

Appendix 2: ENSEMBLES datasets

Introduction

The ENSEMBLES project has generated a vast (>60 terabytes) resource base of data, which is all digital and stored on internet archives. This Appendix describes these datasets – where to find them, what they consist of, and other supporting information. All data are made freely available for academic, educational and commercial use, but use must be acknowledged by inclusion of the following statement: ‘*The ENSEMBLES data used in this work was funded by the EU FP6 Integrated Project ENSEMBLES (Contract number 505539), whose support is gratefully acknowledged.*’ Please see the ENSEMBLES data policy document for more information: http://ensembles-eu.metoffice.com/docs/Ensembles_Data_Policy_261108.pdf.

The following dataset descriptions cover the daily gridded observational datasets (RT5), the seasonal to decadal predictions for streams 1 and 2 (RT1 and RT2A), the global climate change simulations for streams 1 and 2 (RT2A), the regional simulations for the ERA-40 period (RT3), the regional climate change simulations, the quick-look analyses (RT2B), and the statistical downscaling (RT2B).

Daily gridded observational datasets [RT5]

Gridded observational datasets of daily precipitation and temperature have been developed on the basis of a European network of high-quality station series. The datasets cover the period from 1950 to 2008. They are made available on a 0.25 and 0.5 degree regular latitude–longitude grid, as well as on a 0.22 and 0.44 degree rotated pole grid. The grid is the same as the Climatic Research Unit monthly datasets for the globe. The rotated grid is the same as used in many ENSEMBLES Regional Climate Models. As well as ‘best estimate’ values, separate files are provided containing 95% confidence intervals, and surface elevation. A description can be found in Haylock et al. (2008). Note that these datasets are strictly for use in non-commercial research and non-commercial education projects only. They are available from: <http://eca.knmi.nl/download/ensembles/ensembles.php>

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Reference: Haylock MR, Hofstra N, Klein Tank AMG, Klok EJ, Jones PD, New M, 2008. A European daily high-resolution gridded dataset of surface temperature and precipitation for 1950–2006. *Journal of Geophysical Research* 113, doi:10.1029/2008JD010201.

Seasonal to decadal simulations [RT1 and RT2A]

The seasonal to decadal (s2d) experiments comprise two sets of simulations: the stream 1 and stream 2 simulations. For both streams, coordinated forecast experiments over seasonal, interannual and decadal timescales have been performed. Three

different approaches were pursued to represent model uncertainties: the multi-model approach, the perturbed physical parameter approach and the stochastic physics approach. The data are available through the MARS server at ECMWF. For more information on the scope of the experiments as well as results look at: http://www.ecmwf.int/research/EU_projects/ENSEMBLES/data/index.html.

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Centennial simulations [RT2A]

Centennial simulations using climate models from European modelling groups (CNRM, DMI, FUB, INGV, IPSL, METO-HC, MPIMET, NERSC) produced a set of state-of-the-art benchmark simulations during the first phase of ENSEMBLES (stream 1). A set of multi-model simulations were produced over the period 1860–2000 to simulate the longer-term climate anomalies observed during the 20th century in response to a prescribed set of anthropogenic forcings only and also with the addition of natural forcings. A multi-model set of coupled simulations over the 21st century has been produced with the three scenarios of aerosol and GHG forcings proposed by IPCC (scenarios A2, A1B and B1) in order to produce a projection of the future climate with a better estimate of the uncertainties due to model formulation, initial state of the climate system, and scenario choice.

Results of most of the RT2A climate scenarios are stored in the WCRP CMIP3 archive at PCMDI, from where they were used in the IPCC AR4 assessment (see http://www-pcmdi.llnl.gov/ipcc/about_ipcc.php). High temporal resolution (daily and 6-hourly) results from the RT2A multi-decadal simulations are available on the CERA database, run by the Model&Data group at the Max-Planck Institute for Meteorology (<http://www.mad.zmaw.de/projects-at-md/ensembles/>).

