

VIIth European Mountain Convention

15th – 17th September 2010, Lillehammer, Norway

The Role of land use/cover for ecosystem services in a
changing climate.

Pilot project on Hydrology

European Environment Agency

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Content

- What is EEA?
- Methods and first results of the Pilot Project on catchment services
- Consequences and Perspectives for Land Use management
- Conclusions

European Environment Agency

Who we are, what we do...



The EEA mission

“The EEA aims to support sustainable development and to help achieve significant and measurable improvement in Europe’s environment, through the provision of timely, targeted, relevant and reliable information to policy making agents and the public”

The EEA is...

- An independent information provider
 - An analyst and assessor
 - Building bridges between science and policy
 - Dependent upon strong networks to carry out its work
- ...to support policy processes and inform the public

EEA member and collaborating countries



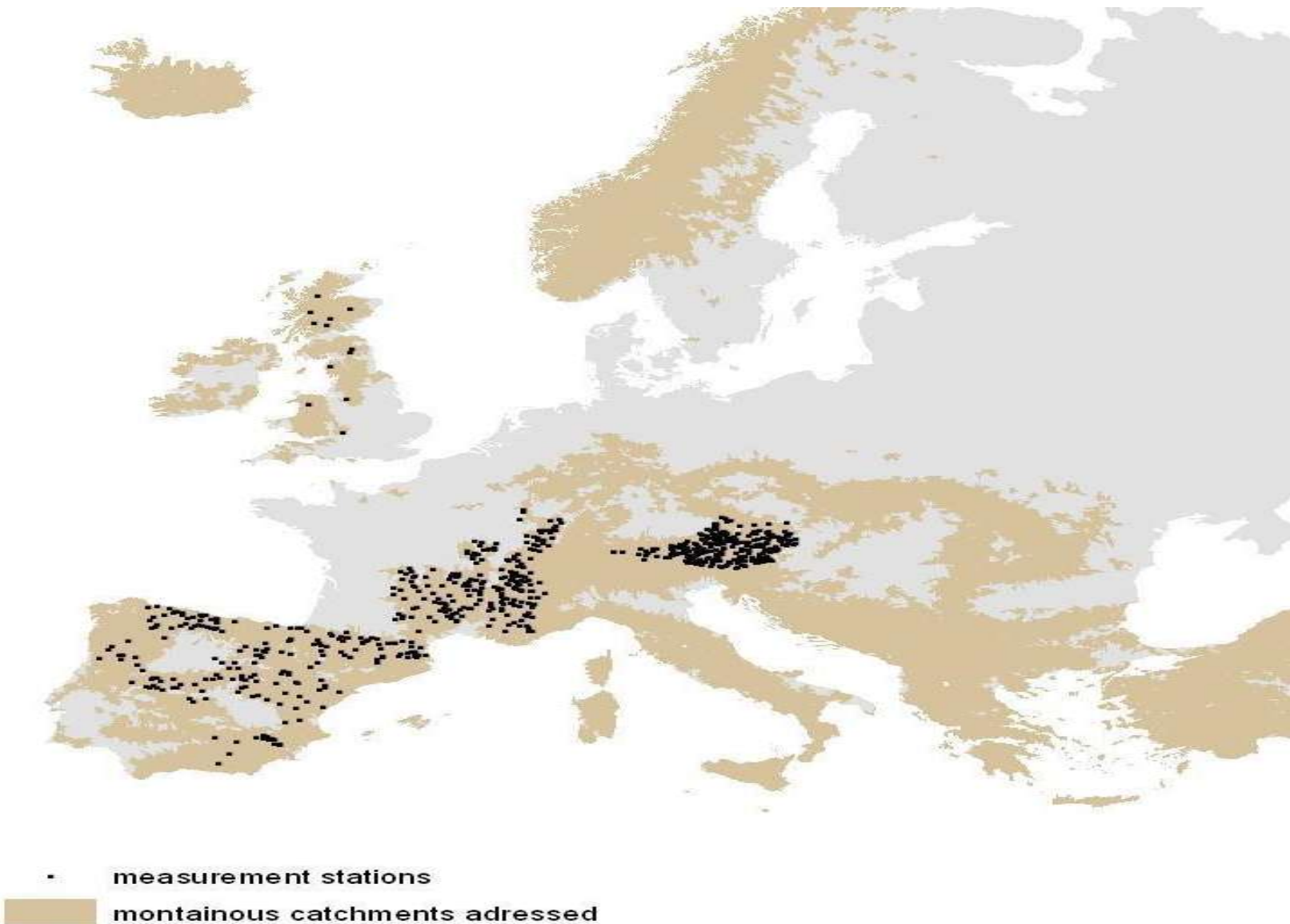
Methods and first results of the Pilot Project on catchment services



Methods and first results of the pilot on hydrology

- 800 mountainous catchments have been selected via statistical methods using discharge data from PO, ES, F;A;UK, they fulfill the following criteria:
- located in the Mountain Massif Layer
- Surface is inferior to 200 km²
- Mean elevation is superior to 200 m
- Gauging stations which have been working from 1999 to 2004 without interruption (some of these stations provide data for the last 30 years)





