AdriaClim

Climate change information, monitoring and management tools for adaptation strategies in Adriatic coastal areas

Project ID: 10252001

D 3.2.2 Sets of simulation outputs together with metadata suitable for information retrieval

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Project Acronym: AdriaClim

Project ID Number: 10252001

Prject Title: Climate change information, monitoring and management tools for adaptation strategies in Adriatic coastal areas

Priority Axis: 2 - Climate change adaptation

Specific objective: 2.1 - Improve the climate change monitoring and planning of adaptation measures tackling specific effects, in the cooperation area

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Activity Title: Design and implementation of the integrated modelling systems

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Reviewers	

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Aims and content of the document

The data stock produced within the AdriaClim Project will be conveyed to a web- infrastructure, based on ERDDAP server, which is expected to provide a holistic geodatabase for the project target areas, i.e. the Adriatic Sea and the marine pilotsites.

To this purpose, the AdriaClim ERDDAP server is expected to host:

i) the observing data gathered by the project monitoring campaigns,

ii) the atmosphere, land and ocean reanalyses datasets used as benchmark for comparing the new modeling results and for preliminary evaluation of climate variability and CC indicators in the present state

iii) a MedCordex AORCM dataset used as the coarse forcing to perform theAdriaClim climate downscaling,

iv) the modelled data produced by the AdriaClim sub-regional and coastal climatedownscaling,

v) the basin-to-local scale climate change indicators processed on the basis ofthe AdriaClim modeling results

The purpose of the present deliverable is to offer guidelines to ensure that the AdriaClim modeling results, collected under the umbrella of Work Package3- Activity 3.2 and shared on the AdriaClim ERDDAP, are easily accessible and interoperable by the whole AdriaClim partnership.

To retrieve any information on data access please refer to Deliverable 4.3.1

The dataset of the regional to sub-regional climate downscaling

The atmosphere climate dataset

Two 31-year climate simulations have been performed with the atmospheric component of the AdriaClim sub-regional earth system. It is based on WRF code which includes a land surface sub-model NOAH.

We named the WRF climate simulations as historical and projection simulations: the former is over the time window 1990-2020, and the latter spans the 2020-2050 range. The first year of both climate simulations is considered as spin-up period. It has been used also to train the quantile mapping method adopted to bias correct the near surface atmospheric fields (details are in the companion Deliverable 3.2.2), thus year 1990 and year 2020 have been removed from the WRF data reposito

The AdriaClim atmosphere-land climate dataset is detailed in Table1

File name	wrfout_d01_${year}-${month}-${day}_12:00:00c_corr
Fields	3D atm field, 2D near surface atm fields, 2D land surface fields, 4 soil layer fields
File format	Compressed NETCDF4, CF-1.6 convention
Time window and Time frequency	1991 to 2020; 2021 to 2050 Daily files with 4 timesteps; 6h frequency instantaneousfields from the current day at 12:00 UTC to the day afterat 06:00 UTC
Computational grid	Arakawa C-type grid *289X403 grid points,* *[5 to 23 degE - 29.8 to 48.8 degN]*
Horizontal coordinates and resolution	Mercator plain coordinates, ~6km
Vertical coordinates and resolution	60 unevenly spaced following terrain ETA-levels (up to ~100 hPa)
Vertical discretization of the land surface submodel NOAH	4 soil layers (DZS variable): [0-0.1]m; [0.1-0.4]m; [0.4,1]m; [1, 2]m

Post Processed fields	Bias-corrected fields (quantile mapping and linearscaling): • 6h 2meter air temperature T2, • 6h 10meter zonal velocity component U10 • 6h 10meter meridional velocity component V10 • 6h cumulated total rainfall (convective + orographic components) RAINTOT

Table1: AdriaClim WRF dataset

The hydrology climate dataset

Two 30-year climate simulations have been performed with the hydrology component of the AdriaClim sub-regional earth system. It is based on WRFHydro code.
We named the WRFHydro climate simulations as historical and projection simulations: the former is over the time window 1991-2020 with start on September 1st 1991 following the definition of hydrological year and by considering 1990 as spin-up year of WRF historical simulation and training year for the bias correction method. The latter spans the 2021-2050 rang with start on September 1st 2021 (year 2020 is the spin-up year of WRF projection simulation and the training year for the bias correction method).
September-December 1991 and September-December 2021 are considered as spin-up months of WRFHYDRO climate simulations thus they have been removed from the WRFHydro data repository.

