

# The Alpine Drought Observatory

*F Greifeneder<sup>1</sup>, G Alampi<sup>2</sup>, T Bastiani<sup>1</sup>, L Bernard<sup>9</sup>, G Bertoldi<sup>1</sup>, L Cetara<sup>1</sup>, E Crouzat<sup>11</sup>, M Erfurt<sup>8</sup>, P Faliero<sup>3</sup>, M Fosatti<sup>3</sup>, G Gregoric<sup>4</sup>, K Haslinger<sup>7</sup>, M Hribernik<sup>5</sup>, A Jacob<sup>1</sup>, S Klemencic<sup>5</sup>, Z Kozinc<sup>6</sup>, B Kristan<sup>5</sup>, G Loucougaray<sup>11</sup>, P Mancin<sup>2</sup>, A Moderer<sup>4</sup>, C Notarnicola<sup>1</sup>, S Schneiderbauer<sup>10</sup>, Z Sinkovec<sup>6</sup>, A Susnik<sup>4</sup>, K Stahl<sup>8</sup>, R Stephan<sup>8</sup>, F Überwimmer<sup>10</sup>, M Zanotti<sup>2</sup>, M Zappa<sup>9</sup>, M Zebisch<sup>1</sup>, M Zun<sup>4</sup>*

*1 Eurac Research, 2 Regione Piemonte, 3 ANBI, 4 Slovenian Environment Agency (ARSO), 5 Slovene Chamber of Agriculture and Forestry - Institute of Agriculture and Forestry Maribor, 6 ISKRIVA, 7 ZAMG, 8 University Freiburg, 9 WSL, 10 Office of the Upper Austrian Government – Water Management Planning, 11 INRAE*

# Motivation – the Alps as water towers

River	Mean contribution of Alps to total discharge [%]	Proportion of total Alpine region [%]	Disproportional influence of the Alpine region
Rhine	34	15	2.3
Rhone	41	23	1.8
Po	53	35	1.5
Danube	26	10	2.6

Source: Weingartner et al., 2007

Mountains and highlands in general, and the Alps in particular, provide considerable quantities of water for their surrounding areas. This fact is due to several reasons: the effect of rising and subsequently cooling air, which increase the precipitation rate; less evaporation; plus, the important fact that the Alps store precipitation in the form of snow and ice, which melts during spring and summer. Due to these reasons, the Alps are often referred to as the water towers of Europe.

The table above shows the the percentual contribution of the Alps to the total discharge of the Rhine, Rhone, Po, and Danube. This highlights the importance of the knowledge about **drought** in the Alps not only for the Alpine region but for an area far beyond.

