

Data archiving and dissemination of the seasonal-to-decadal experiments

ENSEMBLES Team

European Centre for Medium-Range Weather Forecasts

Set-up for seasonal-to-decadal hindcasts

stream 1

month 18-24

Three approaches to tackle model uncertainty:

- **multi-model**: 5 coupled GCMs, each 9 ensemble members
- **perturbed physics**: 1 coupled GCM, 9 ensemble members
- **stochastic physics**: 1 coupled GCM, 9 ensemble members

Hindcast production period: 1991-2001

- **seasonal runs** (7 months): two start dates per year (May, Nov)
- **annual runs** (14 months): at least one start date per year (Nov)
- **multi-annual/decadal runs** (10 years): starting in 1965 and 1994

stream 2

month 48

Temptative:

- multi-model of 5 coupled GCMs
- hindcast production period 1960-2001
- 4 start dates per year
- one annual run per year, one multi-annual run (at least) every 5 years

List of experiments already available in MARS

http://www.ecmwf.int/research/EU_projects/ENSEMBLES/table_experiments/

model	version	origin	expid	method	system	expvars	stream	years	lead	start dates	IC members	MARS	comments
all													
IFS/HOPE	29r2	ECMWF	eplo	1	1	1004	mmsf.msmm	1991-2001	7 months	May 1st	9	ENSEMBLES, rd	control
IFS/HOPE	29r2	ECMWF	epn9	1	1	1004	mmsf.msmm	1991-2001	14 months	Nov 1st	9	ENSEMBLES, rd	control
IFS/HOPE	29r2	ECMWF	epoh	2	1	1001	mmsf.msmm	1991-2001	7 months	May 1st	9	ENSEMBLES, rd	CASBS
IFS/HOPE	29r2	ECMWF	eq04	2	1	1001	mmsf.msmm	1991-2001	14 months	Nov 1st	9	ENSEMBLES, rd	CASBS
IFS/HOPE	30r1	ECMWF	eqhl	1	1	1005	mmaf.mmam	1965	120 months	Nov 1st	9	ENSEMBLES, rd	control
IFS/HOPE	30r1	ECMWF	eqju	1	1	1005	mmaf.mmam	1994	120 months	Nov 1st	9	ENSEMBLES, rd	control
IFS/HOPE	30r1	ECMWF	eqq2	2	1	1005	mmaf.mmam	1965	120 months	Nov 1st	9	ENSEMBLES, rd	CASBS
IFS/HOPE	30r1	ECMWF	eqqg	2	1	1005	mmaf.mmam	1994	120 months	Nov 1st	9	ENSEMBLES, rd	CASBS
GlbSea		MetOffice		1	1	1001	mmsf.msmm	1991-2001	14 months	May & Nov 1st	9	ENSEMBLES	control
GlbSea		MetOffice		1	1	1002	mmsf.msmm	1991-2001	12 months	May 1st	9	ENSEMBLES	lagged ens
GlbSea		MetOffice		1	1	1002	mmsf.msmm	1991-2001	14 months	Nov 1st	9	ENSEMBLES	lagged ens
GlbSea		MetOffice		1	1	1003	mmsf.msmm	1991-2001	7 months	mid April & Oct	9	ENSEMBLES	
GlbSea		MetOffice		1	1	1004	mmaf.mmam	1994	120 months	Nov 1st	9	ENSEMBLES	
GlbSea		MetOffice		1	1	1004	mmaf.mmam	1965	120 months	Nov 1st	9	ENSEMBLES	
DePreSys		MetOffice		10-18	51	1501	mmaf.mmam, mmsf.msmm	1991-2001	120 months	May & Nov 1st	1	ENSEMBLES	pert. param., method->ens memb
DePreSys		MetOffice		10	51	1502	mmaf.mmam, mmsf.msmm	1991	120 months	May 1st	1	ENSEMBLES	pert. param., test IC ens
ARPEGE/OPA		MeteoFrance		1	(0) 1	1001	mmsf.msmm	1991-2001	7 months	May 1st	9	ENSEMBLES	
ARPEGE/OPA		MeteoFrance		1	(0) 1	1001	mmsf.msmm	1991-2001	14 months	Nov 1st	9	ENSEMBLES	
ARPEGE/OPA		MeteoFrance		1	(0) 1	1001	mmaf.mmam, mmsf.msmm	1965	120 months	Nov 1st	9	ENSEMBLES	
ARPEGE/OPA		MeteoFrance		1	(0) 1	1001	mmaf.mmam, mmsf.msmm	1994	120 months	Nov 1st	9	ENSEMBLES	
seasonal multi-model													
IFS/HOPE	29r2	ECMWF	eplo	1	1	1004	mmsf.msmm	1991-2001	7 months	May 1st	9	ENSEMBLES, rd	control
IFS/HOPE	29r2	ECMWF	epn9	1	1	1004	mmsf.msmm	1991-2001	14 months	Nov 1st	9	ENSEMBLES, rd	control
GlbSea		MetOffice		1	1	1001	mmsf.msmm	1991-2001	14 months	May & Nov 1st	9	ENSEMBLES	control
ARPEGE/OPA		MeteoFrance		1	(0) 1	1001	mmsf.msmm	1991-2001	7 months	May 1st	9	ENSEMBLES	
ARPEGE/OPA		MeteoFrance		1	(0) 1	1001	mmsf.msmm	1991-2001	14 months	Nov 1st	9	ENSEMBLES	
seasonal stochastic physics													
IFS/HOPE	29r2	ECMWF	epoh	2	1	1001	mmsf.msmm	1991-2001	7 months	May 1st	9	ENSEMBLES, rd	CASBS
IFS/HOPE	29r2	ECMWF	eq04	2	1	1001	mmsf.msmm	1991-2001	14 months	May 1st	9	ENSEMBLES, rd	CASBS
seasonal perturbed physics													
DePreSys		MetOffice		10-18	51	1501	mmsf.msmm	1991-2001	120 months	May & Nov 1st	1	ENSEMBLES	pert. param., method->ens memb, 1IC
decadal multi-model													
IFS/HOPE	30r1	ECMWF	eqhl	1	1	1005	mmaf.mmam	1965	120 months	Nov 1st	9	ENSEMBLES, rd	control
IFS/HOPE	30r1	ECMWF	eqju	1	1	1005	mmaf.mmam	1994	120 months	Nov 1st	9	ENSEMBLES, rd	control
GlbSea		MetOffice		1	1	1004	mmaf.mmam	1994	120 months	Nov 1st	9	ENSEMBLES	
DePreSys		MetOffice		10-18	51	1501	mmaf.mmam	1991-2001	120 months	May & Nov 1st	1	ENSEMBLES	pert. param., method->ens memb, 1IC
ARPEGE/OPA		MeteoFrance		1	(0) 1	1001	mmaf.mmam	1965	120 months	Nov 1st	9	ENSEMBLES	
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decadal stochastic physics													
IFS/HOPE	30r1	ECMWF	eqq2	2	1	1005	mmaf.mmam	1965	120 months	Nov 1st	9	ENSEMBLES, rd	CASBS
IFS/HOPE	30r1	ECMWF	eqqg	2	1	1005	mmaf.mmam	1994	120 months	Nov 1st	9	ENSEMBLES, rd	CASBS
decadal perturbed physics													
DePreSys		MetOffice		10-18	51	1501	mmaf.mmam	1991-2001	120 months	May & Nov 1st	1	ENSEMBLES	pert. param., method->ens memb, 1IC

