ASPECT
FACILITATING SEAMLESS CLIMATE ADAPTATION

D3.2 Provision of output fields from statistical downscaling

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* **R**=Document, report; **DEM**=Demonstrator, pilot, prototype; **DEC**=website, patent fillings, videos, etc.; **OTHER**=other

** **PU**=Public, **CO**=Confidential, only for members of the consortium (including the Commission Services), **CI**=Classified

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Executive Summary

Statistical downscaling is a technique which aims at transferring climate information from coarse to finer spatial scales. It is a fundamental tool to bridge the gap between the (comparatively coarse) spatial scale at which most state-of-the-art global climate models run, and the (finer) spatial scale required by decision makers to act based on climate predictions.
One of the goals of WP3 is to create and evaluate actionable climate information, including extremes, using downscaling (Task 3.2): the task encompasses developing and testing methods based on statistical downscaling (alongside the alternative dynamical downscaling). Typical applications considered within WP3 involve statistical downscaling of climate predictions on a range of forecast horizons (from seasonal to decadal), and for a variety of target domains (from regional to European-scale).
The statistically downscaling methods developed within WP3 are co-designed with end-users to cater for the different case studies in WP4. The target variables, regions of interests, time horizons, and so forth are selected to meet the specific requirements of the case studies, guided by scientific feasibility. Similarly, the nature and format of data provision is oriented to user needs and established in concert with WP6.
This document contains instructions to access the data produced with the statistical downscaling methods developed within ASPECT and contributing towards Task 3.2, together with the associated technical documentation. It also provides brief information on the case studies they are tailored for, and guidelines to open the data programmatically.

About ASPECT

ASPECT aims to set up and demonstrate a seamless climate information (SCI) system with a time horizon up to 30 years and accompanied with underlying research and using climate information for sectoral applications. The project's goal is to improve existing climate prediction systems and to merge their outputs across timescales together with climate projections to unify a SCI as a standard for sectoral decision-making.

The project focus will be on European climate information, but we will also look where there is a wider policy interest (e.g., disaster preparedness) and in regions of European interest. We will maintain a strong link with the WCRP lighthouse activities to exploit learning for explaining and predicting earth system change. To provide a bandwidth diversity of information, the SCI system will be based on multi-model climate forecasts and will build on learning from projects such as EUCP. It will align with new activities on Digital Twins within Europe, including DestinE. The SCI will combine physical science aspects with those from other disciplines to ensure the information is robust, reliable, and relevant for a range of user-driven decision cases. The information package will incorporate baseline forecasts and projections (plus uncertainty), and will explore new frontiers (e.g., extremes which are of socioeconomic high-level interest).

To ensure success, the research will encompass: an understanding and attribution of various processes along timescales (such as exploring signal-to-noise ratio) and their impact on predictability, new ways of initialisation of the prediction systems, merging predictions with projections, provision of regional SCI for Europe by downscaling (statistical methods, AI) and HighRes models (including convection-permitting models) and innovative post-processing method enhancing the skill and robustness of the climate forecasts.

1 Description of ASPECT's case studies

Within ASPECT, a number of case studies are considered to assess and demonstrate the usability and added value of tailored climate information for a range of societal sectors. For information on the ASPECT's case studies and the associated super users, we refer to the dedicated ASPECT webpage.

2 Accessing the statistically downscaled data

2.1 List of available data

The dataset produced with the statistical downscaling methods developed within WP3 and contributing towards Task 3.2 are listed below:

- Statistically downscaled seasonal climate indicators for the agricultural case study (Eren Duzenli, Verónica Torralba, Carlos Delgado-Torres; BSC)

- Statistically downscaled decadal climate variables for the agricultural, pensions sector and British Red Cross case studies (Sara Moreno-Montes, Carlos Delgado-Torres, Eren Duzenli; BSC)

- Statistical downscaling of seasonal spring-frost events for the agricultural case study (Sebastiano Roncoroni, Panos Athanasiadis; CMCC)

2.2 Data format

Data is stored in the form of zipped archives (.zip): there is one zipped archive for each downscaling method listed in point 2.1 above.

Each zipped archive, in turn, contains climate data in NetCDF format (.nc) and accompanying technical documentation in pdf format (.pdf).

NetCDF is a popular format to store and share climate data. Further information of naming conventions and suggestions to open the data programmatically are given in section 2.4 below.

The technical documentation accompanying the data provides further information about the data which is specific to the downscaling method and is not contained in this document. It includes an explanation of input data, scope and rationale, evaluation of the method, its limitations, and additional references.

2.3 Link to access the data

The data is publicly accessible and can be retrieved freely here.

2.4 Suggestions to open the data

The NetCDF files are provided in adherence to CMOR standards for as much as possible although, due to the local nature of the data, they may not be fully compliant in some cases.

The naming of the seasonal files adopts the following convention:

nature_model_index_smX_ft.nc

for prediction data, and:

nature_product_index_mX.nc

for observational/reanalysis data, where:

- “nature” describes the nature of the data (e.g. “obs”)
- “model” or “product” labels the model used to produce the data (e.g. “ecmwfseas5-1”)
- “index” labels the variable or climate index considered (e.g. “spei1”)
- “sm” labels the start month for initialised predictions.
- “m” labels the target month for observations
- “ft” labels the forecast time for initialised predictions. For example, if “sm” is equal to 6 (June) and “ft” is equal to 3, the predictions are initialised in June and are valid for August.

The naming conventions for decadal data files vary depending on the atmospheric variable. These details are described in the dedicated data documentation for the decadal study referenced in Section 2.1 (i.e., Statistically downscaled decadal climate variables for the agricultural, pensions sector and British Red Cross case studies).

The NetCDF data can be open programmatically, for example with Python. Xarray is a popular, open-source python library which allows coordinate-aware access of climate data. Instructions to install xarray can be found here. Make sure to install the netCDF4 dependency alongside xarray in order to read the files. It is advisable to install new packages within a managed environment. Once xarray is installed, the data can be opened by running the xarray.open_mfdataset() command, see the xarray documentation for examples of usage.