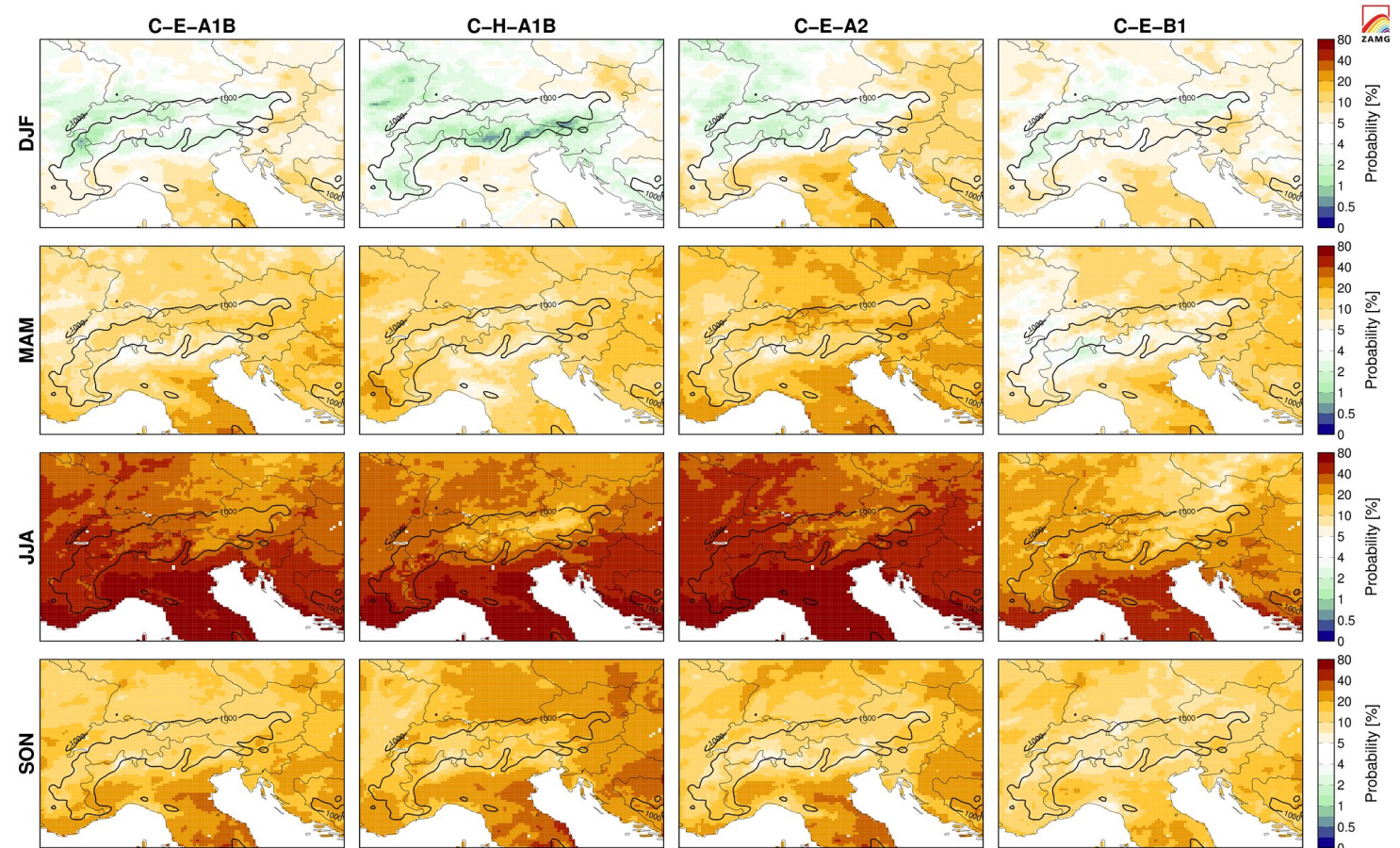
# Motivation – increased frequency of drought



The figure shows the **probability of the occurrence of extreme drought** (SPEI < -2) in one of three months per season by the end of the 21<sup>st</sup> (2071-2100).

This assessment was performed based on four regional climate model simulations with COSMO-CLM forced by ECHAM5 and HadCM3 under different emission scenarios.

This shows how the **drought risk might increase drastically** with climate change and it highlights the importance of drought risk preparedness and the necessity of **well-structured and coordinated drought management strategies** among the Alpine countries. Some of the necessary components for these purposes will be provided by the Alpine Drought Observatory.



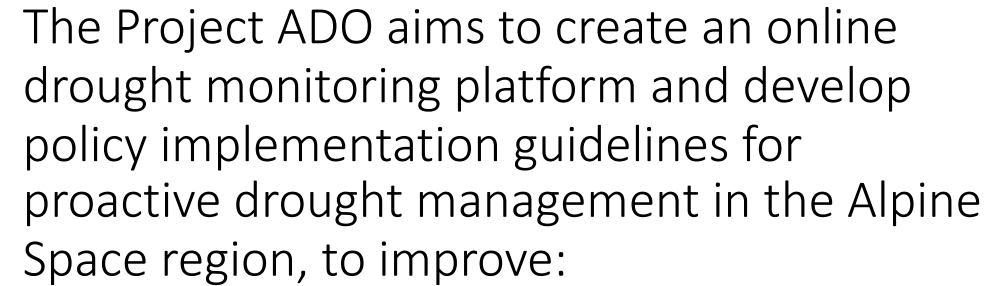
Haslinger et al., 2016, Future drought probabilities in the Greater Alpine Region based on COSMO-CLM experiments – spatial patterns and driving forces, ([link](#))