Archiving and dissemination strategy

Hindcasts run/archived at ECMWF (access to member state users)

MARS

common data
atmosphere

additional data

ECFS

common data
ocean

ECMWF firewall

ENSEMBLES public data server (5 Tb)

common data
atmosphere

common data
ocean

MARS client

OPeNDAP
server

diagnostics

Climate
Explorer

Content of the archive

List of common variables

■ Atmosphere

- 4 pressure levels (850, 500, 250, 50 hPa): Z,T,u,v,q
- surface data
- daily data (at 00 GMT or accumulated) and monthly means
- common 2.5°x2.5° grid

■ Ocean

- monthly means of 3D and 2D fields
- common Levitus regular grid (ENACT convention)

Additional variables

- **Model levels:** 6-hourly data from 3 GCMs
- Additional atmosphere and ocean data from Met Office and ECMWF

For units, encoding and archiving, check the information in
http://www.ecmwf.int/research/EU_projects/ENSEMBLES/data/index.html

New NetCDF definitions

- The ocean output is required to be written in NetCDF format. A proper dissemination of the atmospheric output also benefits from the availability of NetCDF files.
- A set of NetCDF headers has been created to allow writing self-explanatory NetCDF files for operational and research ensemble forecasts in a multi-model/perturbed physics context. These headers have not been defined yet by the forecasting community.
- The new conventions need to be approved by the CF group.
- A GRIB to NetCDF translator has been written in python. It can be adapted to translate free-format NetCDF to NetCDF files compliant with the new rules.