The AdriaClim hydrology climate dataset is detailed in Table2. It has to be considered as a first version of the WRFHydro data repository because some small and medium rivers ending on the western Adriatic coastline have been found to underestimate the observed runoff on the historical range and a further calibration is underway. Thus a second version of the WRFHydro climate simulations will be released by May.
The list of the catchments solved by the WRFHydro system and the subset which has been selected to represent the freshwater release into the AdriaClim ocean component NEMO are provided and commented on in the Appendix.
The AdriaClim WRF-WRFHydro system includes a double shallow water system (2D overland waterflow and 1D channel streamflow) with 600m resolution and is able to represent 145 catchments ending into Adriatic Sea,
i.e. the ones with a basin area major than 70 km2. They are shown in Figure A1. For each river, a monitoring point has been fixed along the river network on the computation grid as close as possible to the river mouth. WRFHydro is not able to

spatially discretize the Po river delta system thus the river discharge at Pontelagoscuro monitoring point is considered for coupling with the ocean model component and splitted among the nine branches of the delta: Po di Goro, Po di Gnocca, Po di Tolle, Po di Bastimento, Po di Scirocco, Po di Bonifazi, Po di Dritta, Po di Tramontana, Po di Maistra (light blue markers in Figure A2). Percentages provided by Provini et al. (1992) are used for the partitioning.

File name	runoff_hist_${river_code}_${year}.txt runoff_proj_${river_code}_${year}.txt Note: “river_code” is the numeric code used byWRFHydro
Fields	column 1: Date column 2: river_code column 3: longitude (degree east)column 4: latitude (degree north) column 5: streamflow (m^3/sec) column 6: streamflow (feet^3/sec) column 7: water level (m)
File format	ASCII; Unidata Observation Dataset v1.0
Time window and Time frequency	1992 to 2020; 2022 to 2050 Annual files with 1h frequency

File name	${year}${month}${day}0000.CHANOBS_DOMAIN1
Fields	WRFHydro river streamflow for each of the 145 modeled rivers
File format	Compressed NETCDF4, Unidata Observation Dataset v1.0
Time window and Time frequency	1992 to 2020; 2022 to 2050 Daily files with 1h frequency

File name	${year}${month}${day}0000.CHRTOUT_DOMAIN1
Fields	WRFHydro river streamflow for each of the 145 modeled rivers at all the pixes representing the river networks
File format	Compressed NETCDF4, Unidata Observation Dataset v1.0

Time window and Time frequency	1992 to 2020; 2022 to 2050 Daily files with 1h frequency

File name	${year}${month}${day}0000.LDASOUT_DOMAIN1
Fields	WRFHydro Land Surface sub-model soil laver fields
File format	Compressed NETCDF4, CF-1.6 convention
Time window and Time frequency	1992 to 2020; 2022 to 2050 Daily files with with 24 timesteps: 1h frequency instantaneous fields on the current day fro 00:00 UTCto 23:00 UTC

Computational grid	Arakawa E-type grid
Horizontal coordinates:	Mercator plain coordinates
Horizontal resolution:	~600 m (1:10 with respect to WRF)
Vertical coordinates:	-
Vertical resolution:	4 soil layers: [0-0.1]m; [0.1-0.4]m; [0.4, 1]m; [1, 2]m
Post Processed fields:	**-**

Table2: AdriaClim WRFHydro dataset

The marine thermo-hydrodynamics climate dataset

Two 29-year climate simulations have been performed with the ocean component of the AdriaClim sub-regional earth system. It is based on NEMO code.
We named the NEMO climate simulations as historical and projection simulations. They cover the time window 1992-2020 and 2022-2050respectively, both chosen by considering the spin-up periods of WRF and WRFHydro climate simulations.
January 1992 and January 2022 are considered as spin-up months of NEMO climate simulations thus they have been removed from the NEMO data repository.
The AdriaClim ocean climate dataset is detailed in Table3. It has to be considered as a first version of the NEMO data repository. The final version ofthe NEMO climate simulations will be collected by June in order to embed the river runoff simulated by the new release of WRFHydro climate experiments. Moreover the final NEMO climate simulations print out the 2D sea surface fields and air-sea fluxes with 3h frequency while maintaining daily frequency for the 3D fields.