Improved model versions, some including new components for the carbon cycle and aerosols, have run a new set of simulations taking into account land-use change, as observed or computed by a recent version of the IMAGE integrated assessment model. In addition to an A1B scenario, a new stabilisation scenario to 450 ppm of CO₂-equivalent, developed in collaboration with RT7, was used for the stream 2 climate change simulations. A subset of the stream 2 data is stored at the CERA database in Hamburg.

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The probabilistic projections produced by the Met Office Hadley Centre and commonly referred to as the ‘grand ensemble’ are also available online. The data are supplied in numerical form in terms of 10,000 distribution sample points per grid box. Rockel, northern Europe, Mediterranean and Europe regions are also defined. The data are available from http://ensembles-eu.metoffice.com/secure/RT6_data_230609/data_for_RT6.html.

Regional simulations driven by ERA-40 reanalysis data [RT3]

The ENSEMBLES RT3 simulations with the ERA-40 reanalysis as boundary conditions are available on the RT3/RT2B archive at <http://ensemblesrt3.dmi.dk>. Up to 130 fields are available from each simulation, covering the period 1951–2002. The data are available through an OpenDAP interface, which allows sub-windows and sub-periods to be selected for download. Institutes, models and contact persons are listed below:

C4I	RCA	Ray McGrath
CHMI	ALADIN	Petr Štěpánek
CNRM	ALADIN	Michel Déqué
DMI	HIRHAM	Ole B. Christensen
ETHZ	CLM	Christoph Schär
GKSS	CLM	Burkhardt Rockel
HC	HadRM	Erasmus Buonomo
ICTP	RegCM	Filippo Giorgi
INM	RCA	Bartolomé Orfila
KNMI	RACMO	Erik van Meijgaard
METNO	HIRHAM	Jan Erik Haugen
MPI	REMO	Daniela Jacob
SMHI	RCA	Erik Kjellström
UCLM	PROMES	Manuel de Castro
OURANOS	CRCM	Dominique Paquin

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Regional climate change simulations and quick-look analysis [RT2B]

RT2B formed Part 2 of the ENSEMBLES model engine, i.e., the regional component (RT2A forms Part 1, the global component). It constructed and analysed probabilistic high-resolution regional climate scenarios and seasonal–decadal hindcasts. An ensemble of regional climate change scenarios using as many GCM-RCM combinations as possible was constructed and is described in Table A2.1. These simulations are available on the RT3/RT2B archive at <http://ensemblesrt3.dmi.dk>

Quick-look analysis [RT2B]

A quick-look analysis has been set up in order to provide very fast information on the RCM scenarios results. For 2 m temperature, precipitation and evaporation, area means for the eight Rockel regions are available on a monthly basis by each modelling partner for their transient runs on 25 km horizontal resolution. MPI-M has computed yearly means, seasonal means and annual cycles for each decade and produced plots showing time-series of the results of all ENSEMBLES RCMs.

Statistical downscaling [RT2B]

Statistical downscaling (SDS) was conducted by ten ENSEMBLES partners in RT2B using a range of different

Table A2.1: ENSEMBLES GCM-RCM Matrix of RCM simulations at 25 km resolution. Those simulations and institutes marked with an asterisk (*) are non-contractual runs. For the METO-HC GCM, there are standard (std), low and high sensitivity runs.

RCM	GCM	ERA40	METO-HC, Std	METO-HC, Low	METO-HC, High	MPIMET	IPSL	CNRM	NERSC	CGCM3	Total
METO-HC <i>HadRM</i>		1961–2002	1951–2100	1951–2100*	1951–2100*	1951–2100					4
MPIMET <i>REMO</i>		1961–2002				1951–2100	1951–2050*				2
CNRM <i>ALADIN</i>		1961–2002						1951–2050			1
DMI <i>HIRHAM</i>		1961–2002				1951–2100*		1951–2100	1951–2100*		3
ETH <i>CLM</i>		1961–2002	1951–2100								1
KNMI <i>RACMO</i>		1961–2002				1951–2100					1
ICTP <i>RegCM</i>		1961–2002				1951–2100					1
SMHI <i>RCA3</i>		1961–2002		1951–2100*		1951–2100*			1951–2100		3
UCLM <i>PROMES</i>		1961–2002	1951–2050	1951–2050							1
C4I <i>RCA3</i>		1961–2002			1951–2100*	1951–2050*					2
GKSS <i>CLM</i>		1961–2002					1951–2050*				1
Met.No <i>HIRHAM</i>		1961–2002	1951–2050						1951–2050*		1
CHMI <i>ALADIN</i>		1961–2002						1951–2050*			1
OURANOS* <i>CRCM</i>		1961–2002								1951–2050*	1
EC* <i>GEMLAM</i>		1961–2002									
VMGO* <i>VMGO</i>			1951–2050*								1
Total			3	3	2	7	2	3	3	1	25

