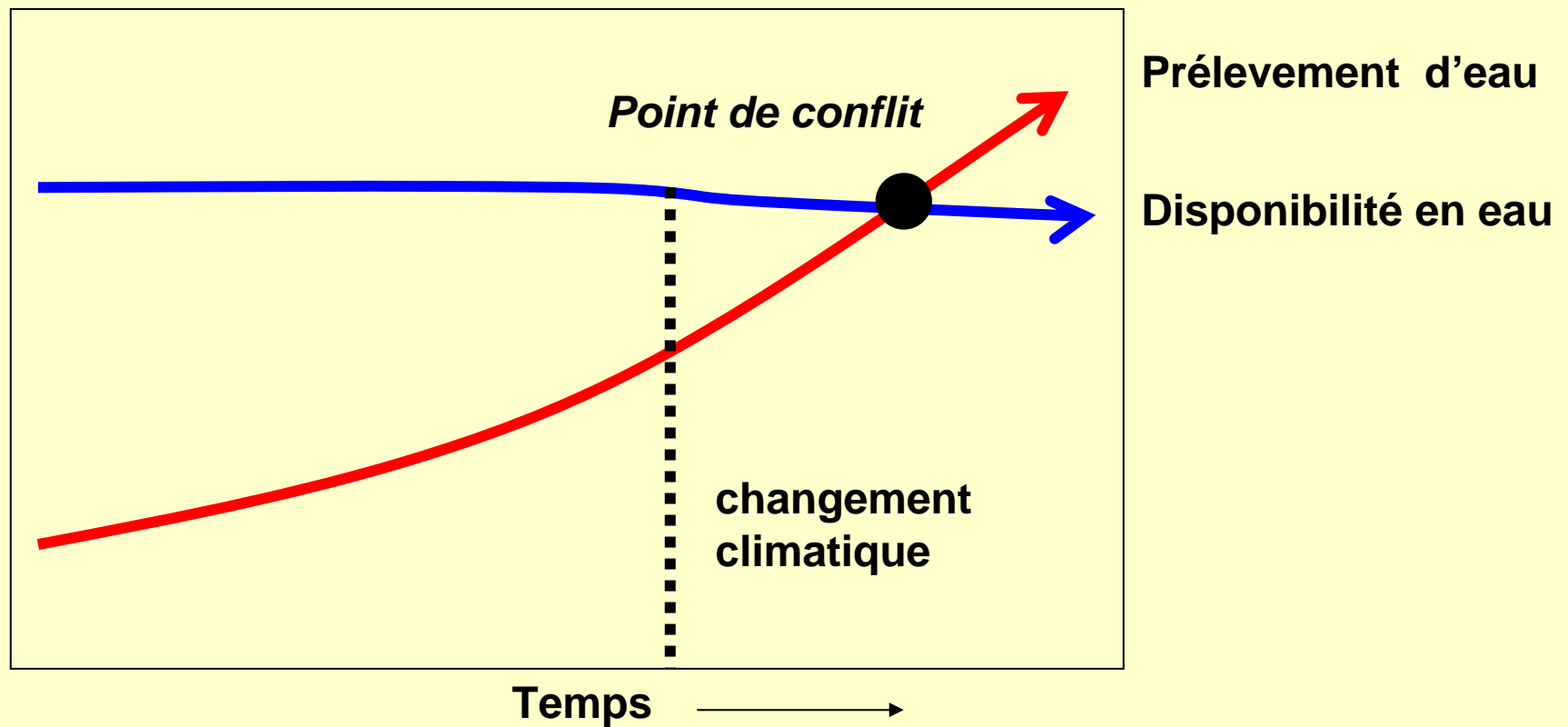
Alp-Water-Scarce

Water management strategies against water scarcity in the Alps



Water problems in mountains ?