File name	ADRIACLIM2_1d_${year}${month}${day}_grid_T.nc ADRIACLIM2_1d_${year}${month}${day}_grid_U.nc ADRIACLIM2_1d_${year}${month}${day}_grid_V.nc ADRIACLIM2_1d_${year}${month}${day}_grid_W.nc
Fields	3D ocean field, 2D sea surface ocean fields, 2D air-sea fluxes
File format	Compressed NETCDF4, CF-1.6 convention
Time window and Time frequency	1992 to 2020; 2022 to 2050 daily files with 1 timestep representing daily average fields
Computationalgrid	Arakawa C-type grid *432X331 grid points,* [12 to 20.98 degE; 39.0 to 45.88 degN]

Horizontal coordinates and resolution:	regular spherical coordinates, ~2km
Vertical Coordinates and resolution	120 unevenly spaced z-geopotential levels with partial steps atthe bottom (0.4 m to 2629.3 m on T-grid)

File name	ADRIACLIM2_3h_${year}${month}${day}_grid_T.nc ADRIACLIM2_3h_${year}${month}${day}_grid_U.nc ADRIACLIM2_3h_${year}${month}${day}_grid_V.nc

Fields	2D sea surface ocean fields, 2D air-sea fluxes
File format	Compressed NETCDF4, CF-1.6 convention
Time window and Time frequency	1992 to 2020; 2022 to 2050 daily files with 8 timesteps representing 3h fields
Computationa lgrid	Arakawa C-type grid *432X331 grid points,* [12 to 20.98 degE; 39.0 to 45.88 degN]
Horizontal coordinates andresolution:	regular spherical coordinates, ~2km

Table3: AdriaClim NEMO dataset.

Toward the marine biochemistry climate dataset

File name	BFM_1d_${year}${month}${day}_${year}${month}${day+10}_grid_bfm.nc
Fields	3D mean biogeochemical variables: - concentration of chlorophyll-a - concentration of phosphate PO4 - concentration of nitrate NO3 - concentration of oxygen O2 - ph
File format	NETCDF4
Time window and Time frequency	10-day files with 5-day mean variables
Computational grid	*432X331X120 grid points (corresponding to NEMO T 3D grid)* [12 to 20.98 degE; 39.0 to 45.88 degN]

Horizontal coordinates and resolution:	regular spherical coordinates, ~2km

Toward the marine wave climate datase

Wave simulations are based on WW3 v6.07 code. Final wave simulations will be performed using the atmospheric wind (WRF) and ocean currents and temperature (NEMO) fields of the AdriaClim system. Until now, sensitivity experiments have been performed with ECMWF winds and no current forcing for 1 year (2019).

The AdriaClim wave dataset will have the format described in Table 4.

File name	ww3.${year}${month}${day}.nc
Fields	2D instantaneous wave parameters: significant wave height,period and direction
File format	NETCDF4
Time window and Time frequency	Daily files with 23 timesteps representing hourly fields
Computationa lgrid	*432X331 grid points (corresponding to NEMO T grid)* [12 to 20.98 degE; 39.0 to 45.88 degN]
Horizontal coordinates andresolution:	regular spherical coordinates, ~2km
Spectral resolution	30 frequencies with logarithmic repartition from 0.05 s^{-1} to 1.1 s^{-1}10 degrees in direction

Table4: AdriaClim WW3 dataset.

Appendix

The AdriaClim WRF-WRFHydro system includes a double shallow water system (2D overland waterflow and 1D channel streamflow) with 600m resolution and is able to represent 145 catchments ending into Adriatic Sea, i.e. the ones with a basin area major than 70 km^2. They are also shown in Figure A1.