# Motivation - Summary

- Drought in the Alps can impact the water availability of a large area in Europe
- The frequency of drought will likely increase in future, also in areas, which were less affected in the past
- Scarcity of water creates strong conflict of interest between stakeholders, which means that national and local decision makers are facing several new challenges and are forced to act to increase their drought preparedness
- Existing platforms provide data either for specific regions or do not fulfil the specific requirements of a mountainous region
- Homogenous information about the impacts of drought (on both economy and environment) doesn't exist
- There is a need for a common platform and drought monitoring system



## 5



- the understanding of drought impacts in the Alps,
- the current drought monitoring and forecasting capabilities,
- and the current drought management practices and drought preparedness

Project end: 06-2022

# ADO – the consortium



Institute for Earth Observation (Italy)



Institute for Development of Local Potentials (Slovenia)



Environment Department (Italy)



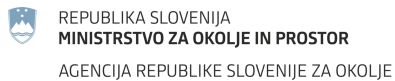
Central Institute for Meteorology and Geodynamics,  
Climate Research Department (Austria)



National Association of Consortiums  
for the Management and Protection  
of the Territory and Irrigation Waters (Italy)



Faculty of Environment and Natural Resources,  
Environmental Hydrological Systems (Germany)



Slovenian Environment Agency,  
Meteorological and Hydrological Office  
(Slovenia)



Swiss Federal Institute for Forest, Snow and Landscape,  
Mountain Hydrology and Mass Movements (Switzerland)



Slovene Chamber of Agriculture and Forestry,  
Institute of Agriculture and Forestry Maribor  
(Slovenia)