Projection des disponibilités en eau et des prélèvements en fonction du temps



Changing climatic pressures



Zermatt in 1890

Lopé 1884

Artificial snow for nordic skiing



Terre Sauvage 2008

Snow making is water intensive



4700 m³ / ha

Changing anthropogenic pressures



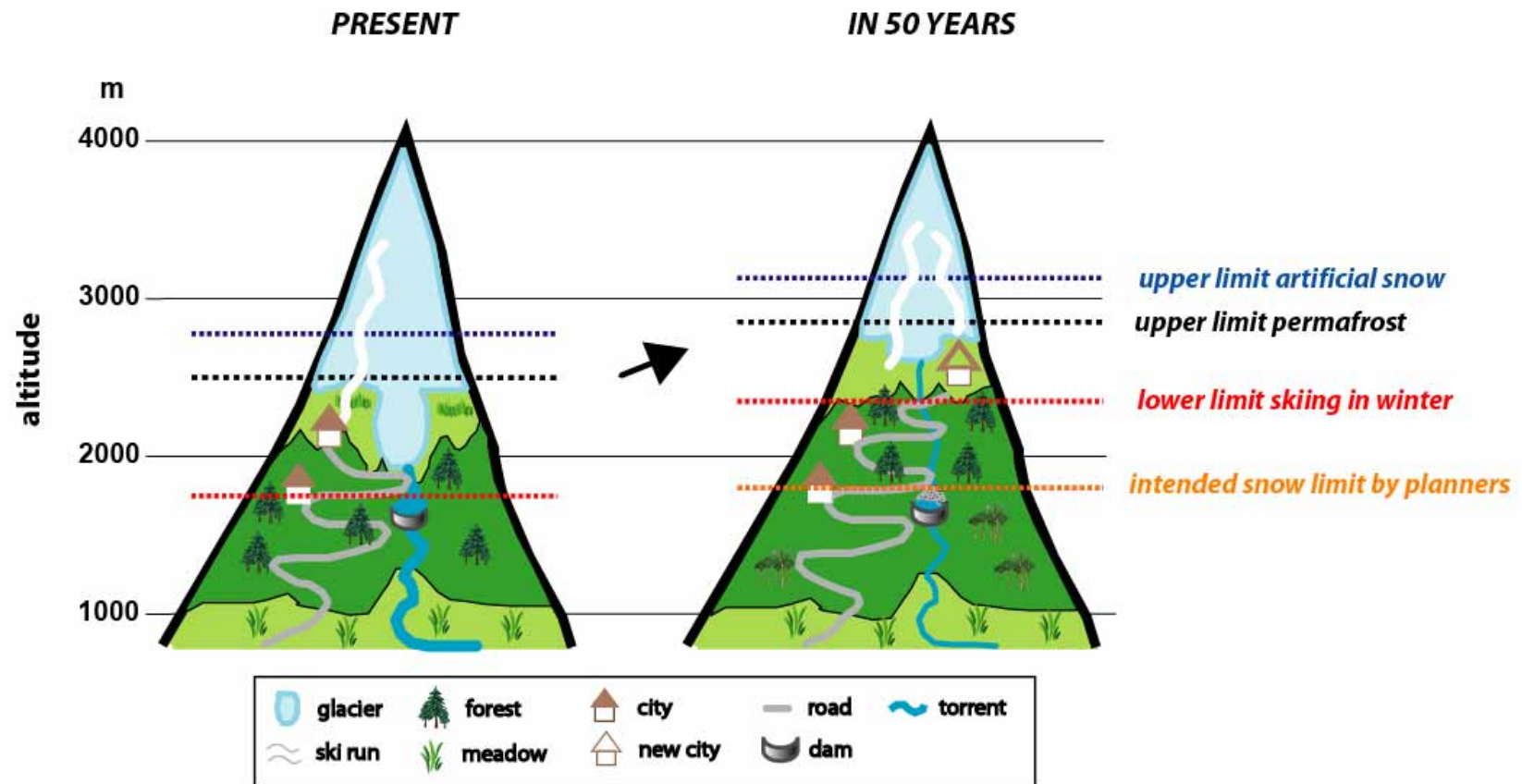
Zermatt, Petit Cervin: model



Zermatt, Petit Cervin

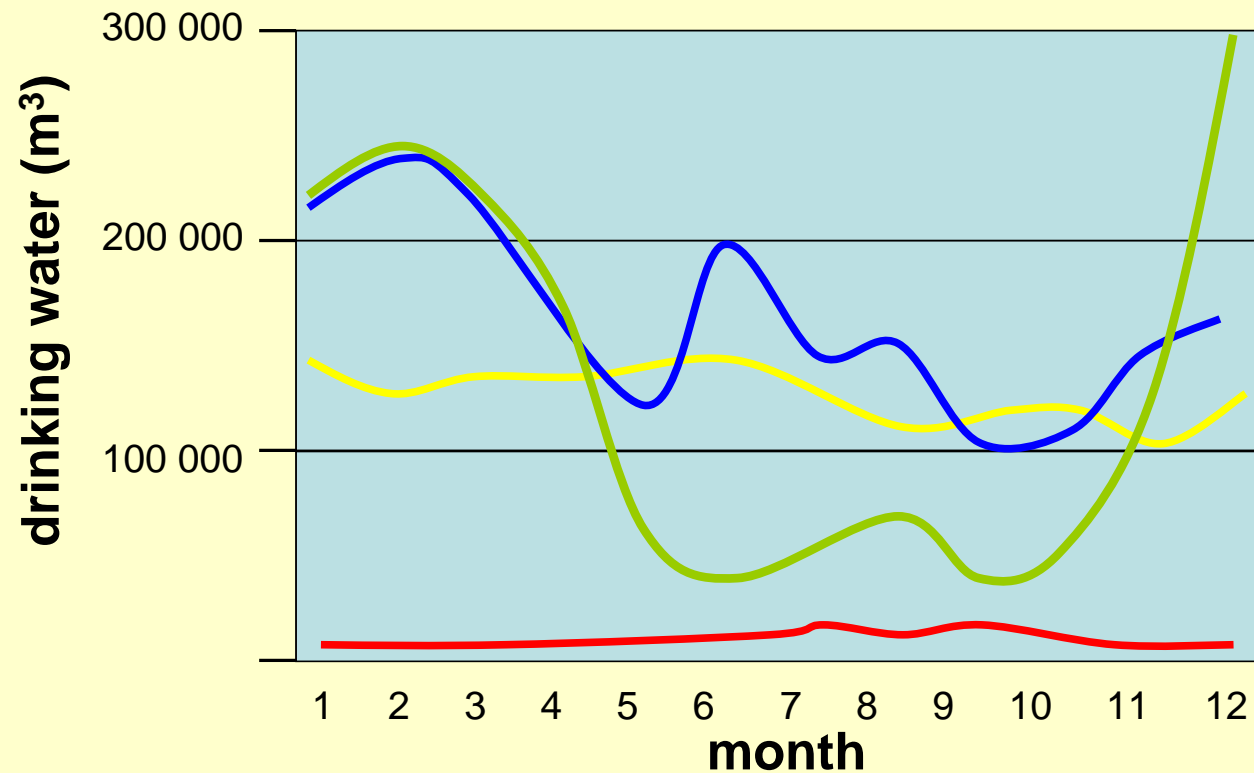
**Plans for tourist platform and pressurised hotel
(117 m in height, extension up to 4000m)**

Anthropogenic and climatological pressures on mountain catchments



Will the upper anthropogenic limits be constrained by altitude, or not?

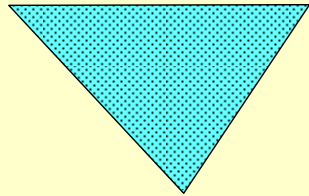
Seasonal Water Consumption for Tourism



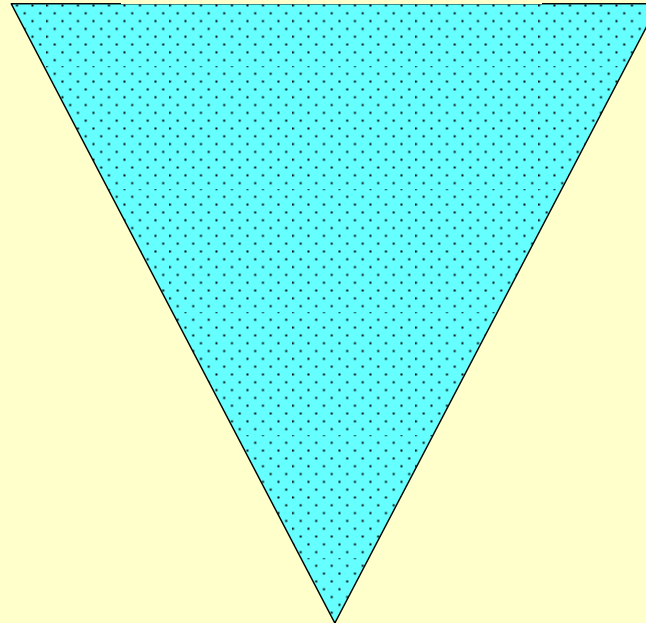
— Les Chapelles — Albertville
— St. Martin de Belleville — Bourg St. Maurice

