The Alpine Drought Observatory, how to organize and share data in a cross-national mountain region following the fair data principles

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“The Alpine Drought Observatory (ADO) aims to create an online drought monitoring platform and develop policy implementation guidelines for proactive drought management in the Alpine Space region”

Droughts in the Alps?

Can we detect these events using the ADO platform?
What are the most suitable and robust drought indicators for the alps?

Produce these indicators and validate them from 1980 - 2020:

- Meteo (SPI, ...)
- Satellite (VHI, ...)
- Hydrology (Disch., ...)
- Impacts (News, ...)
- Vulnerabilities (Farms, ...)

Open Source
Operational
Timely

Accessible
Understandable
FAIR
Actionable

Science  Data  Production  Dissemination
The ADO Platform

Production
Docker
GitLab
Kubernetes

Access
Rasdaman/ODC
openEO
Env. Data Platform

Metadata
Fact Sheets
STAC
DOI
FAIR

Data
Drought Indices
Hydro Stations
Impacts
Vulnerability
Design Phase - Thinking about users...

... not only experts!
ADO on gitlab - Open Source

https://gitlab.inf.unibz.it/ado

Tutorial and snippets on how to use openEO in the ADO project.

accessing and analyzing ADO datasets with openEO

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Date: 2021/04/15

Useful links:

OpenEO Python Client documentation: https://openeo.github.io/openeo-python-client/index.html
ADO Production Pipelines

- Codes producing Data
- Environment Files
- Documentation
- (Docker Image)

Changes are directly integrated to pipeline

- Docker
- CI/CD
- Kubernetes
- Triggering

Modules of the pipelines can be triggered by different events

Results are directly integrated into web-portal
ADO Pipelines

ECMWF Climate Data Store

ado-download_operational

snowgrid-cl_preprocessing_operational

ado-downscaling_operational

snowgrid-cl_operational

spi_operational

SMA

vhi_operational

ado_portal_update_db

ado-data

ADO Webportal

AppEEARS

odc_datasets_scripts

Open Data Cube
Pipeline Operations

Success Mail

Error Mail

API Key etc.

Schedule

Variables

Pipeline

Jobs
List of Production Indices

1. Precipitation Anomalies (%)
2. Standardised Precipitation Index (SPI)
3. Standardised Precipitation-Evapotranspiration Index (SPEI)
4. Soil Moisture Anomalies
5. Normalized Difference Vegetation Index (NDVI)
6. Vegetation Health Index (VHI)
7. Standardised Snowpack Index (SSPI)
8. Hydrological Indices (SDI, SGI, …)

+ combined drought index
+ integration of impacts
## Current List of Production Indices

**WCS service endpoint:** [http://saocompute.eurac.edu/rasdaman/ows](http://saocompute.eurac.edu/rasdaman/ows)

119 coverages available, total volume 8.94 TB

<table>
<thead>
<tr>
<th>Coverage ID</th>
<th>Coverage subtype</th>
<th>Coverage size</th>
<th>Display footprints</th>
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<td>ReferenceableGridCoverage</td>
<td>1.97 GB</td>
<td></td>
</tr>
</tbody>
</table>

[http://saocompute.eurac.edu/rasdaman/ows#/services]
Hydrological Data

**Alpine-wide dataset**: discharge, water level, groundwater level, metadata

Problems: **different data providers**, real time data availability

![Map of Alpine region with stations marked](https://edp-portal.eurac.edu/cdb_doc/ado/)

<table>
<thead>
<tr>
<th>Country</th>
<th>Runoff stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>567</td>
</tr>
<tr>
<td>Italy</td>
<td>242</td>
</tr>
<tr>
<td>Switzerland</td>
<td>235</td>
</tr>
<tr>
<td>Slovenia</td>
<td>185</td>
</tr>
<tr>
<td>Germany</td>
<td>129</td>
</tr>
<tr>
<td>France</td>
<td>65</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1423</strong></td>
</tr>
</tbody>
</table>

[Visit the Alpine Space Observatory](https://edp-portal.eurac.edu/cdb_doc/ado/)
Drought Impacts

• Substantial update of EDII database
  • Various German and Italian text-reports
  • Unwetterchronik ZAMG
  • Drought.ch
  • DMCSEE
  • Propluvia.fr

• Filtered to the Alpine Space

→ First version of EDII\textsubscript{ALPS} allows various analyses

Meta Data

Findable on EDP Environmental Data Platform

Findable on GEOSS

Digital Object Identifiers DOI
https://doi.org/10.48784/16006b70-534a-11ec-809b-0200a08f41d.