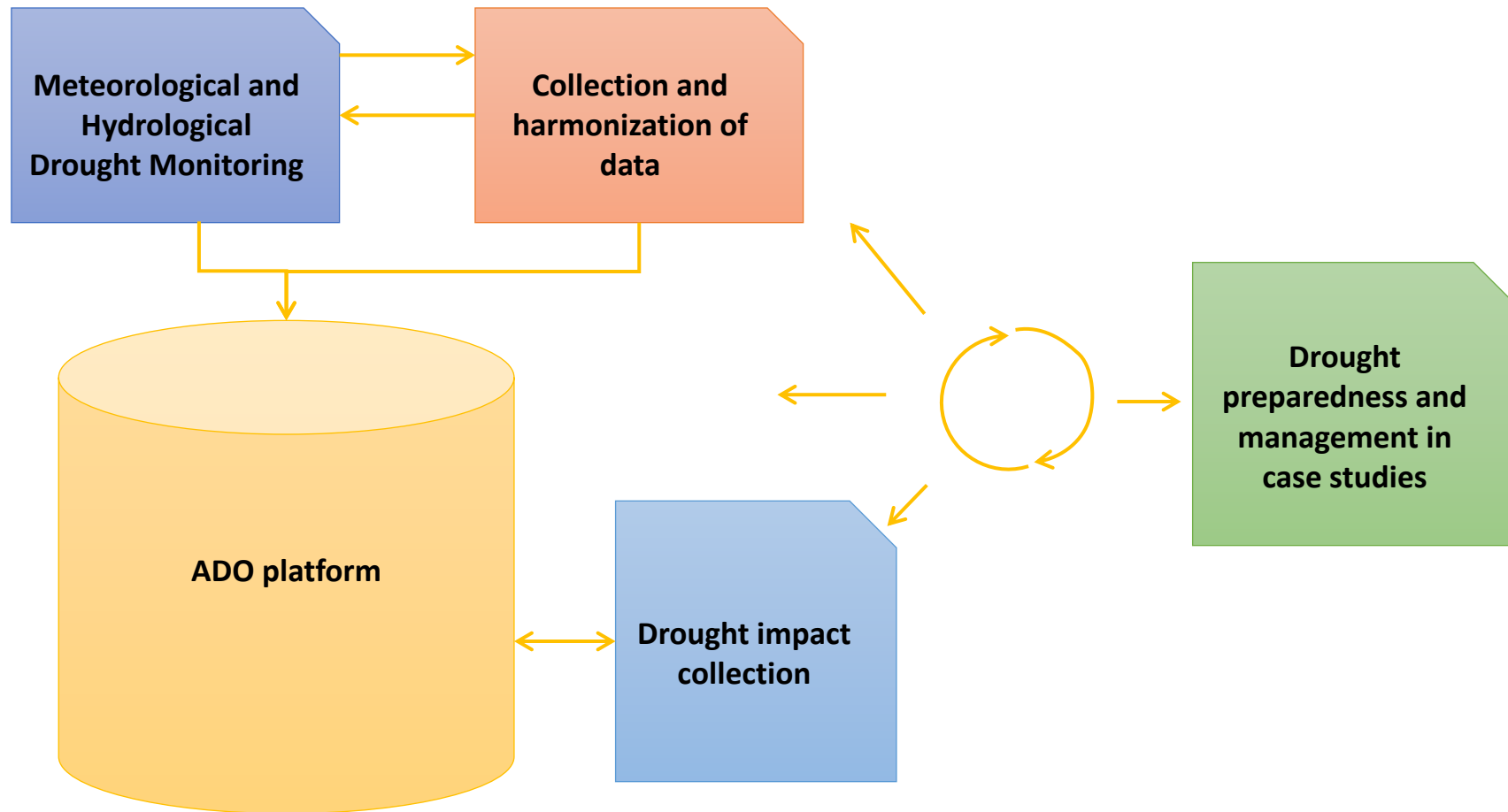


Office of the Upper Austrian Government,  
Water Management Planning (Austria)



French National Research Institute for Agriculture,  
Food and the Environment (France)