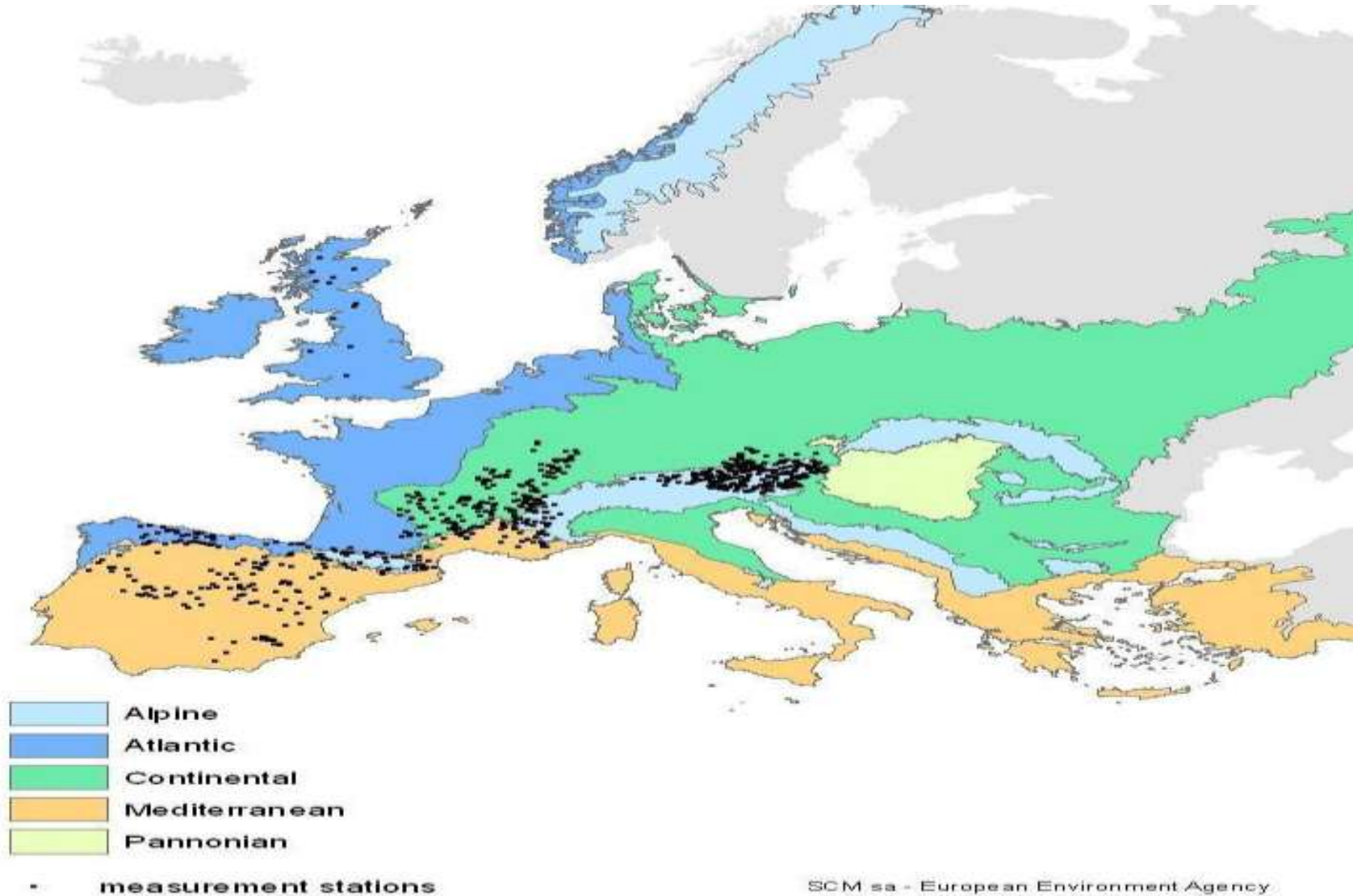
SCM sa - European Environment Agency

Integration of further Information

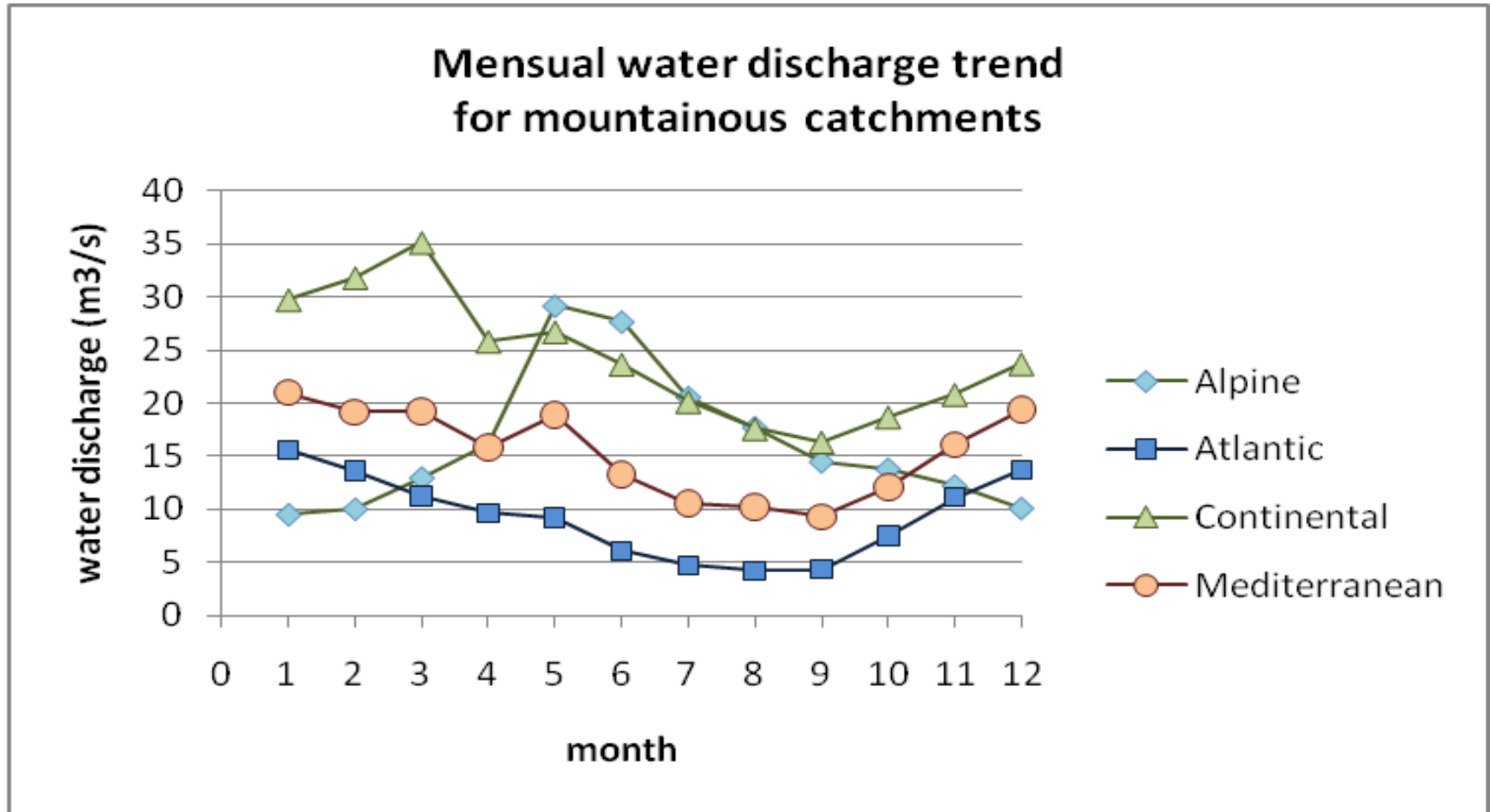
- **Catchment physical properties** : ECRINS data set provide information related to the catchment mean elevation, surface and average slope
- **Land use** : CORINE LAND COVER 2006 provide the percentage of forest and wooded land, agriculture and artificial surfaces for each catchment
- **Climate** : ATEAM and MARS data sets provide monthly data related to temperature and precipitations for each catchments from 1900 to 2000
- **Water discharge**: National data sets provide information related to daily river water discharge and surface drain of the river



Bio-geographical Regions in Europe



Annual Trend of Water Discharge of Catchments for four bio-geographical regions



Important Definitions

- **Land use**

Land use stands for the percentage of forest, incl. OWL, agricultural surfaces and artificial surfaces, as defined by CORINE LAND COVER data set

- **Ecosystem response**

The ecosystem response is quantified by the following discharge properties:

River productivity: water discharge divided by river surface drain (m/s)