Spatial Water Consumption for Tourism

200 km²



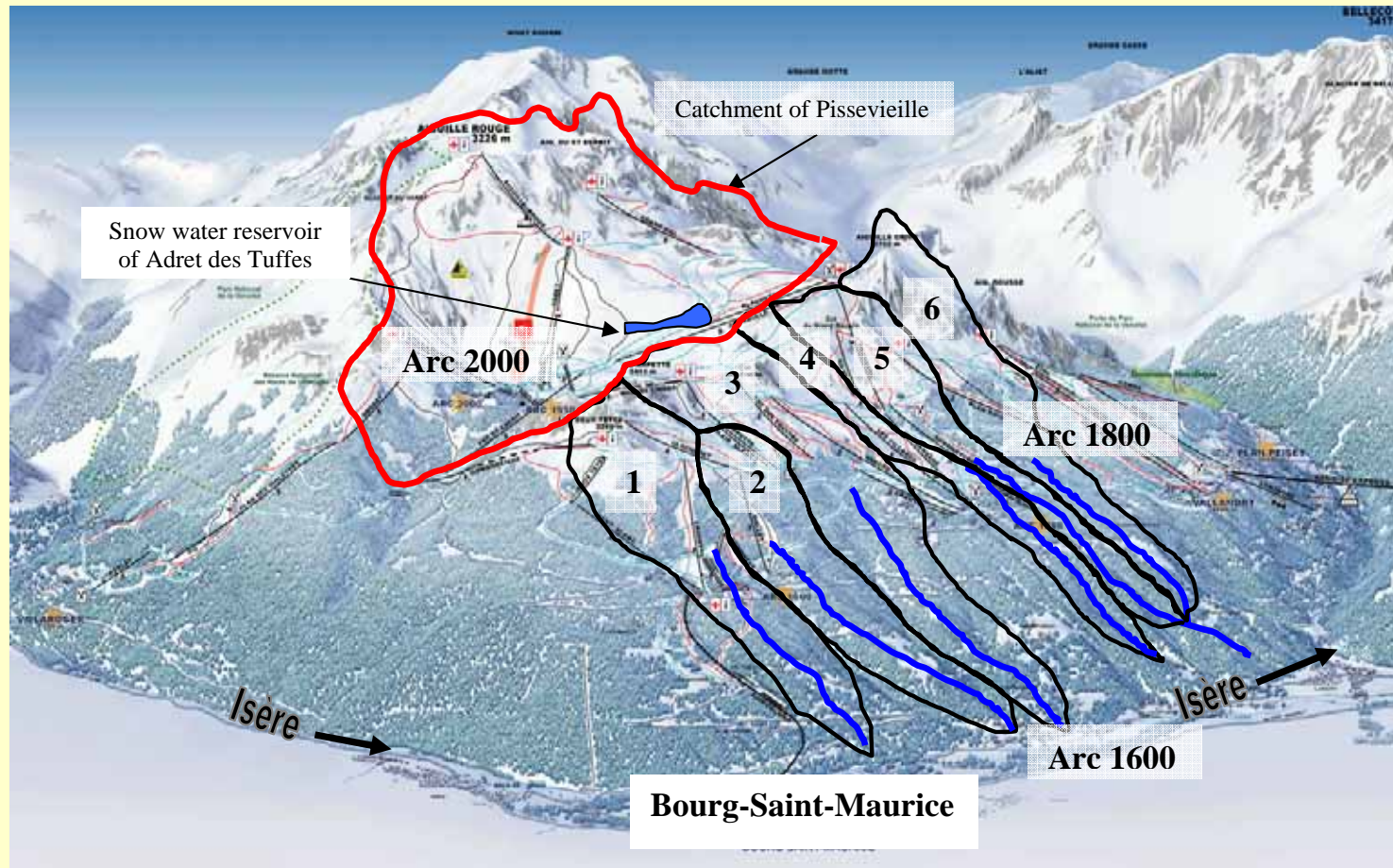
1600 km²



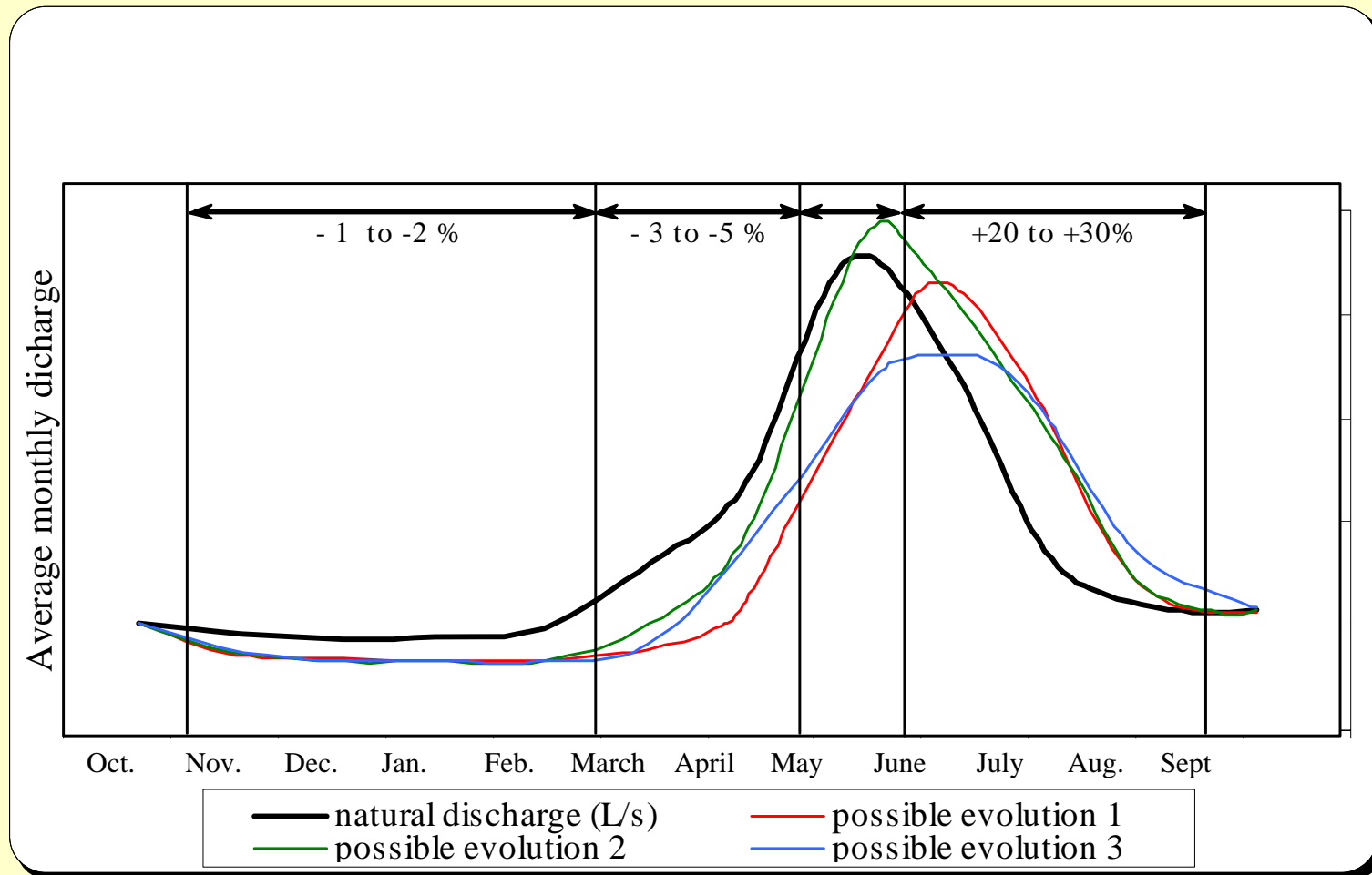
- sub catchment of 200 km²
- relative winter discharge of 10 L/s/km²
- tourist density of 300 beds/km²