# ADO – project structure



## Project outputs

Recommendations and guidelines for an improved drought management

Alpine wide mapping of meteorological, hydrological, and agricultural drought

Drought impact catalogue

Methods for drought risk assessment and economic impact assessment

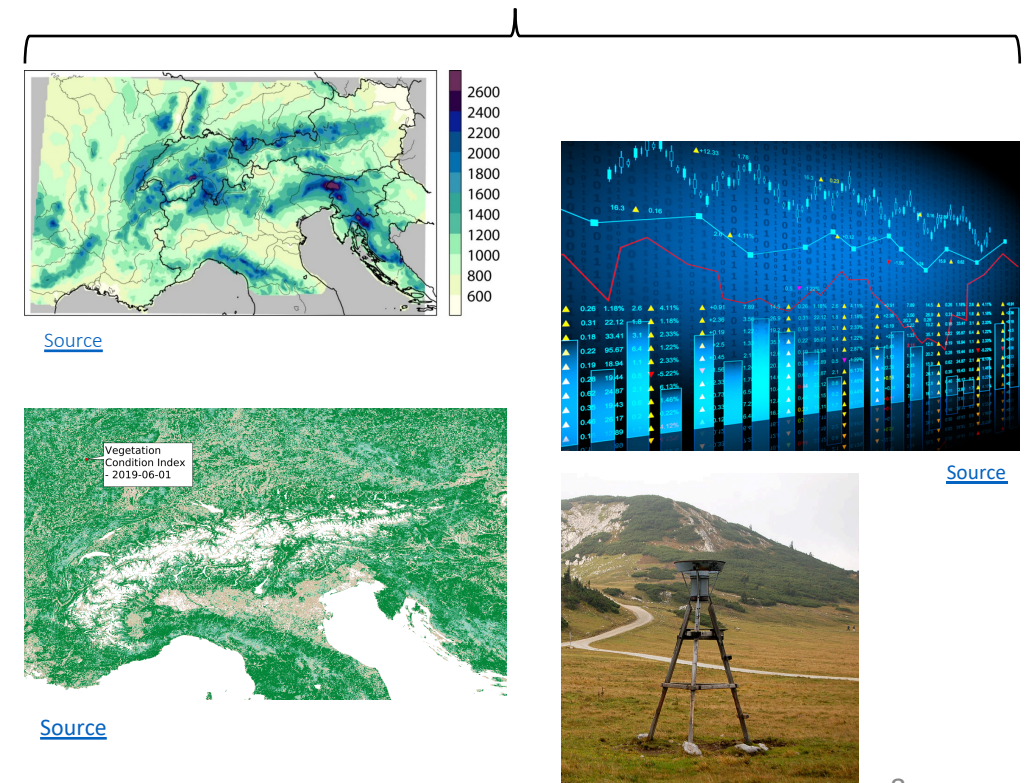
ADO online platform



# Drought Monitoring and Data Collection

The aim of these activities is to

- Assess the currently available tools and data, which are currently used for drought monitoring in the Alpine countries
- Identify available data, for the monitoring of drought related variables in the Alps (e.g. temperature, precipitation, evapotranspiration, snow, river discharge), exploiting different measurement (in-situ and remote sensing) and modelling methodologies
- Validate and adapt these data (considering the specific requirements related to the terrain) to enable a comprehensive monitoring of the current state of drought in the Alps – all data must fulfil the specific requirements of a mountainous area related to accuracy and spatial resolution
- Identify and produce drought indices, which are relevant for the kind of drought impacts that occur in the Alps
- Selected meteorological, hydrological, and remote sensing datasets, as well as drought indices, will be available through the ADO online platform