River regularity: annual river variance

- **Mountainous catchments**

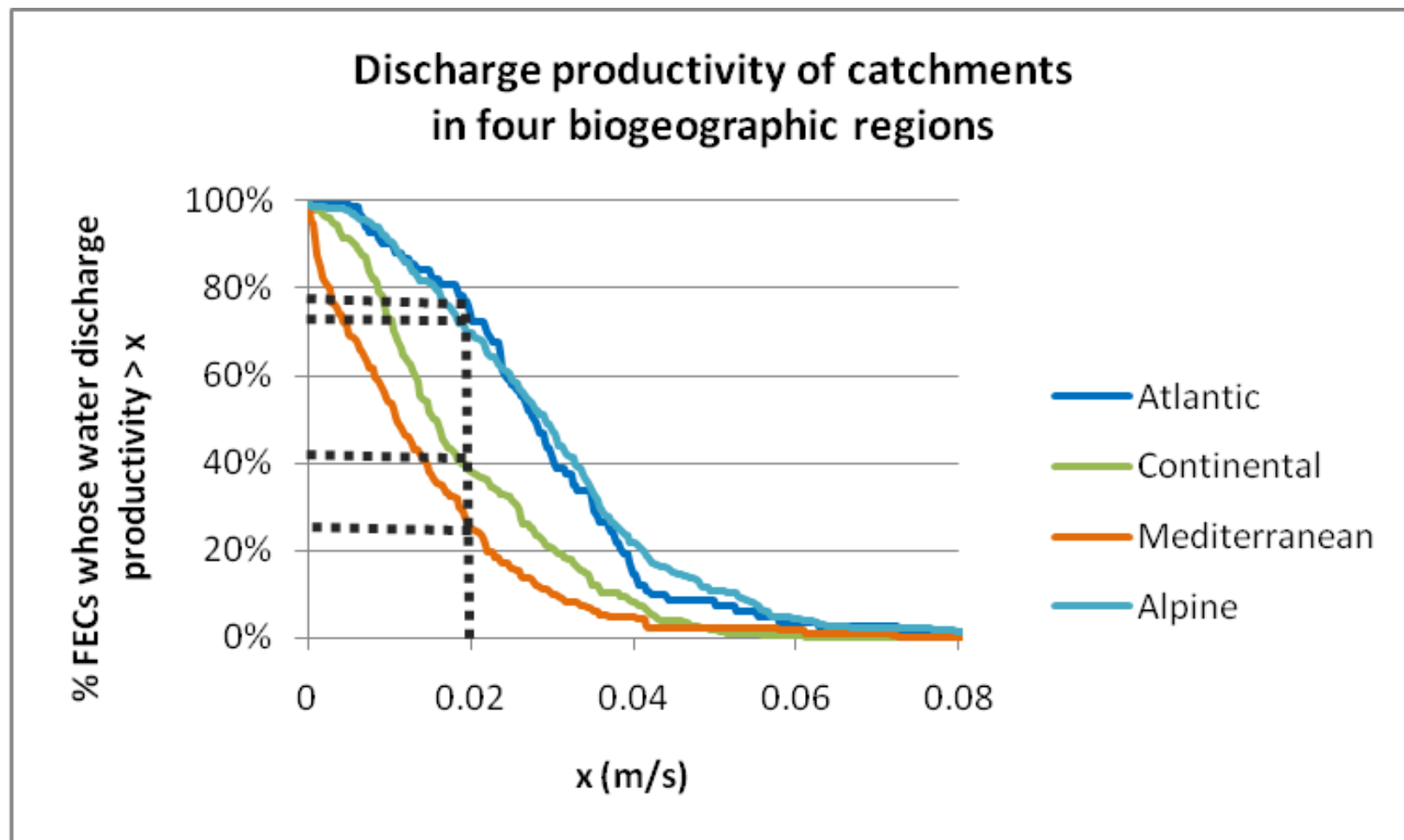
The mountainous catchments addressed are belonging to European Mountain Massif layer provided by EEA

- **FEC**

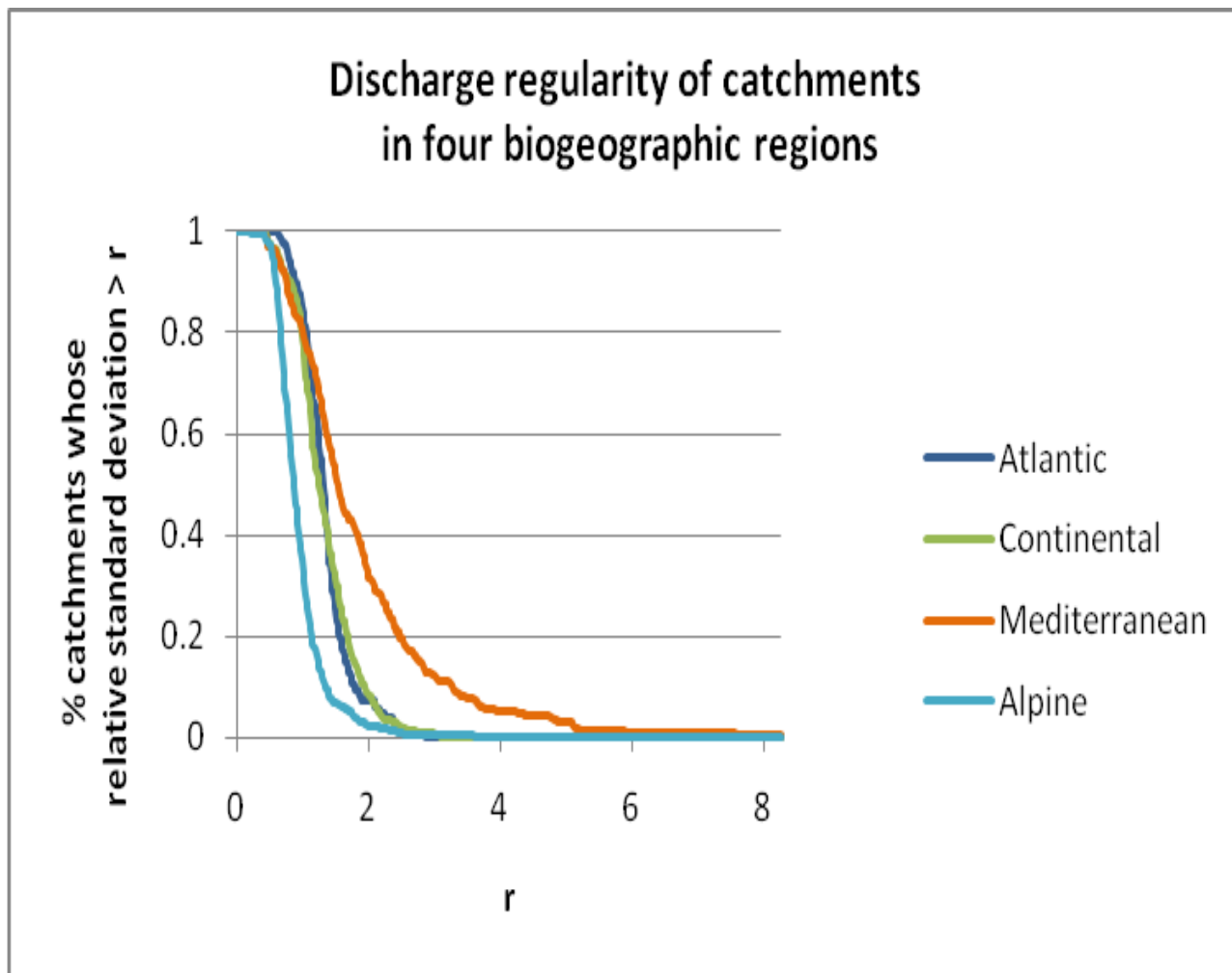
The Functional Elementary Catchments (FECs) are the catchments modeled by EEA hold by ECRINS data set