- main catchment of 1600 km²
- relative winter discharge of 10 L/s/km²
- tourist density of 190 beds/km²

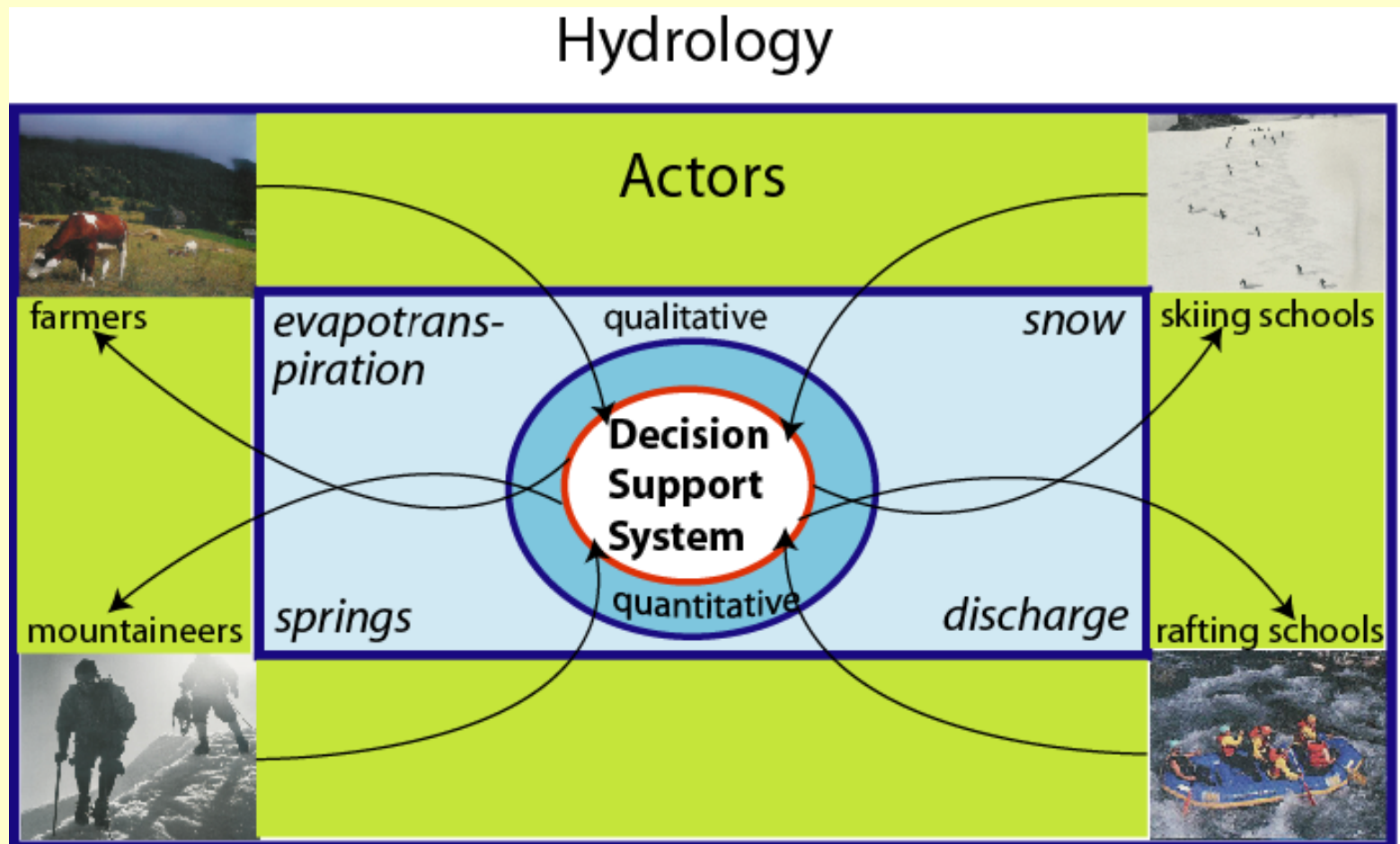
The Arcs ski resort: construction of water reservoir for snow making



Possible evolution of the hydrograph under the impact of artificial snow



3. Propositions pour la gestion intégrée de l'eau en montagne en soulignant le rôle des acteurs et les approches interdisciplinaires