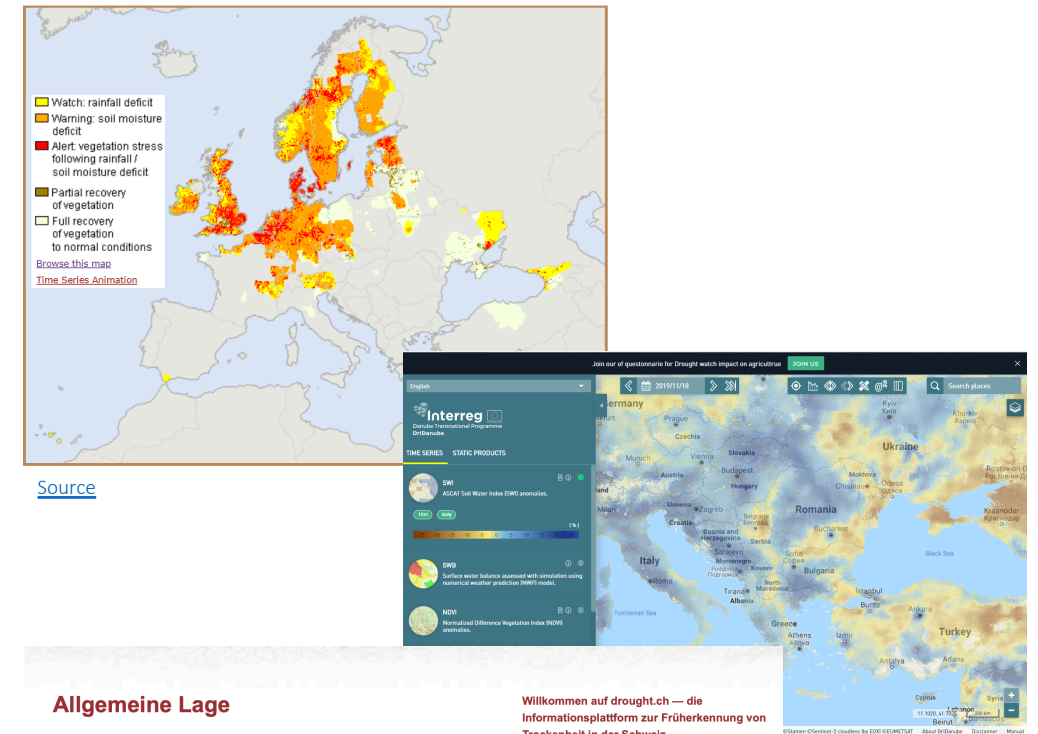




# The ADO platform

## Setting up a drought monitoring platform for the Alps

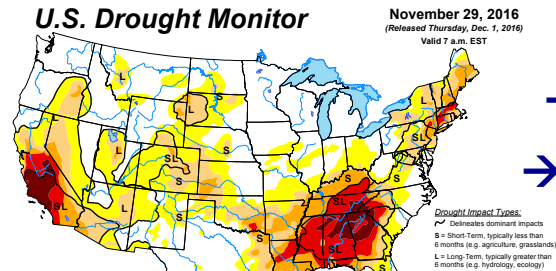
- Following the example of other existing drought platforms like the [EDO](#), [droughtwatch.eu](#), or [drought.ch](#), one of the outputs of ADO will be an online platform, which act as an interface for all the drought monitoring tools and data, which will be developed in the project
- The development of the platform will be carried out in close collaboration with users and stakeholders
- The project case studies will play an important role for the design and testing of the platform



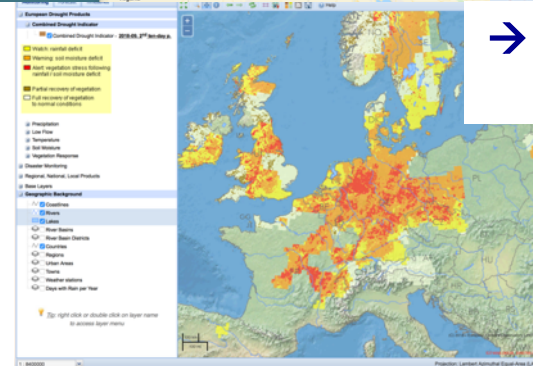
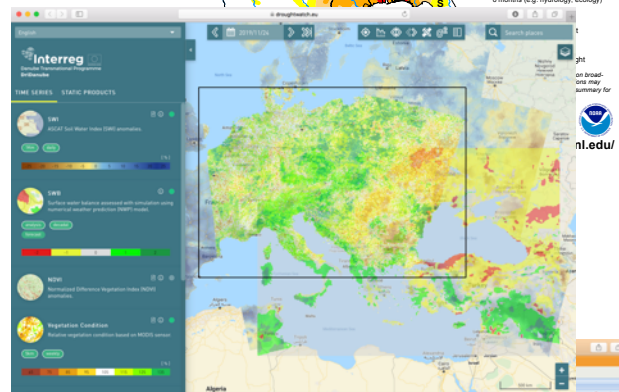
[Source](#)