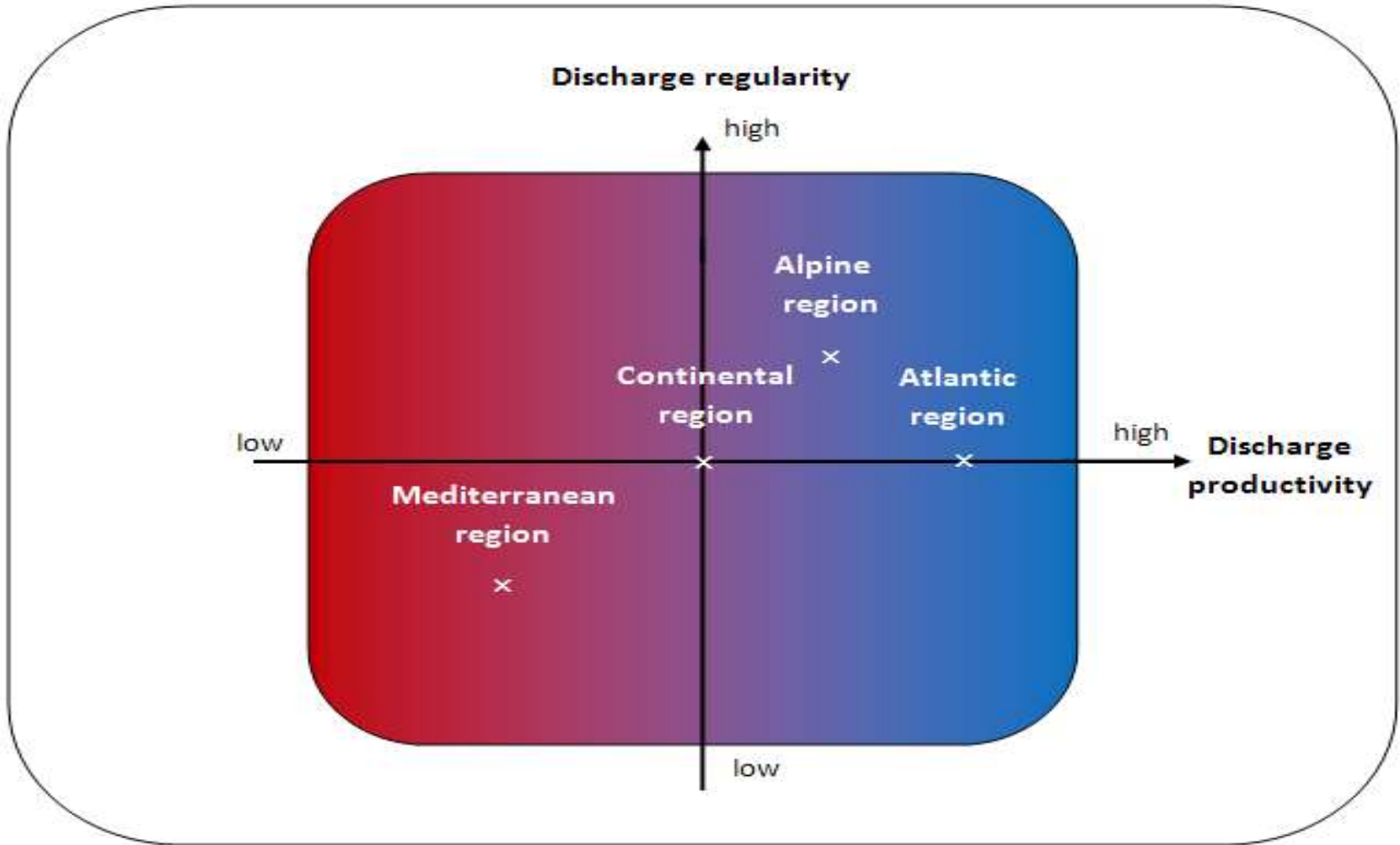
Water discharge productivity of mountainous catchments of four bio geographical regions



