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STRENGTHENING INFRASTRUCTURE RISK MANAGEMENT IN THE ATLANTIC AREA

WP4 DELIVERABLE 4.1

Climate Database Variables & Forcing Definitions

Abstract

Definitions of the extracted climate database variables and the forcing used in the models are extracted from their source and demonstrated in this deliverable file

Table 1: Climate Database Variables Definition

Variable	Definition
Near Surface Eastward Wind	Eastward component of the 10m wind. It is the horizontal speed of air moving towards the east, at a height of ten metres above the surface of the Earth, in metres per second. Care should be taken when comparing this variable with observations, because wind observations vary on small space and time scales and are affected by the local terrain, vegetation and buildings that are represented only on average in the ECMWF Integrated Forecasting System. This variable can be combined with the V component of 10m wind to give the speed and direction of the horizontal 10m wind. A negative sign indicates air moving towards the West. **Comment:** near-surface (usually, 10 meters) eastward component of wind.
Near Surface Northward Wind	1-Northward component of the 10m wind. It is the horizontal speed of air moving towards the north, at a height of ten metres above the surface of the Earth, in metres per second. Care should be taken when comparing this variable with observations, because wind observations vary on small space and time scales and are affected by the local terrain, vegetation and buildings that are represented only on average in the ECMWF Integrated Forecasting System. This variable can be combined with the U component of 10m wind to give the speed and direction of the horizontal 10m wind. A negative sign indicates air moving towards the south. **Comment**: near-surface (usually, 10 meters) northward component of wind.
Daily Mean Near Surface Wind Speed	This parameter is the horizontal speed of the wind, or movement of air, at a height of ten metres above the surface of the Earth. The units of this parameter are metres per second. Care should be taken when comparing this parameter with observations, because wind observations vary on small space and time scales and are affected by the local terrain, vegetation and buildings that are represented only on average in the ECMWF Integrated Forecasting System (IFS). **Comment**: near-surface (usually, 10 meters) wind speed.
Significant height of combined wind waves and swell	This parameter represents the average height of the highest third of surface ocean/sea waves generated by wind and swell. It represents the vertical distance between the wave crest and the wave trough. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that were generated by the wind at a different location and time. This parameter takes account of both. More strictly, this parameter is four times the square root of the integral over all directions and all frequencies of the two-dimensional wave spectrum. This parameter can be used to assess sea state and swell. For example, engineers use significant wave height to calculate the load on structures in the open ocean, such as oil platforms, or in coastal applications.
Sea water X velocity	Eastward horizontal surface velocity of a water parcel, as calculated by the physical circulation model. The horizontal surface velocity is a vector quantity, which is broken up into Northward and Eastward components. “Eastward” indicates a vector component which is positive when directed eastward (negative westward). Several factors can influence the horizontal velocity field, and thus drive ocean currents. Across the continental shelf, and especially in near shore environments, the effect of tides is often evident and can drive ocean currents with speeds well in-excess of 1 m s-1.
Sea water Y velocity	Northward horizontal surface velocity of a water parcel, as calculated by the physical circulation model. The horizontal surface velocity is a vector quantity, which is broken up into Northward and Eastward components. "Northward" indicates a vector component which is positive when directed northward (negative southward). Several factors can influence the horizontal velocity field, and thus drive ocean currents. Across the continental shelf, and especially in near shore environments, the effect of tides is often evident and can drive ocean currents with speeds well in-excess of 1 m s-1.

Near Surface Air Temperature	Temperature of air at 2m above the surface of land, sea or in-land waters. 2m temperature is calculated by interpolating between the lowest model level and the Earth's surface, taking account of the atmospheric conditions. **Comment**: Daily-mean near-surface (usually, 2 meter) air temperature.
Sea Surface Temperature	The temperature a parcel of sea water would have if moved adiabatically to sea level pressure. The potential temperature field is 4D (time, location, depth), and is calculated by the physical circulation model. The area covered by the model domain is characterized by large latitudinal and seasonal variations in surface temperature, with the lowest surface temperatures found in the northern reaches of the domain, where typical values are a few degrees above zero in winter. In contrast, in the southern reaches of the domain, surface temperatures can exceed 25 deg. C in the summer. Away from the surface, and especially in deeper waters off the continental shelf, temperatures are generally more stable with a typical value being a few degrees above zero. The temperature of sea water influences ocean currents and mixing. It also influences many biological processes, and species are generally adapted to a specific range of temperatures.
Precipitation	Accumulated liquid and frozen water, including rain and snow, that falls to the Earth's surface. It is the sum of large-scale precipitation (that precipitation which is generated by large-scale weather patterns, such as troughs and cold fronts) and convective precipitation (generated by convection which occurs when air at lower levels in the atmosphere is warmer and less dense than the air above, so it rises). Precipitation variables do not include fog, dew or the precipitation that evaporates in the atmosphere before it lands at the surface of the Earth. This variable is accumulated from the beginning of the forecast time to the end of the forecast step. The units of precipitation are depth in metres. It is the depth the water would have if it were spread evenly over the grid box. Care should be taken when comparing model variables with observations, because observations are often local to a particular point in space and time, rather than representing averages over a model grid box and model time step. **Comment**: at surface; includes both liquid and solid phases from all types of clouds (both large-scale and convective)
Near Surface Relative Humidity	1-This parameter is the water vapour pressure as a percentage of the value at which the air becomes saturated (the point at which water vapour begins to condense into liquid water or deposition into ice). For temperatures over 0°C (273.15 K) it is calculated for saturation over water. At temperatures below -23°C it is calculated for saturation over ice. Between -23°C and 0°C this parameter is calculated by interpolating between the ice and water values using a quadratic function. 2- Amount of moisture in the air divided by the maximum amount of moisture that could exist in the air at a specific temperature and location. **Comment**: near-surface (usually, 2 meter) relative humidity. This is the relative humidity with respect to liquid water for T> 0 C, and with respect to ice for T<0 C.
Near Surface Specific Humidity	1-This parameter is the mass of water vapour per kilogram of moist air. The total mass of moist air is the sum of the dry air, water vapour, cloud liquid, cloud ice, rain and falling snow. 2-Amount of moisture in the air near the surface divided by amount of air plus moist at that location. **Comment**: near-surface (usually, 2 meter) specific humidity.
Sea Surface Salinity	The salt content of sea water as measured on the practical salinity scale. The sea water practical salinity field is 4D (time, location, depth), and is calculated by the physical circulation model. Within the model domain, low salinity values can be found near to sources of freshwater such as river mouths. The salinity of sea water influences ocean currents and mixing. 1 psu = 1 g of salt (Na + Cl -) per kg of seawater.
Sea Surface Height Above Geoid	Vertical distance between the actual sea surface and a surface of constant geopotential with which mean sea level would coincide if the ocean were at rest, this height, when multiplied by the area fraction of the grid cell covered by ocean (or sea ice), yields the volume of sea water above the geoid. As defined here, "the geoid" is a surface of constant geopotential that, if the ocean were at rest, would coincide with mean sea level. Under

