

Requirements and datasets relevant to design for climatic actions with the Eurocodes

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*Climate resilience and design codes - factoring
in climate projections
Aligning infrastructure standards with information
about the future climate*



Insights from the new EU Strategy on Adaptation to Climate Change

2.3.2.Reducing climate-related risk

Investing in resilient, climate-proof infrastructure pays off. Infrastructure often lasts for many decades but much of the existing stock is not coping well with the changing climate. To minimise the risk of disasters and be cost-effective over its lifetime, infrastructure investments should be climate resilient. This may require an additional upfront cost of ~3% of a project but resilience investments have a cost-benefit-ratio of about 1:4. The Commission has developed extensive climate proofing guidance for new major infrastructure projects. These guidelines have been updated and will be expanded to other EU funds with special attention to critical infrastructure. The Commission will continue to update this guidance and extend to existing infrastructure and promote its use beyond EU funding. It will also use external policy instruments to promote their international uptake. The Commission has worked with European Standardisation Organisations to update standards governing the safety and performance of infrastructure in a changing climate. They produced guidance for standard writers and initiated an update of 12 infrastructure standards as a pilot. This action will cover a wider range of standards and help speed up the standardisation of adaptation solutions. The Commission will encourage Member States to involve national standardisation in the implementation of their National Adaptation Strategies, in complementarity with the EU-level standardisation work.



EN 1991: weather actions on structures

Then, a first investigation considers actions on structures exerted by weather forcing (temperature, wind, and snow loadings) are described in EN 1991:

THERMAL ACTIONS	<p><i>maximum shade air temperature T_{max}</i>: value of maximum shade air temperature with an annual probability of being exceeded of 0.02, based on the maximum hourly values recorded</p> <p><i>minimum shade air temperature T_{min}</i>: value of minimum shade air temperature with an annual probability of being exceeded of 0.02, based on the minimum hourly values recorded</p>
SNOW LOADING	<p><i>characteristic value of snow load on the ground</i>: snow load on the ground based on an annual probability of exceedance of 0.02, (equivalent to a mean return period of 50 years) excluding exceptional snow loads.</p> <p><i>exceptional snow load on the ground</i>: load of the snow layer on the ground resulting from a snow fall which has an exceptionally infrequent likelihood of occurring.</p>
WIND ACTIONS	<p><i>mean wind velocity</i>: the basic wind velocity modified to account for the effect of terrain roughness and orography</p> <p><i>fundamental basic wind velocity</i>: the 10-minute mean wind velocity with an annual risk of being exceeded of 0.02, irrespective of wind direction, at a height of 10m above flat open country terrain and accounting for altitude effects (if required)</p> <p><i>basic wind velocity</i>: the fundamental basic wind velocity modified to account for the direction of the wind being considered and the season (if required)</p>

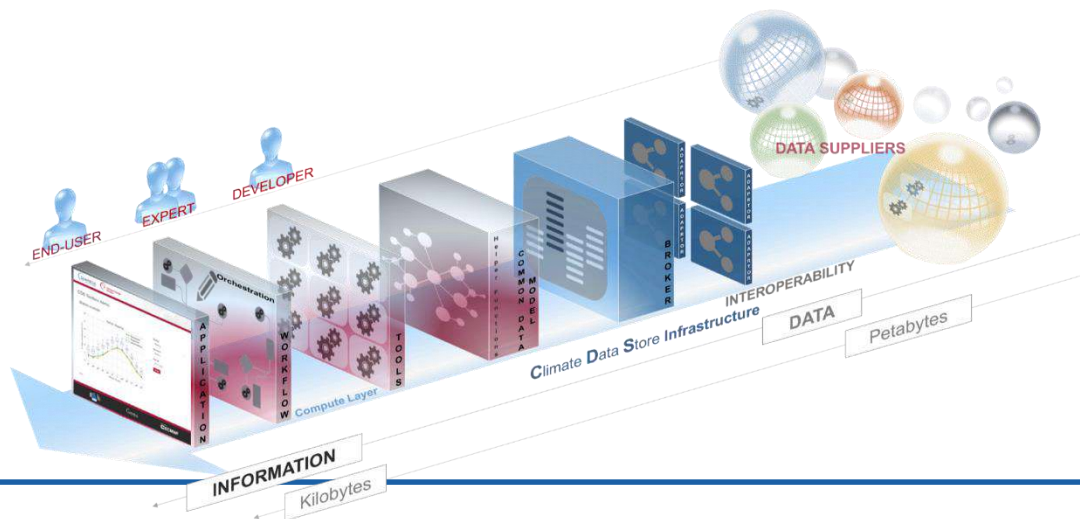


Retrieving authoritative data sources for the assessment and update of weather-related actions

The assessments of the weather-related actions are entrusted to the National Annexes of the countries implementing the Eurocodes.