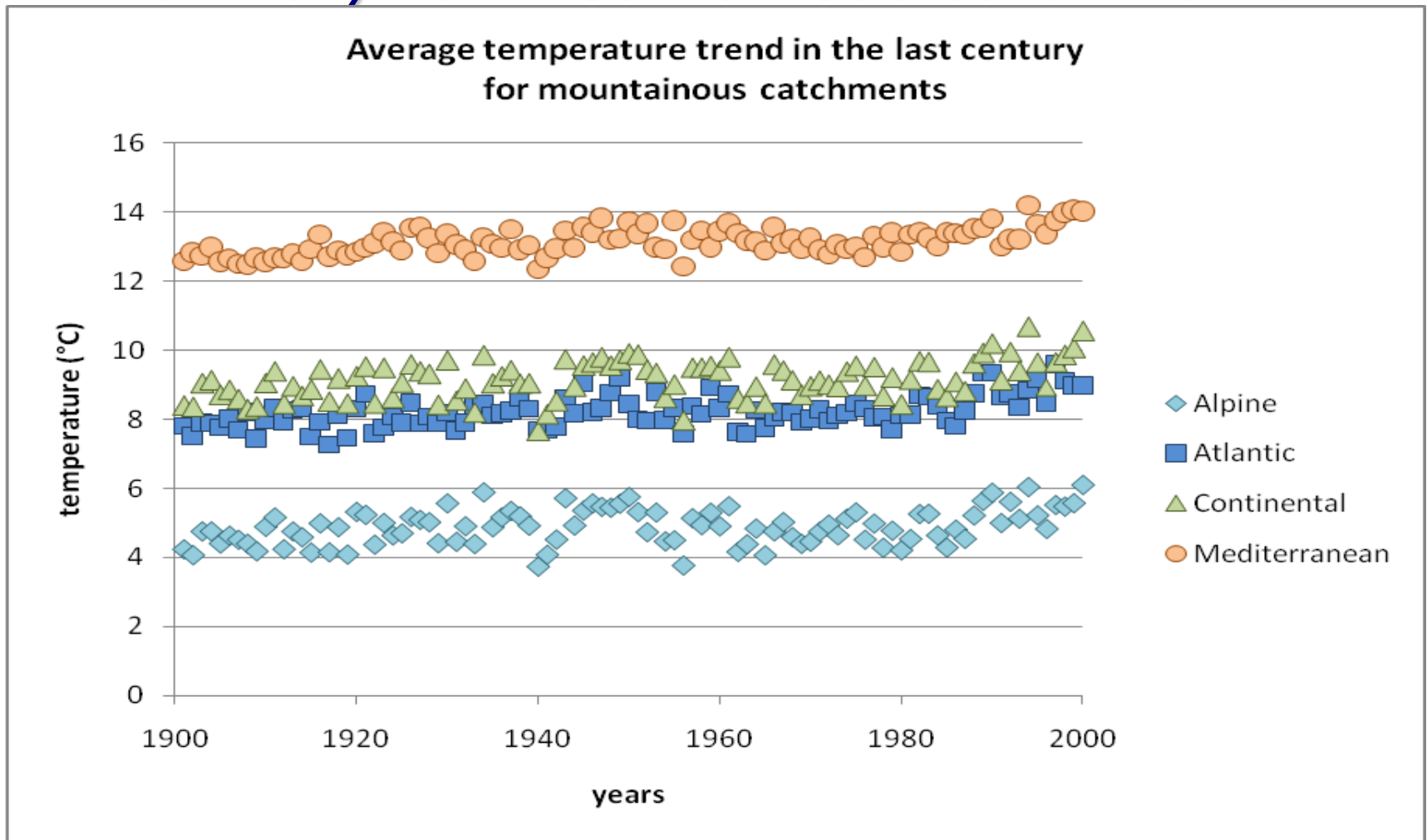
Water discharge regularity of mountainous catchments of four bio geographical regions