Metadata available in ISO 19139 (XML) or STAC (JSON)

https://edp-portal.eurac.edu/geonetwork/
Drought Indices - Time Series

How to read the values:

Did you know? You can select and compare several indices.

### SPEI / SPI / SMA

<table>
<thead>
<tr>
<th>Value</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Extremely wet</td>
</tr>
<tr>
<td>1.5</td>
<td>Very wet</td>
</tr>
<tr>
<td>1</td>
<td>Moderately wet</td>
</tr>
<tr>
<td>0</td>
<td>Normal</td>
</tr>
<tr>
<td>-1</td>
<td>Moderately dry</td>
</tr>
<tr>
<td>-1.5</td>
<td>Very dry</td>
</tr>
<tr>
<td>-2</td>
<td>Extremely dry</td>
</tr>
</tbody>
</table>

### SSPI

<table>
<thead>
<tr>
<th>Value</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Highly more than normal</td>
</tr>
<tr>
<td>1.5</td>
<td>Much more than normal</td>
</tr>
<tr>
<td>1</td>
<td>More than normal</td>
</tr>
<tr>
<td>0</td>
<td>Near normal conditions</td>
</tr>
<tr>
<td>-1</td>
<td>Less than normal</td>
</tr>
<tr>
<td>-1.5</td>
<td>Much less than normal</td>
</tr>
<tr>
<td>-2</td>
<td>Highly less than normal</td>
</tr>
</tbody>
</table>

### VCI / VHI

<table>
<thead>
<tr>
<th>Value</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Extremely high vitality</td>
</tr>
<tr>
<td>75</td>
<td>High vitality</td>
</tr>
<tr>
<td>50</td>
<td>Average vitality</td>
</tr>
<tr>
<td>25</td>
<td>Low vitality</td>
</tr>
<tr>
<td>0</td>
<td>Extremely low vitality</td>
</tr>
</tbody>
</table>

More information about the data:

Download SPEI Factsheet

https://doi.org/10.3734/146651517-5346-11EC-9163-0000608E41D
Drought Impacts

2020

Impact category:

Description:
Veneto Drought: Extraordinary irrigation in action throughout the region. Doubts about the quantity of the first mowing of the stable meadows. For the wheat there has been poor tillage and a very stunted raising, the current water stress in the pre-mowing phase further compromises the harvest. The maize encounters difficulties in germinating in tenacious soils and in any case water is needed to grow. Beets, good or bad, have germinated but without water resources they do not grow constantly.

Nuts: IT1 / IT2 / IT3

Year: 2020

This page is under development. Do not expect everything to work.
More information about the project at https://www.alpine-space.org/projects/dad/
Raw data can be found in the public repository https://github.com/eurac-research/ado-data

Eurac Research, June 2022
Quality check

Quality check and statistics for hydrological station from the ADO project database

Summary of Station ADO_DSC_I TC1_0037 in Italy in the region Piemonte in Isola S. Antonio Po with coordinates latitude: 45.036153 and longitude: 8.821928

Metadata information

Description of the dataset

<table>
<thead>
<tr>
<th>country</th>
<th>region</th>
<th>location_site</th>
<th>lat</th>
<th>lon</th>
<th>start_date</th>
<th>end_date</th>
<th>unit</th>
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</thead>
<tbody>
<tr>
<td>Italy</td>
<td>Piemonte</td>
<td>Isola S. Antonio Po</td>
<td>45.036153</td>
<td>8.821928</td>
<td>1996-01-02 00:00:00</td>
<td>2019-12-31 00:00:00</td>
<td>Po</td>
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</table>

Primary statistics

Statistic description of the dataset

<table>
<thead>
<tr>
<th>count</th>
<th>mean</th>
<th>std</th>
<th>min</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
<th>max</th>
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<tbody>
<tr>
<td>6322.000000</td>
<td>441.060795</td>
<td>511.930453</td>
<td>30.200000</td>
<td>202.000000</td>
<td>294.000000</td>
<td>495.000000</td>
<td>9780.000000</td>
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</table>
Can we detect the reported impacts?

Winter 2017

Winter 2022

Winter 2023

https://gitlab.inf.unibz.it/ado/openeo4ado/-/blob/master/r/openeo_ado_showcase.html
Conclusion & Outlook

- Web and Data Portal following FAIR data principles
- Combining data from all relevant sources
- Catering to the needs of different target user groups
- Maintaining the portal to be fully operational

- Framework is a blueprint for further drought monitoring platforms (Regional Drought Observatories/JRC)
- Open Source, deployable in other institutes/regions/countries!
- Great collaboration between domain experts and IT
http://ado.eurac.edu
https://gitlab.inf.unibz.it/ado

Thank you for your kind attention!

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peterjames.zellner@eurac.edu