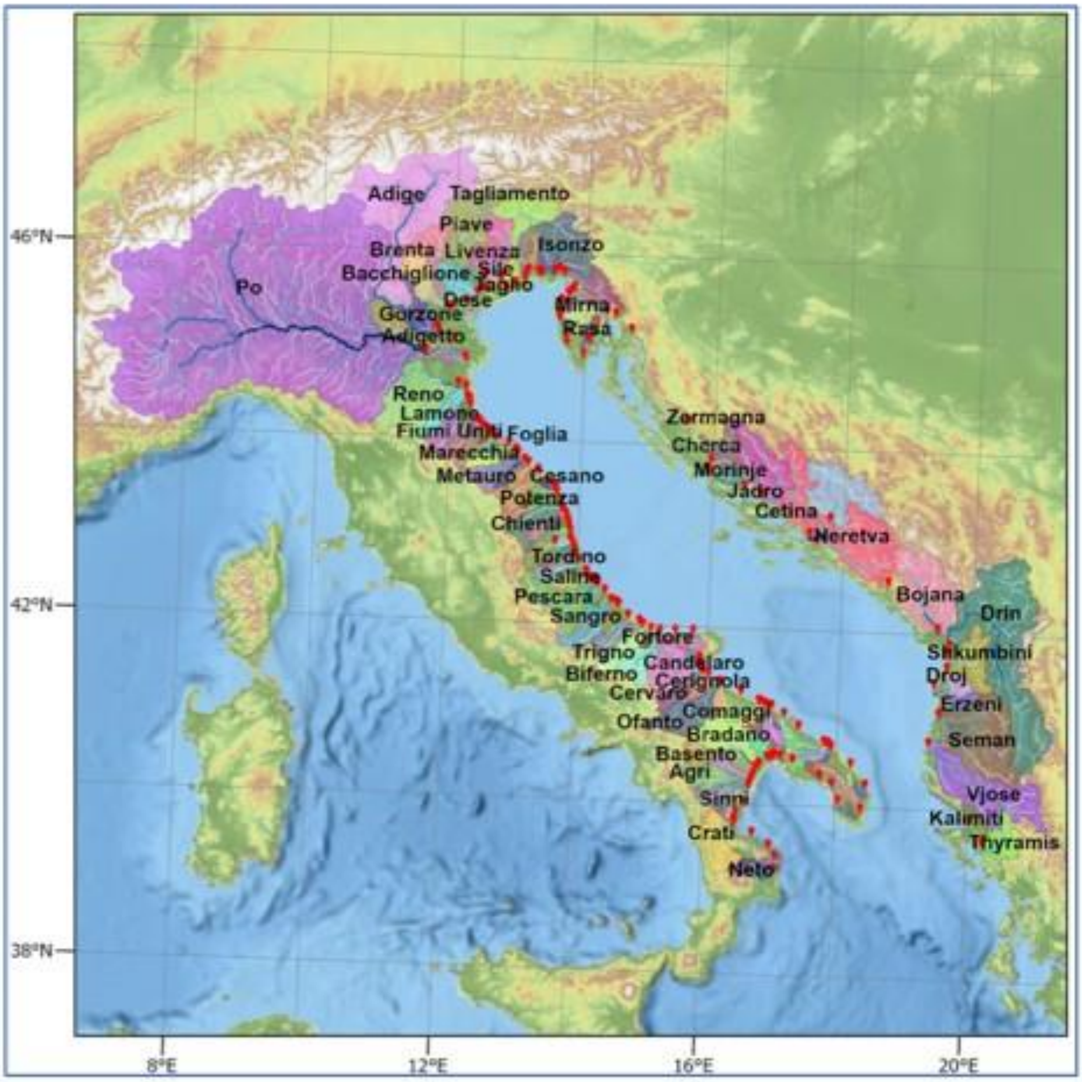

Figure A1: The WRFHydro river catchments ending into the Adriatic Sea

A subset of 71 catchments among the 145 ones solved by WRFHydro is considered into NEMO computational grid to represent the Adriatic river release. They are listed in Table A1.
This subset follows some constraints:

- a lower threshold has been introduced and rivers with catchment area smallerthan 500 km^2 are not considered as they have not been calibrated and maybe unrealistic, e.g. anomalous peaks. Sile, Rijecina, Dubracina, Jadro, Uso, Rubicone rivers make exception to this rule and their mouths are embedded into NEMO domain because (i) their runoff is >10 m^{3}s^{-1} or (ii) they enter the Adriatic basin close each other with a total non-negligible runoff
- WRFHydro rivers which are tributaries of main networks and do not enter the sea have been excluded

- three WRFHydro catchments are lumped, thus they embed multiple catchments: Bistrica+Pavla+Kaimiti, Seman+Shkumbini, Timavo. Their outlets convey the resulting volume fluxes (red markers in Figure A2)
- Bacchiglione river is a tributary of Brenta river but WRFHydro solve the two of them as detached rivers ending directly into the sea (green markers in Figure A2)

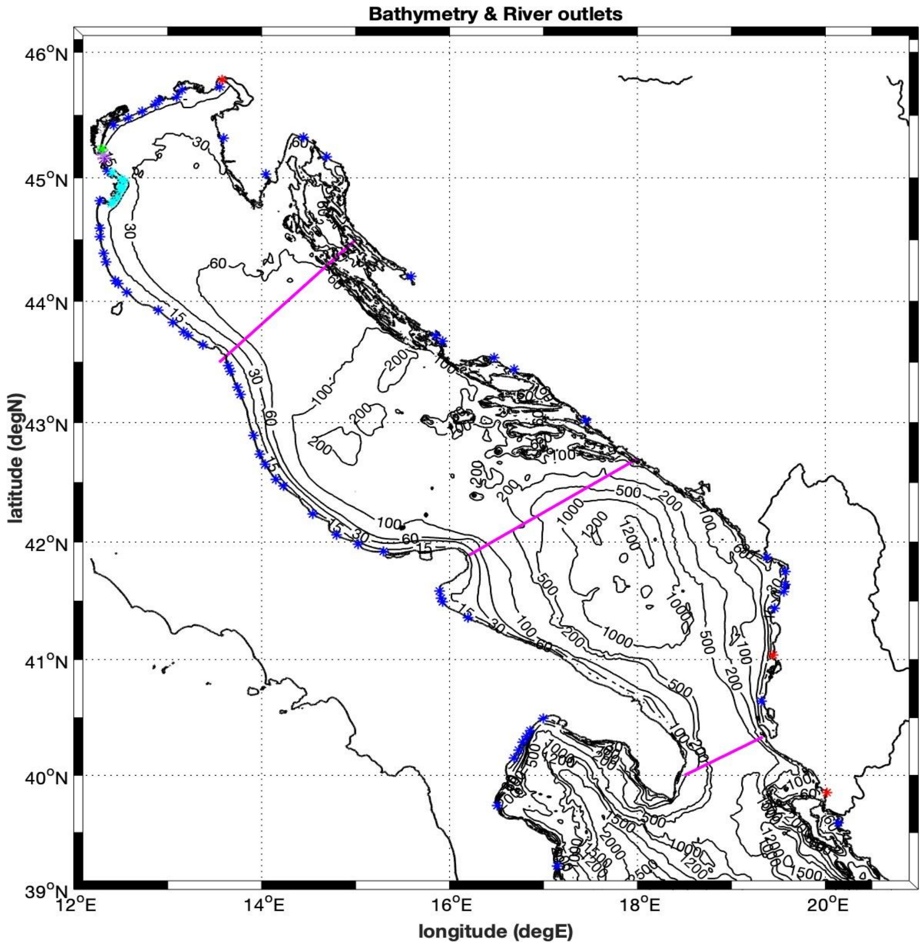

Figure A2: AdriaClim ocean model domain, bathymetry and locations of the river mouths on the computational grid. the riverine sources have been selected as a subset of the river catchments solved by AdriaClim hydrological model WRFHydro