CONCLUSIONS

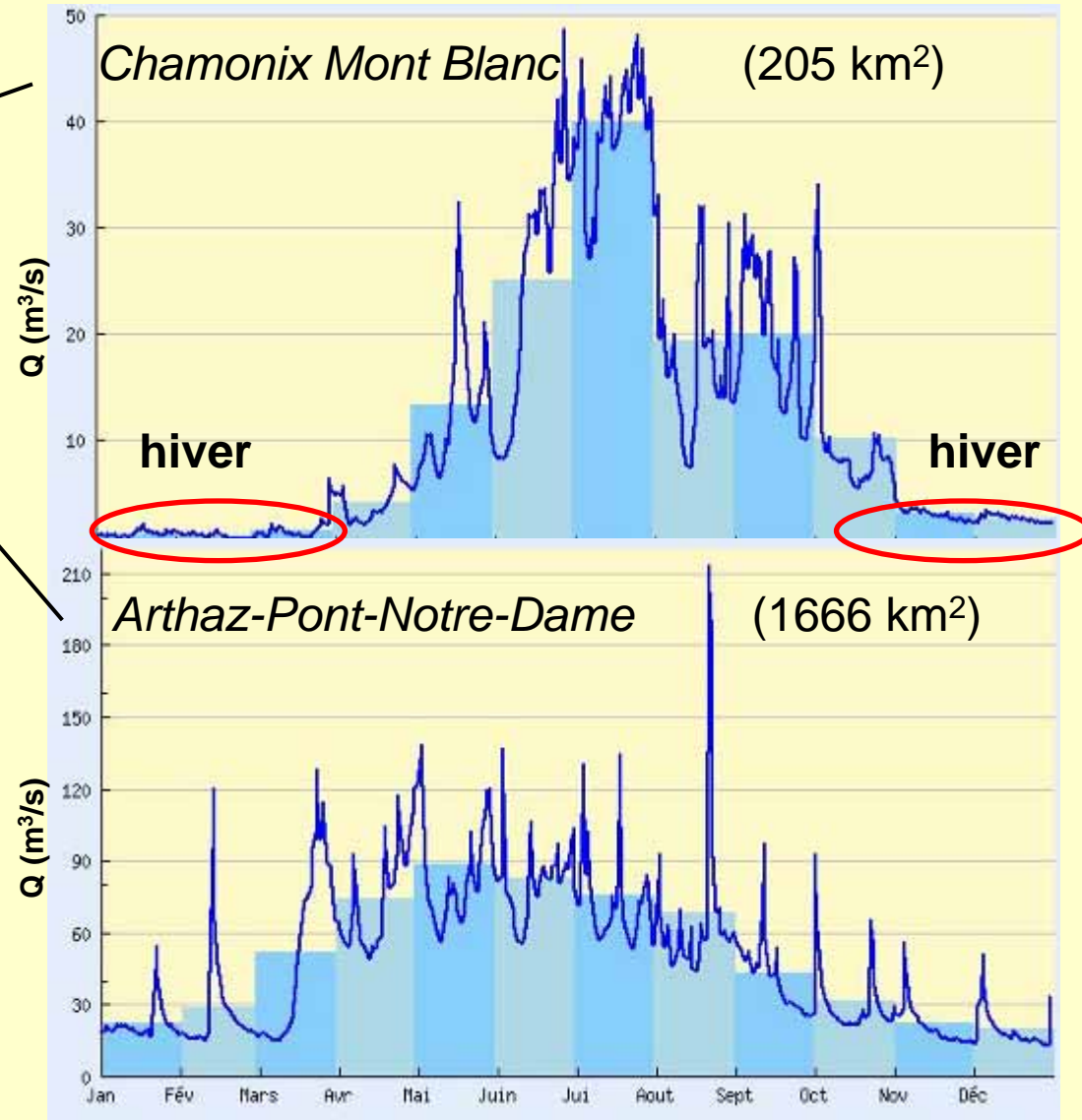
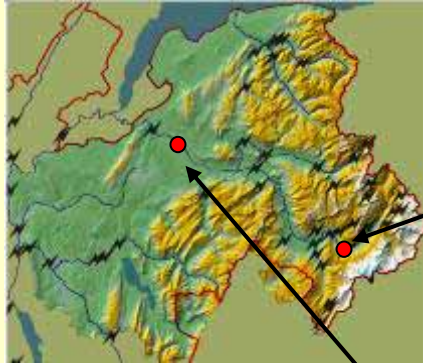
- AlpWaterScarce will intensify long term, **observational networks** and integrate “soft” (or qualitative) **stakeholder knowledge**
- integrate **short term, in situ** (but significant) water abstraction such as for snow production or tourism in monitoring and modelling approaches
- develop **adaptation and mitigation strategies** (drought resistance crops)
- create **Early Warning Systems** at sub-catchment scale, integrating economical and hydrological requirements
- develop new mountain water regulations together with **Alpine Convention**

An aerial photograph of a mountain town built on a steep, rocky slope. A large glacier flows down the mountain side, and several ski lift towers are visible. The town consists of numerous buildings, some with red roofs, and a winding road. The overall scene is rugged and mountainous.

CHALLENGE

Help to develop an interdisciplinary
and intersectorial **problem
consciousness** and **acceptance**

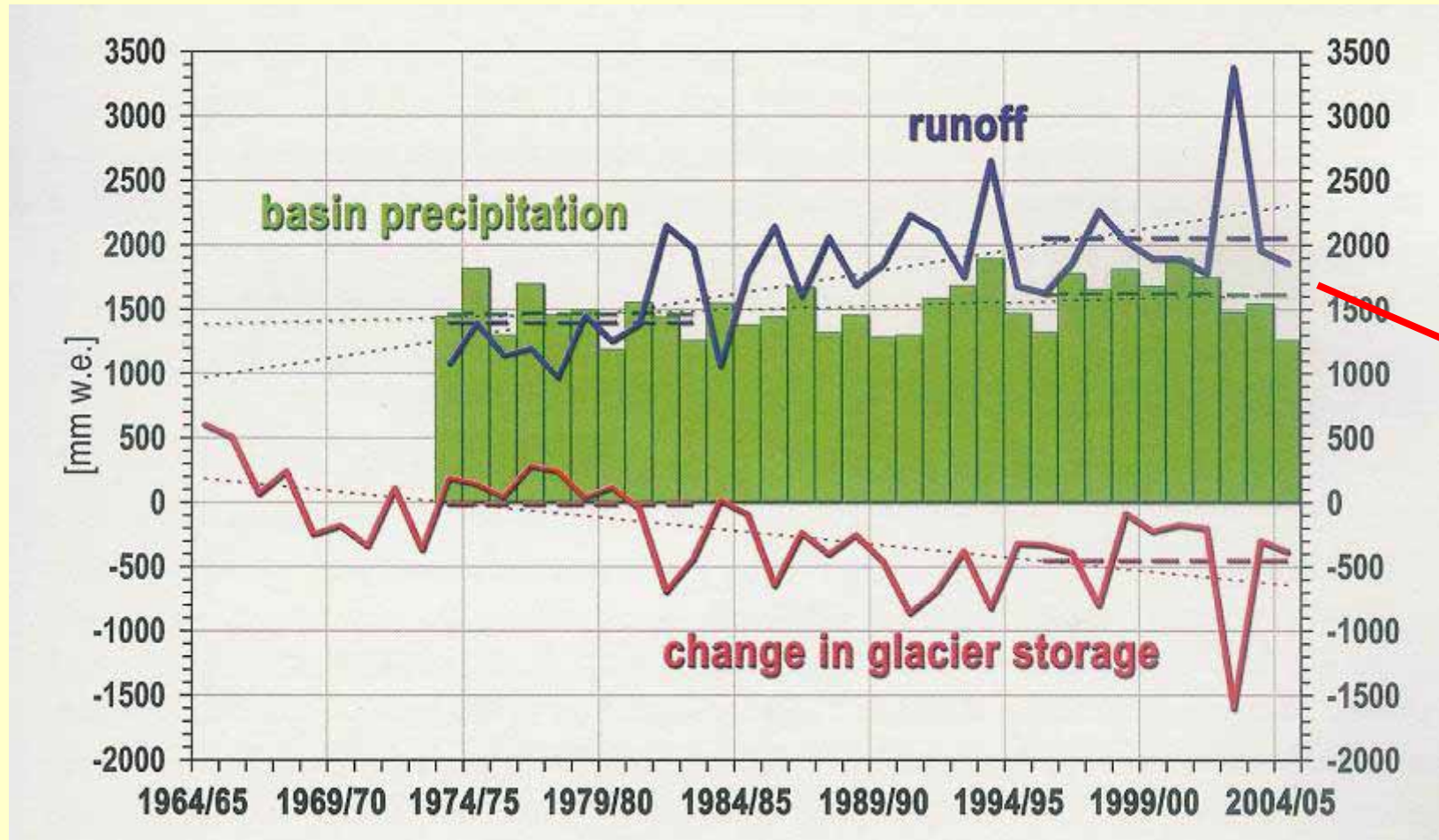
Périodes de conflits d'usage de l'eau



Prélèvements en eau pour :