# Drought Impact Assessment

## Drought Indices: Monitoring & Early Warning

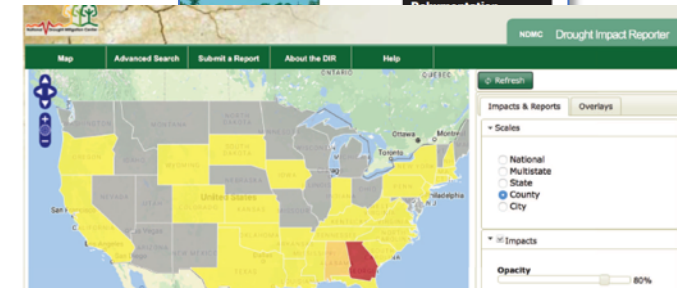


→ Give meaning to indices  
→ Customize drought indices



→ Model likelihood of impact  
→ Forecast impacts

## Drought Impacts: Reports & Monitoring

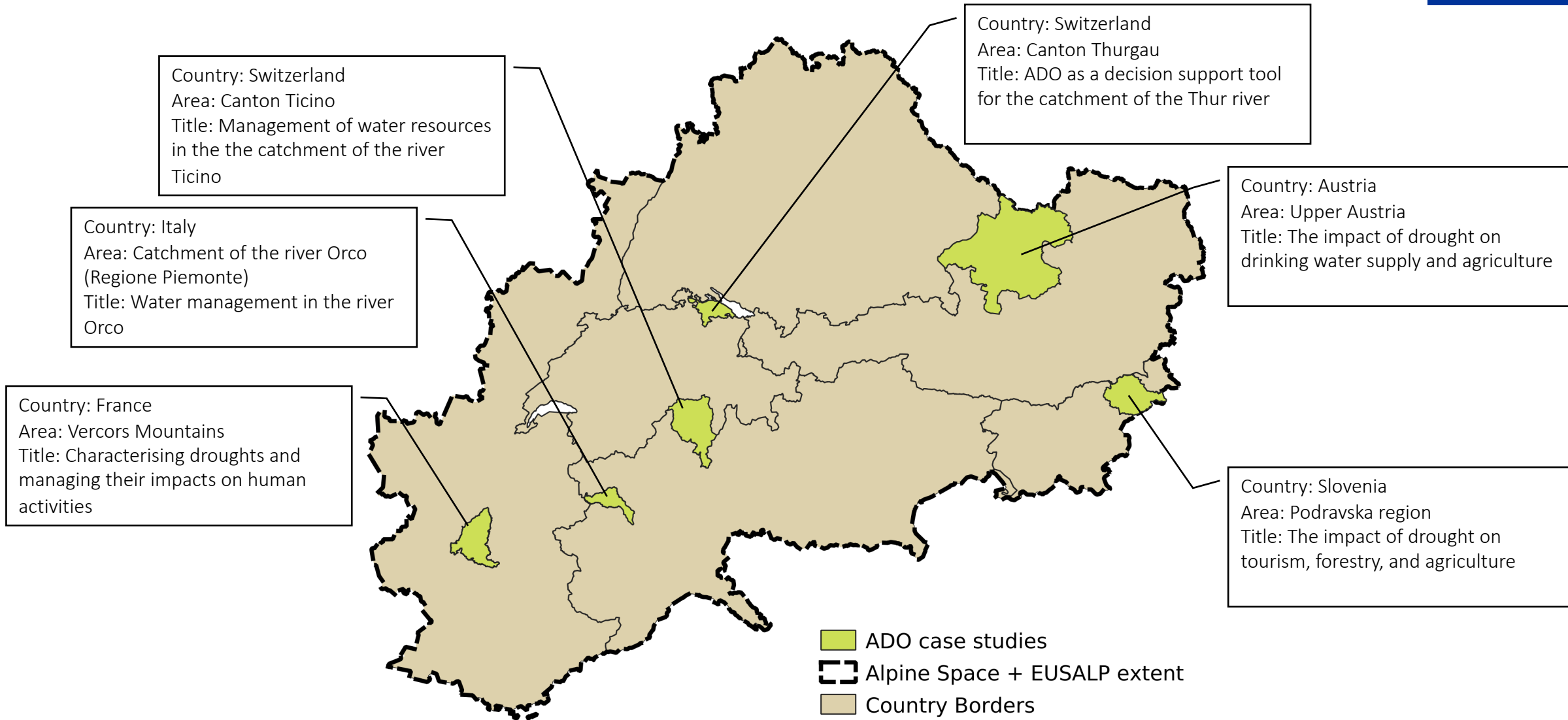


# Drought Impact Assessment

The assessment of drought impacts, with a focus on the Alpine region, will be a key component of the project. It will consist of:

- Collection, collation and analysis of drought impact records
- Impact assessment for relevant sectors regarding general space-time differences and similarities over the Alps
- Their relationship to specific drought indices to derive the probability of impact type occurrence under certain drought conditions
- An integrated risk assessment
- The assessment of economic impacts
- These activities create an important link between the collected data and the application in the ADO case studies and other potential users by creating a direct link between drought indices and specific impacts.
- Furthermore, they will aid the choice of the content of ADO (in terms of relevant data and drought indices)