In most of the applications, the datasets adopted to retrieve the reference values do not go **beyond 90s'**.

In this regard, a valuable support can be represented by Climate Data Store (CDS) included in Copernicus Climate Change Service. CDS “is a one-stop shop for information about the climate: past, present and future. It provides easy access to a wide range of climate datasets via a searchable catalogue. An online toolbox is available that allows users to build workflows and applications suited to their needs”.



Copernicus Climate Change Service is implemented by the European Centre for Medium-Range Weather Forecasts (ECMWF) on behalf of the European Commission. There is no restriction on data use or reproduction and redistribution, with or without adaptation, for commercial or non-commercial purposes.



Retrieving authoritative data sources for the assessment and update of weather-related actions

The analysis of datasets included in Climate Data Store is aimed at addressing three main questions:

Assessments of ongoing changes: in a climate change perspective, how reliable are the datasets currently exploited by National Annexes?

Assessments of future changes: which could be, according to the State-of-the-Art, the expected variations in weather forcing of interest for Actions on Structures?

Harmonisation of reference values: is it possible to rely on authoritative datasets permitting the assessments of reference values at pan-European scale (preventing, for example, cross-borders inhomogeneity)?



Detailed information on available datasets in CDS

In the supporting material to the workshop (https://sirma-project.eu/wp-content/uploads/Climate_Change_Presentations.zip), detailed tables with information about the available datasets in CDS (for historical and future time periods) are reported for the three weather actions.

An example for temperature values:

Dataset	Type	Link	variables	spatial coverage	spatial resolution	temporal coverage	temporal resolution
ERA5	reanalysis	DOI: 10.24381/cds.adbb2d47	2m temperature (daily maximum and minimum as computed from the hourly data); Maximum/Minimum 2m temperature since previous post-processing (1h); Temperature on pressure levels (1-1000 hPa)	global	0.25° x 0.25°	1950-1978 (preliminary); 1979 to present	1 hour

historical/current period

Dataset	Type	Link	variables	spatial coverage	spatial resolution	temporal coverage	temporal resolution
EURO-CORDEX	Ensemble of Regional Climate Models	https://cds.climate.copernicus.eu/cdsapp#!/dataset/projections-cordex-domains-single-levels?tab=overview	max, mean, min 2m temperature	From 27°N to 72°N and from 22°W to 45°E (Europe)	0.11° x 0.11°	From 1989 to 2008 for evaluation experiments From 1951 to 2005 for historical experiments From 2006 to 2100 for RCP experiments	from 3h to daily according to the climate simulation chains

future period



Brief insights about the datasets in CDS

- For historical/current periods, several datasets (raw/corrected reanalysis, gridded observations) provide information about the three weather forcing; they permit going backwards since 50s' (e.g. E-OBS and ERA 5) covering, at least, the European domain.
- For future time spans (up to 2100), data are made available by exploiting ensemble of global and regional climate models under different Representative Concentration Pathways (RCPs); it permits including also a robust analysis of the uncertainties associated to the assessments
- The number of datasets hosted in CDS increases week after week; then, the reported details are aimed at giving a first brief overview about the potentialities of the Service.
- In some cases, the available datasets cannot properly fit the specific requirements for the computation of weather actions (e.g. wind speed values over 10 minutes are currently not available)
- Not all the variables returned by the datasets are currently available on CDS (e.g. snow related variables for EURO-CORDEX ensemble climate projections).
- The reported information only refer to the time series while, in some cases, synthetic indicators are available in datasets and applications on CDS.



Key question

Which climate information should have priority for the construction sector?

Please provide your priorities for the next step, considering, e.g., which parameters are *more relevant* for the users of the Eurocodes, the weather actions requiring *most urgently* an update respect to the current references or for which *significant (ongoing or future) trends* can be detected more clearly at Country or continental level.

In this regard, several aspects must be considered: e.g. challenges for their adoption (available spatial, temporal resolution) or how to handle the uncertainties associated to the adoption of multiple climate simulation chains/RCPs



Thank you for your attention