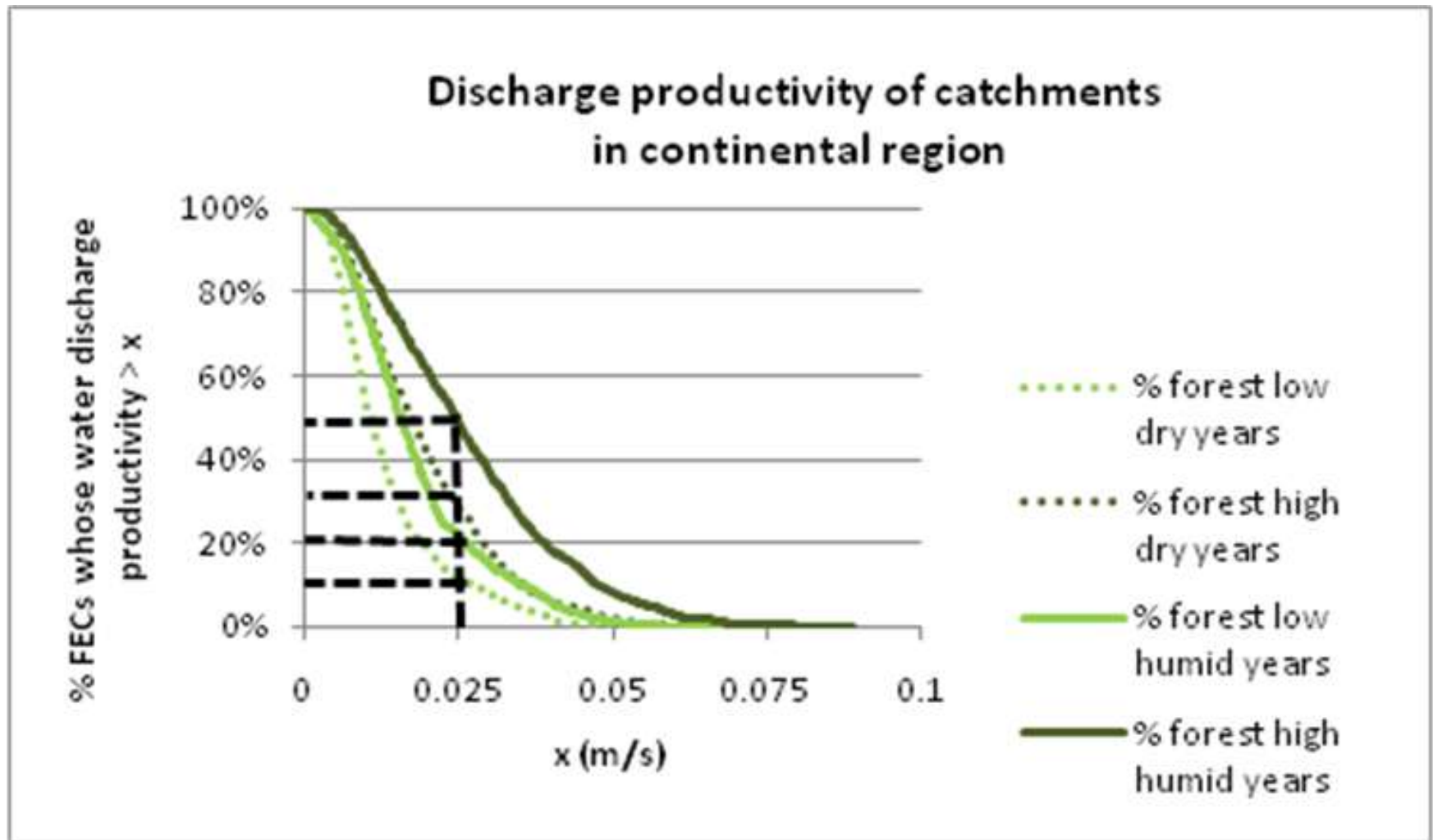
Hydrologic properties of the mountainous catchments



Yearly average temperature trend in the last century for mountainous catchments



catchments located in continental region- the role of forests



percentage of catchments whose water discharge productivity is superior to 0.025 m/s is:

- 10% if the percentage of forest is low and if we are in a dry year
- 20% if the percentage of forest is low and if we are in humid year
- 10% if the percentage of forest is low and if we are in a dry year
- 20% if the percentage of forest is low and if we are in humid year
- 30 % if the percentage of forest is high and if we are in dry year
- 50 % if the percentage of forest is high and if we are in humid year



Data uncertainties

- Nature of different national data sources in Europe
- Not all data sets are homogeneous
- Day and night measuring uncertainties
- National Data are not easy available