# ADO case studies

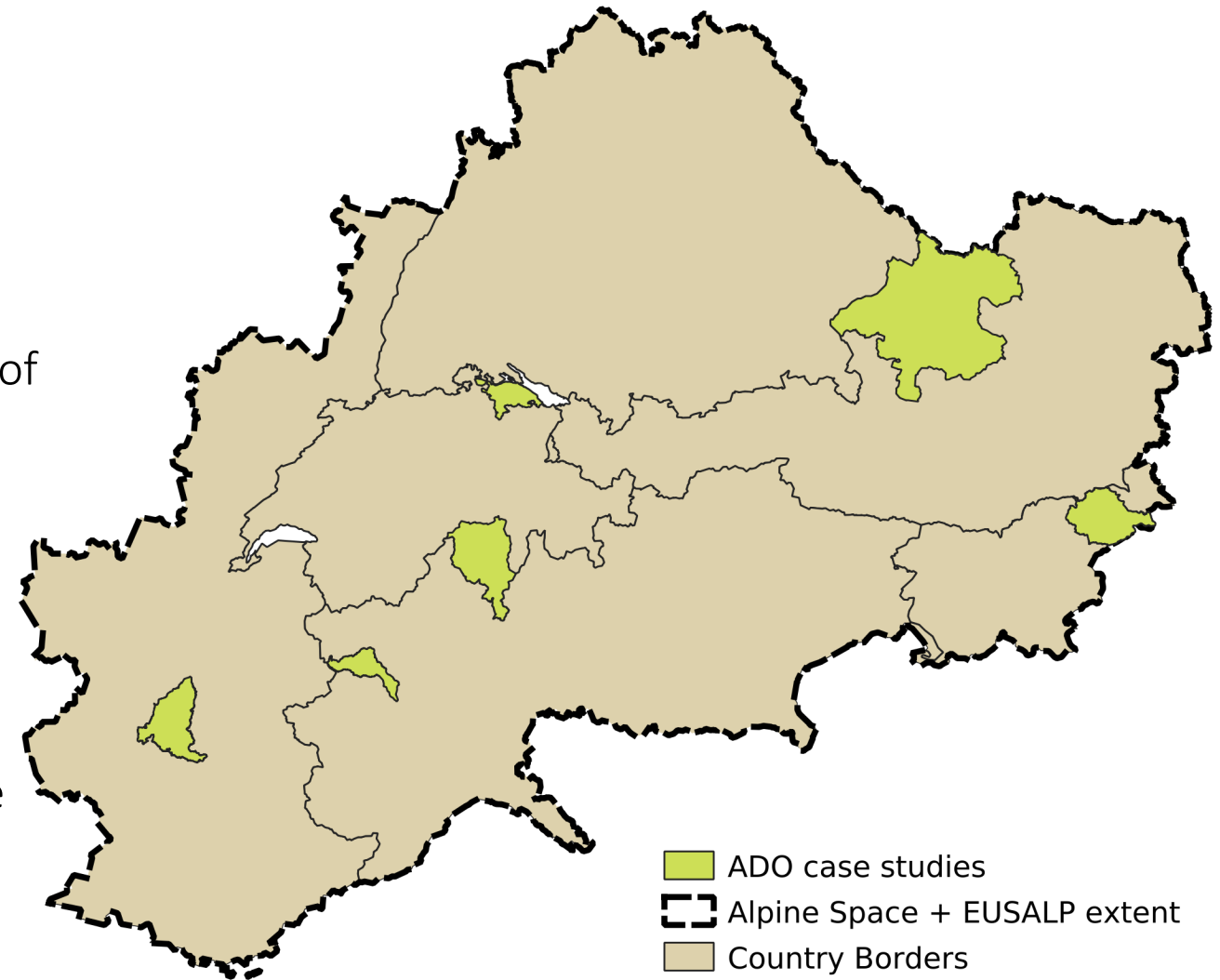




# ADO case studies



- The six case studies serve as demonstrators for the application of the ADO in real-world drought management scenarios
- Activities consist of the analysis of current management practices and the assessment of the potential improvements
- Findings from the case studies will act as an input for general recommendations for efficient drought management
- And, along with other results from the project, for the analysis of drought related policies, to derive recommendations for the future



# The Alpine Drought Observatory

Contact: Felix.Greifeneder@eurac.edu

Project website: <https://www.alpine-space.eu/projects/ado/en/home>