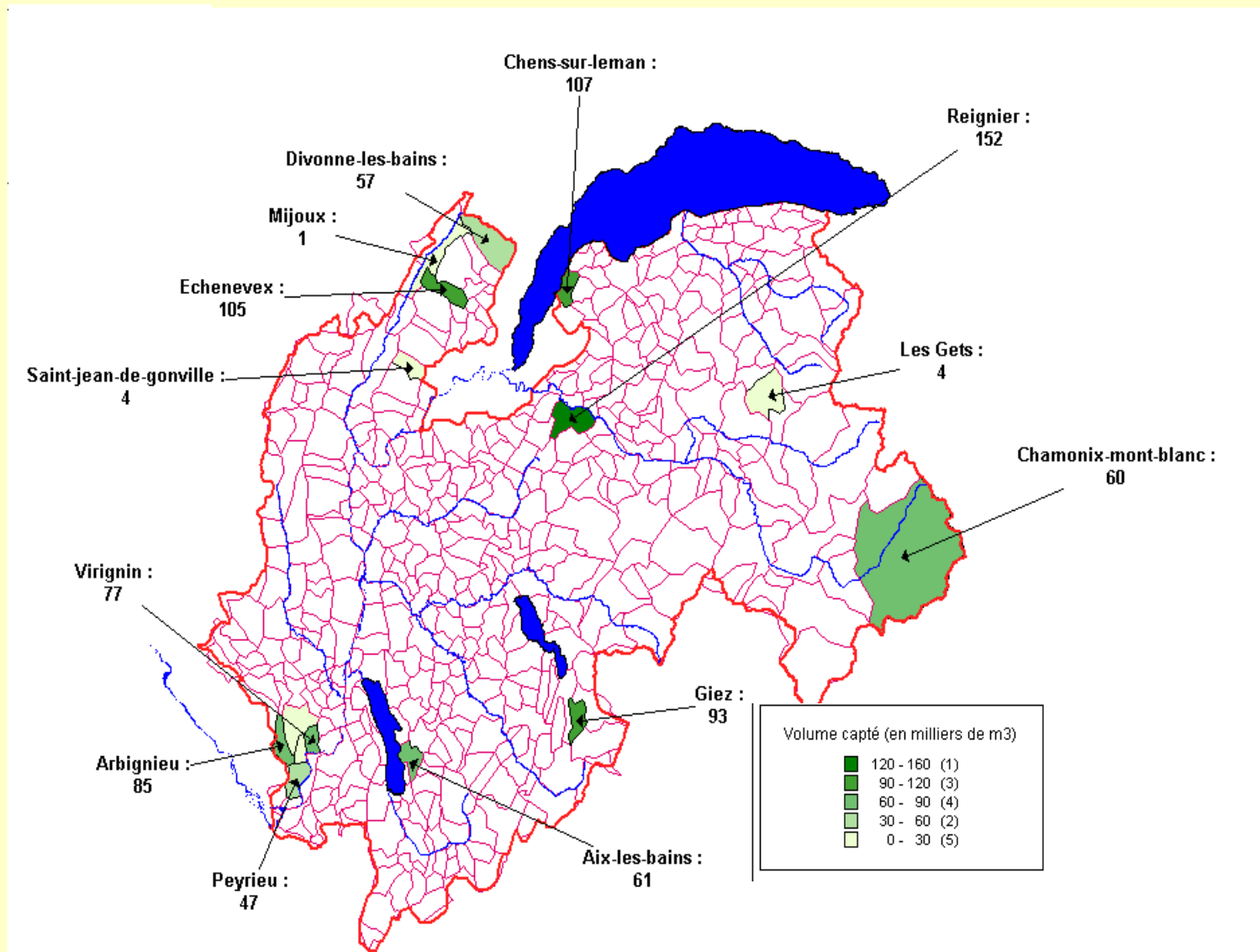
- tourisme
- neige de culture
- hydroélectricité
- agriculture