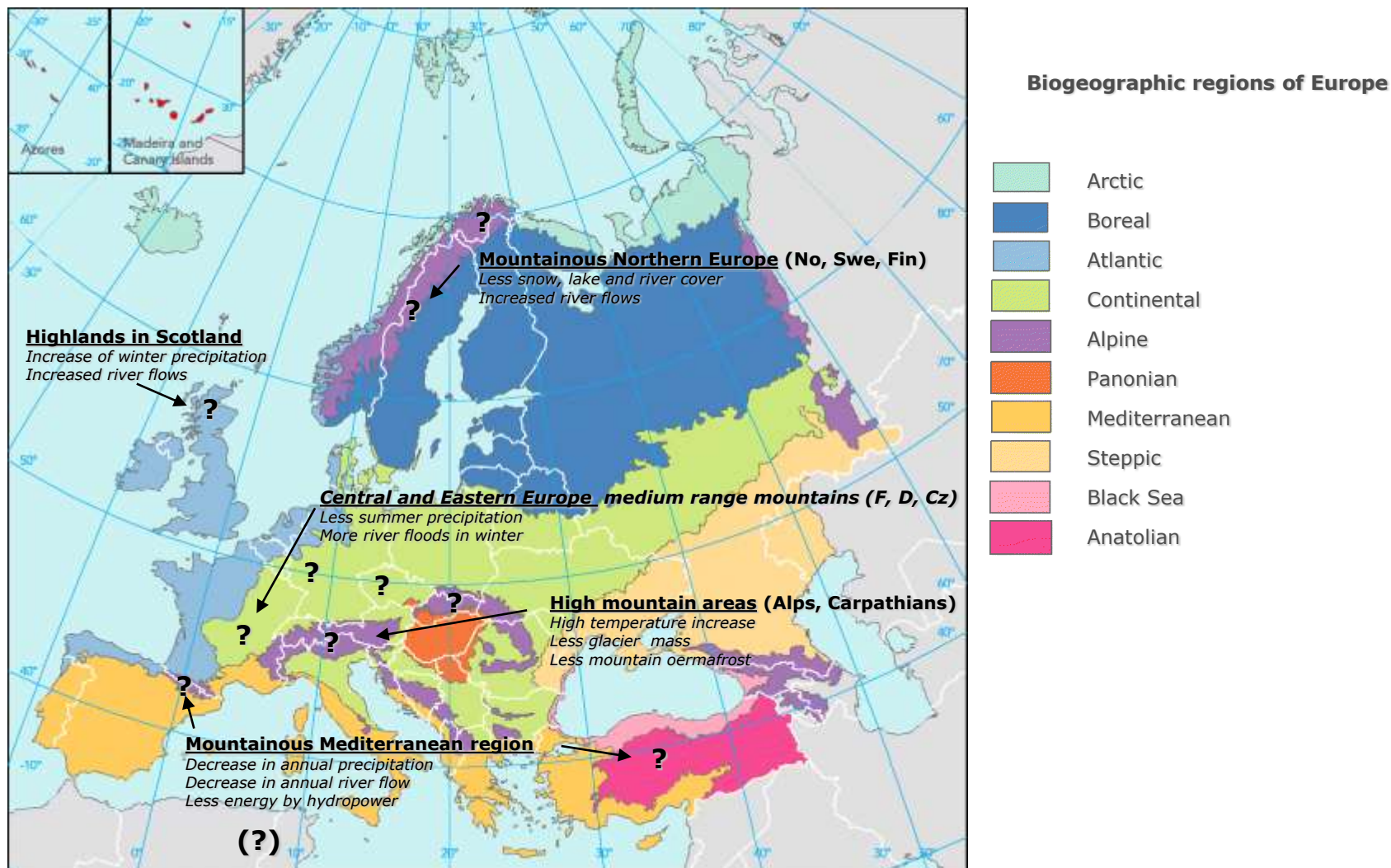
First results

- All major bio geographic regions in Europe show specific discharge behavior.
- Temperature and precipitations as indicators for climate change impacts showed no clear trend.
- A high percentage of Forests land use in catchments seems to have a positive effect on water productivity of catchments for all major bio geographical regions in Europe.



Consequences and Perspectives for Land Use management

Selection of catchments on the basis of forest covered water catchments



Source: EEA Report No 4/2008, p.19

Proposed selection criteria for water catchments in the frame of this project:

- **Size: up to 200 km², one or more for each bio-geographical region**
- **Physical and bio-geographical data and information on actual land-use/changes in land-use**
- **±Even distribution of land-uses protected areas, forests and agriculture**
- **East-West/West-East direction of the river flow ($\pm 20^\circ$), preferably**
- **Full discharge information quantity/quality for the catchment Forest growth; Carbon stored; etc.**
- **Information on weather extremes in the past 30 years (either drought, extreme precipitation)**



Multifunctionality of water catchments and their services

For all cases: average development for the last 30 years

Functions Land uses	Water discharge	Biodiversity	C-storage	Culture aspects/ landscape	Protection of infrastructure	Income
Forests						
Agriculture						
Infrastructure						
?						

Multifunctionality of water catchments in Europe

For all cases: Impacts of extreme weather events in the past 30 years and climate change impacts in recent years (if available)

Functions Land uses	Water discharge	Biodiversity	C-storage	Culture aspects/ landscape	Protection of infrastructure	Income
Forests						
Agriculture						
Infrastructure						
?						

Questions to be answered for each case study:

- **How do the ecosystem services vary over Europe in reality?**
- **Do the different land-uses full fill the multiple functions of ecosystems in catchments?**
- **Which conclusions can be taken from the information on past extreme weather events?**
- **Which recent impacts related to climate change can be observed?**
- **Which conclusion need to be drawn in terms of recommendations for the future management of water catchments in different bio-geographical regions in Europe?**
- **Consequences for the river mangement plans under the WFD for the EU 27 countries?**



Next steps

- Extending the data base
- Assessing the influence of forest cover on regional precipitation events
- Integration of Water quality information
- Integration of Biodiversity related information
- Development of an interactive internet communication tool: Visualisierung of services in the catchments



Mountainous catchment (Norway)



Mountainous catchment (Alps)



Conclusions

On basis of the first results:

- Selected catchments in all bio geographical regions show a characteristic discharge behaviour
- The landuse forest(OWL) seem to have a positive impacts on different discharge properties
- SFM of forests in catchments therefore will become matter of further discussion in Europe (optimising regional and local services)!



Thank you for your attention
!

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