methods. Most groups downscaled GCM simulations, but C4I applied SDS to RCM outputs.

For each group (ARPA-SIM, FIC, GKSS, IAP, KNMI, NIHWM, NMA, UEA) and downscaling method, the following information is provided: predictands and predictors, brief description of method and reference, source of predictors, region(s)/predictand datasets which have been downscaled, and a brief outline of how uncertainties are addressed and/or probabilistic projections derived. A summary of the information available is shown in Table A2.2.

This table does not list the methods implemented in the ENSEMBLES web-based downscaling service developed by the University of Cantabria (UC) (www.meteo.unican.es/ensembles). This service is intended as a useful and friendly service for end-users with limited experience in the technical issues associated

with statistical downscaling. It allows downscaling of ENSEMBLES seasonal–decadal hindcasts as well as climate change simulations. It also incorporates a data access tool which provides easy access to reanalysis data and a number of ENSEMBLES data outputs.

Dynamically downscaled hindcast simulations undertaken by INM in RT2B are available at:
http://www.ecmwf.int/research/EU_projects/ENSEMBLES/data/index.html

Access to RT2B SDS outputs is through the Regional Scenarios Portal, which also provides access to many other relevant datasets and background information: <http://www.cru.uea.ac.uk/projects/ensembles/ScenariosPortal/>

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Table A2.2: Summary of statistical downscaling methods used in RT2B. Note that methods implemented in the ENSEMBLES web-based downscaling service (www.meteo.unican.es/ensembles) are not listed. ACC: Anthropogenic Climate Change runs to 2100; s2d: seasonal to decadal hindcasts.

ENSEMBLES partner	Variables to be downscaled	Method	ENSEMBLES runs to be downscaled	Region(s) where downscaling will be applied
ARPA-SIM	Daily Precipitation, Tmin, Tmax	Regression, conditioned by circulation - canonical correlation analysis (CCA)	ACC GCM runs	N-Italy
ARPA-SIM	Daily Precipitation, Tmin, Tmax	Multiple linear regression –Model Output Statistics + BLUE	Stream 1 s2d runs	Italy
FIC	Daily precipitation and temperatures. Wind and humidity will be tested.	Two-step analogue method	ACC GCM runs RT2B RCMs later	Europe – ENSEMBLES gridded observations
GKSS	Marine surface wind	Conditional stochastic weather generator	ACC GCM runs	Germany/Netherlands
IAP	Daily temperature (& daily precipitation?)	Regression, conditioned by circulation	ACC GCM runs	ECA&D European stations
IAP	Daily temperature	Multilayer perceptron neural network	ACC GCM runs	ECA&D European stations
IAP	Precipitation, Tmin and Tmax, solar radiation	Conditional stochastic weather generator	ACC GCM runs	ECA&D European stations
IAP	Daily temperature (& daily precipitation?)	Multiple linear regression	ACC GCM runs	ECA&D European stations
KNMI	Multi-site (sub)daily RCM precipitation (and temperature)	Nearest-neighbour resampling	ACC GCM runs	River Rhine catchment
NIHWM	Temperature, precipitation, drought indices, river discharge	Conditional stochastic weather generator	ACC GCM runs	Danube basin
NMA	Daily precipitation	Mixture between two-state first order Markov chain and CCA	ACC GCM runs Possibly RCM runs	Southern Romania
UEA	Daily precipitation, Tmax, Tmin, vapour pressure, wind speed, sunshine duration, relative humidity, reference PET	Stochastic weather generator	Change factors taken from RT2B RCM runs	7 mainland European stations, plus 3–4 UK stations.