Water balance Vernagt Glacier

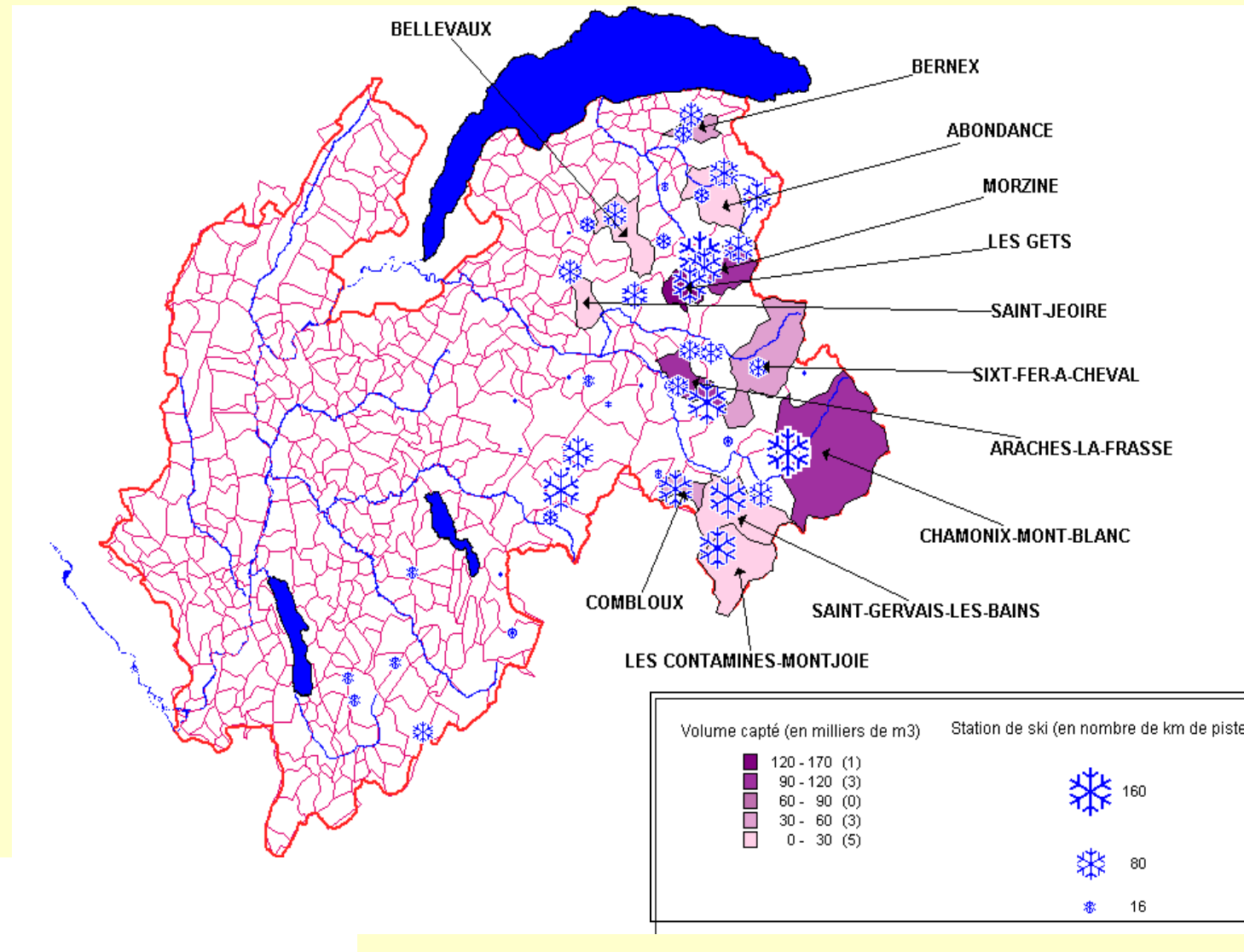


Parameters based on direct measurements

L'eau utilisée pour l'agriculture



L'eau utilisée pour la production de neige

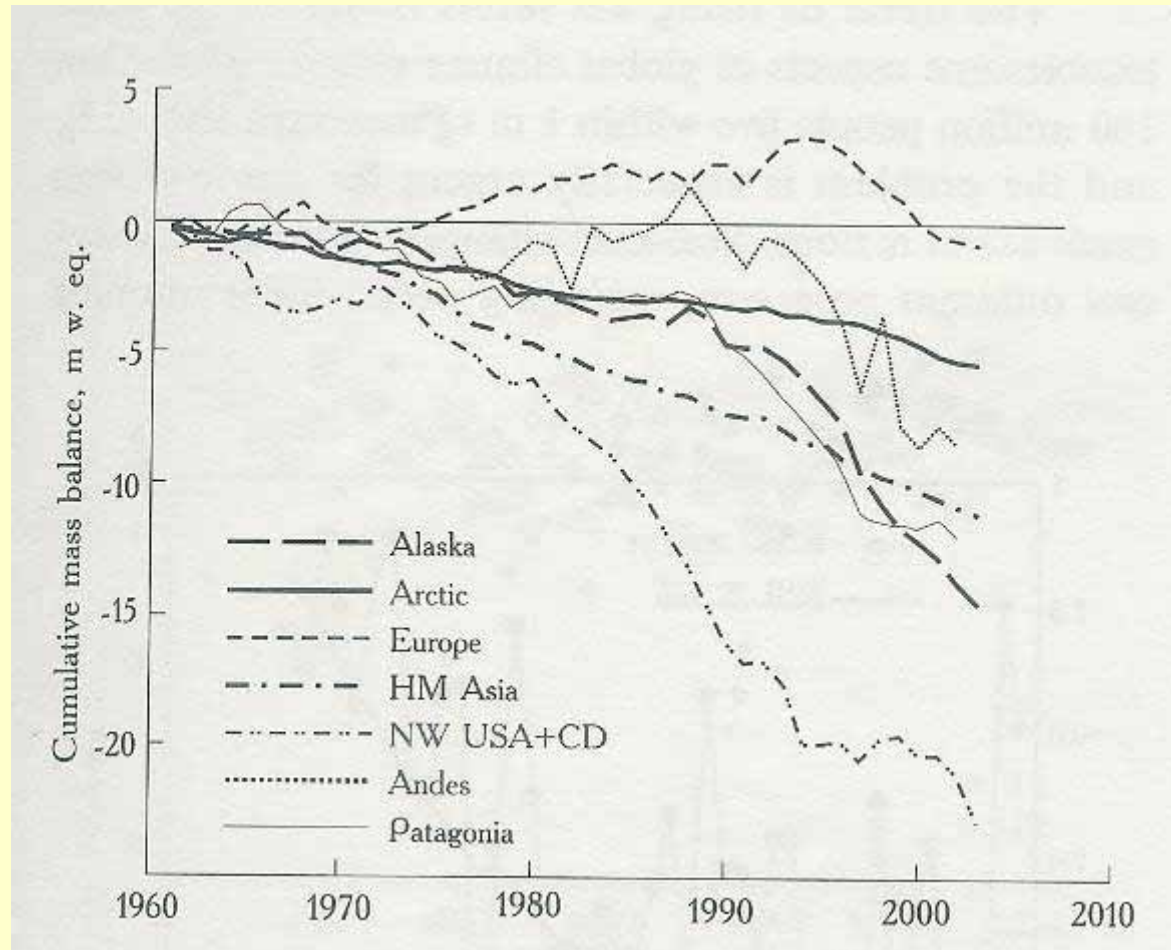


Réalisation Pierre Paccard – Données Savoie Mont Blanc Tourisme & Agence de l'Eau RMC, 2004

Pressure on mountain water resources by tourism

Town	permanent/ average tourist population	Max. drinking water in winter (m³)	Ratio water (m³)/ person
Albertville	18 000	140 000	7.8
Les Chapelles	400	2 000	5
Bourg St. Maurice	6750 20 000	160 000	23.7/ 8