	this definition, the geoid changes as the mean volume of the ocean changes (e.g., due to glacial melt, or global warming of the ocean). Report zos as "missing" over grid cells that are entirely land. There are a couple of acceptable options for reporting this field: 1) if the geoid is defined to relate to the instantaneous volume of the ocean, the global mean of zos will always be zero 2) if the geoid is defined relative to a time-mean sea level over some period, then the global mean of zos will be time-dependent. In general IPCC analysis of global mean sea level changes will not rely on zos. It is recommended that in reporting zos, the atmospheric "inverted barometer" effect be omitted, since it can be easily calculated from the reported mean sea level pressure field. The "comment" attribute associated with zos should indicate whether or not the atmospheric "inverted barometer" influence on zos has been included. Additionally, it should be noted in the "comment" attribute whether zos is obtained directly, as in a free-surface model, or has been derived, for example, from geostrophic using diagnosed velocities at some level or from geostrophic relative to an assumed level of quiescence.
Global average sea level change	A function only of time, zosga is the total change in global mean sea level, relative to some fixed distance from the centre of the earth, due to thermosteric changes, water flux input from land/glaciers/atmosphere, and salinity influences on density. If the model cannot be trusted to provide estimates of the water flux input from land/glaciers, there is no need to report zosga (since salinity influences are of secondary importance and the thermosteric contribution is reported by zostoga). Note that to good approximation the difference between zostoga and zosga yields the global mean change in sea level due to water budget imbalances (presumably, resulting largely from changes in glacial mass
Global average thermosteric sea level change	A function only of time, zostoga is the contribution to change in global mean sea level, relative to some fixed distance from the centre of the earth, due only to thermal structure changes. The fixed reference height should be invariant across all IPCC simulations by a model. In a rigid-lid model this quantity can be calculated by using a reference 3D salinity field to compute density as the 3D temperature field evolves. If only the total sea level change (due to thermosteric changes, water flux input from land/glaciers/atmosphere, and salinity influences on density) is available, omit zostoga, and report only zosga
Mean wave period	This parameter is the average time it takes for two consecutive wave crests, on the surface of the ocean/sea, to pass through a fixed point. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). This parameter is a mean over all frequencies and directions of the two-dimensional wave spectrum. The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that were generated by the wind at a different location and time. This parameter takes account of both. This parameter can be used to assess sea state and swell. For example, engineers use such wave information when designing structures in the open ocean, such as oil platforms, or in coastal applications.
Global average steric sea level change	refers to global changes in sea level due to thermal expansion and salinity variations
River Flow	It is computed as the river flux of water into the ocean divided by the area of the ocean portion of the grid cell
Sea level Pressure	Sea water pressure at sea water surface. It increases with the depth

Table 2: Climate Models Forcing Definitions

Forcing	Definition
Nat	Natural forcing as a combination that might include, for example(Solar and Volcanic)
Ant	Anthropogenic forcing as a mixture that might include for example, well mixed greenhouse gases, aerosols, ozone and land-use changes
GHG	Well mixed greenhouse gases as a mixture
SD	Anthropogenic sulfate aerosol, accounting only for direct effects
SI	Anthropogenic sulfate aerosol, accounting only for indirect effects
SA=(SD+SI)	Anthropogenic sulfate aerosol, accounting for direct and indirect effects
TO	Tropospheric ozone
SO	Stratospheric ozone
OZ=(TO+SO)	Ozone=(Tropospheric and Stratospheric ozone)
LU	Land-use change
SI	Solar irradiance
VI	Volcanic aerosol
SS	Sea salt
Ds	Dust
BC	Black Carbon
MD	Mineral Dust
OC	Organic Carbon
AA	Anthropogenic aerosols as a mixture of aerosols

All the definitions concerned on the climate database variables and models forcing are obtained from their sources (Copernicus Service – CMIP5).