Glacier mass balance worldwide



Dyurgerov & Meier 2006

Glacier retreat of Sonnblick Glacier



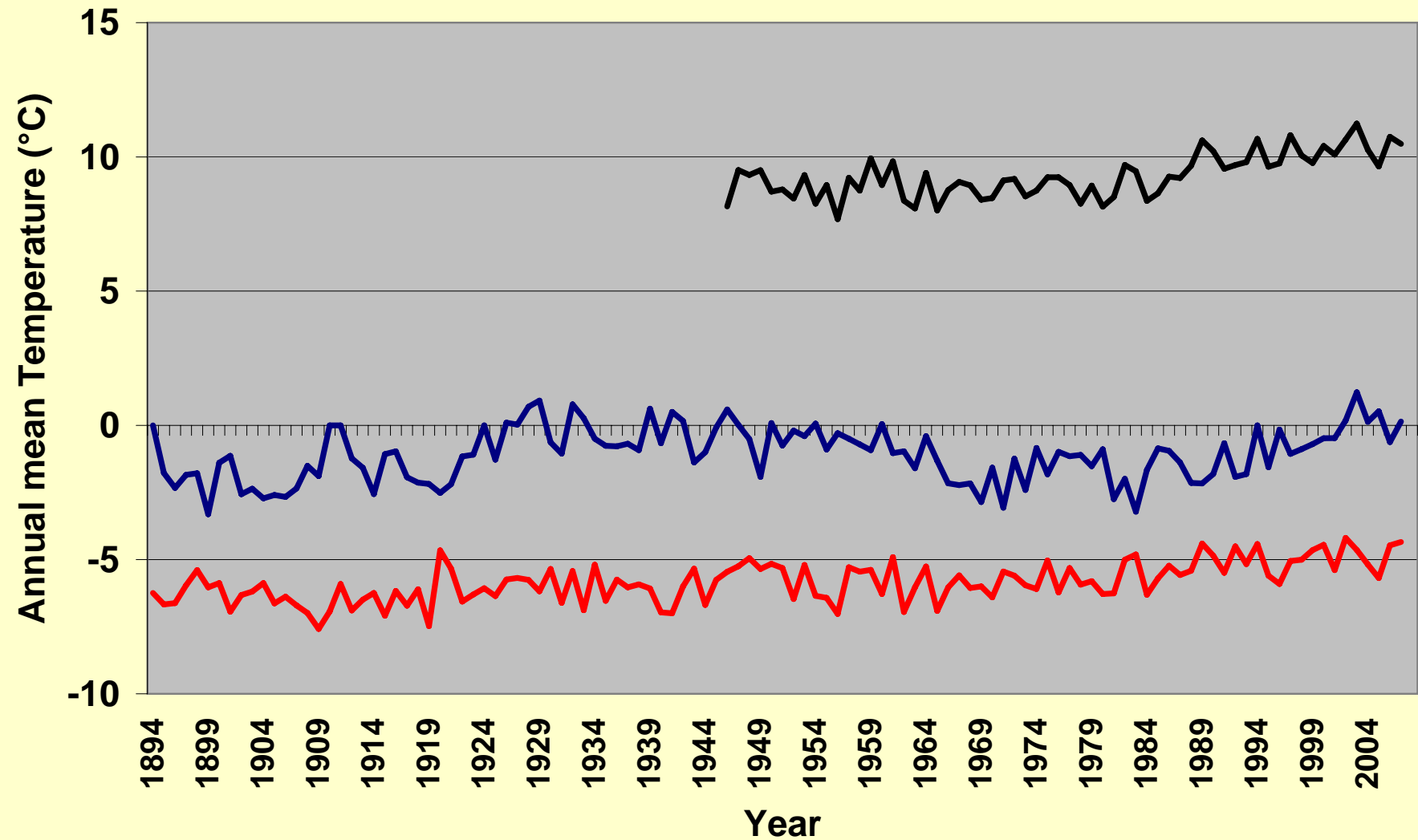
2007

Foto von R. Böhm, Standort Herzog Ernst,
Blickrichtung W

Austria

Böhm et al 2007

Temperatures compared for high latitudes and high altitudes



— Bourg St. Maurice (900 m) — Sonnblick (3100 m) — Angmagssalik 65°36' N (52 m)

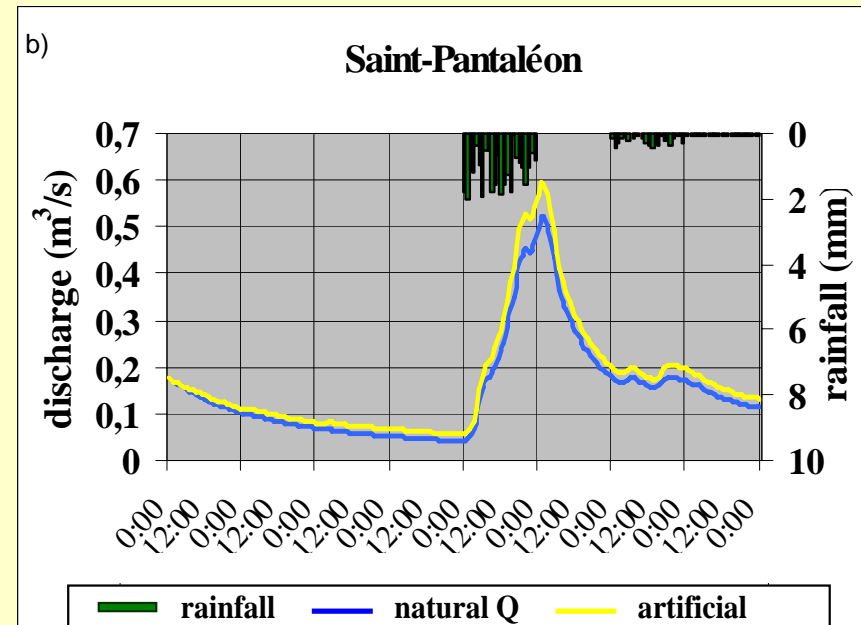
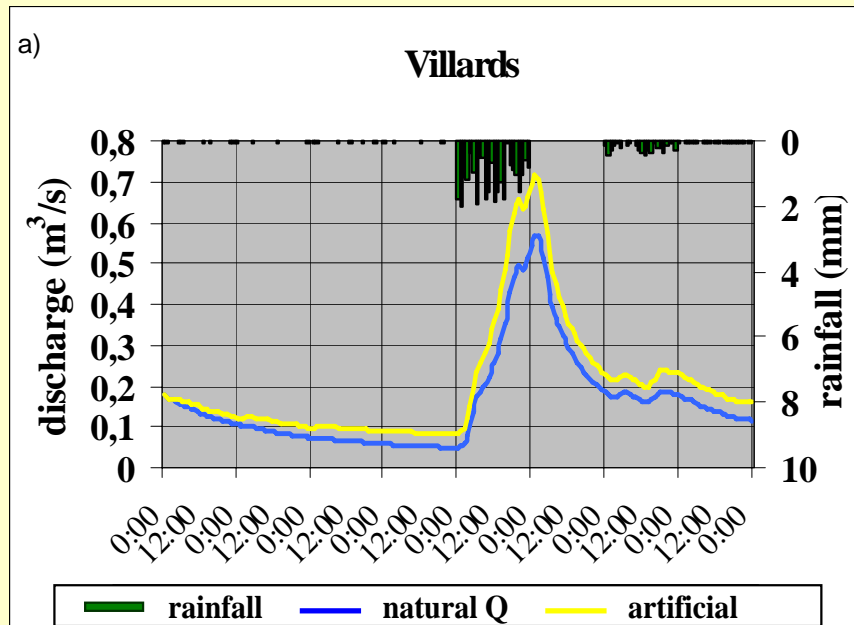


Fig. 4 Precipitation, extreme flood of 12th June 2003 (blue line) and reconstruction of impacts of artificial snow melt (yellow line) for the torrent a) Villards (5) and b) Saint Pantaleon (4).