New NetCDF variables:

- Forecast_reference_time
- Forecast_period
- Ensemble_member_number
- Experiment_identifier
- Origin
- ...

Public dissemination: Examples with DEMETER data

<http://data.ecmwf.int/data>

<http://ensembles.ecmwf.int:8080/thredds/variables.html>

The screenshot shows the DEMETER data selection interface. It includes sections for 'Forecasts', 'Decade' (with years 1950-2000 and 'all'), 'DEMETER' (with 'Monthly fields' and 'Daily fields' sub-sections), 'ERA 40' (with 'Daily fields', 'Monthly means', 'Monthly daily means', 'Invariant fields', and 'Monthly invariant fields' sub-sections), 'Other', 'Personal', 'Data Usage', 'See also...', and 'GRIB decoder', 'Data services', 'ECMWF Archive'. The main area is titled 'DEMETER, Monthly fields' and contains a table for selecting experiments and starting dates. Below this is a 'Select parameters' section with 'Pressure levels' (850, 500, 200) and 'Surface' options (10 metre U wind component, 10 metre V wind component, 2 metre temperature, Mean sea level pressure, Soil temperature level 1, Total precipitation). There is also a 'Select Forecast month' section (1-6) and a 'Select Ensemble member' section (0-8). At the bottom are buttons for 'Retrieve GRIB', 'Retrieve NetCDF', and 'Plot data'. Two red arrows point from the text 'Retrieve monthly and daily fields' to the 'Monthly fields' and 'Daily fields' links. Another red arrow points from the text 'Retrieve ERA40' to the 'ERA 40' section. A third red arrow points from the text 'GRIB, NetCDF and plot data' to the bottom buttons.

	CERFACS	ECMWF	INGV	LODYC	Météo France	Max Planck Institute	UK Met Office
2000-02	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2000-05	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2000-08	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2000-11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2001-02	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2001-05	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2001-08	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2001-11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Retrieve monthly and daily fields

GRIB, NetCDF and plot data

Retrieve ERA40

Thredds (OPeNDAP) aggregation server

Catalog <http://ensemble.ecmwf.int:8080/thredds/variables.xml>

Dataset

- [DEMETER geopotential](#)
- [DEMETER air temperature](#)
- [DEMETER zonal wind positive to the east](#)
- [DEMETER meridional wind positive to the north](#)
- [DEMETER mass fraction of water vapor in moist air](#)
- [DEMETER SST over sea, soil temperature over land and ice temperature over sea ice](#)
- [DEMETER mean sea level pressure](#)
- [DEMETER cloud area fraction for the whole atmosphere column](#)
- [DEMETER 10-metre zonal wind positive to the east](#)
- [DEMETER 10-metre meridional wind positive to the north](#)
- [DEMETER 2-metre temperature](#)
- [DEMETER 2-metre dewpoint temperature](#)
- [DEMETER solar radiation incident at the surface](#)
- [DEMETER longwave radiation incident at the surface](#)
- [DEMETER difference of solar radiation from above and from below at the surface](#)
- [DEMETER difference of longwave radiation from above and from below at the surface](#)
- [DEMETER difference of solar radiation from above and from below at the top of the atmosphere](#)
- [DEMETER difference of longwave radiation from above and from below at the top of the atmosphere](#)
- [DEMETER total precipitation accumulated in the previous 24 hours](#)

THREDDS Data Server Version @VERSION.MINOR@ Build Date = 2006-05-22 18:24:58 [Documentation](#)

Public dissemination: link to the Climate Explorer

<http://climexp.knmi.nl>

- Development in collaboration with RT5
- Reference datasets: station data, climate indices, obs, reanalyses, seasonal forecasts, scenario runs
- Calculation of basic statistics including correlations and EOF analysis
- New feature: forecast skill assessment of DEMETER data
- In a few weeks: link to the ENSEMBLES OPeNDAP server at ECMWF and extreme event analysis (RCLIM) tools

The screenshot shows the 'Climate Explorer' interface for 'Field verification' of 'Demeter ensemble feb T2m'. It includes a table for selecting temperature fields (e.g., 1850-now anomalies, 1958-2002 ERA-40), a 'Map verification measures' section with radio buttons for metrics like RMSE, MAE, and Brier score, and a sidebar with navigation links like 'Introduction, results', 'Select a time series', and 'Investigate this field'. An orange arrow points from the text 'List of forecast quality measures available' to the 'Map verification measures' section.

List of forecast quality measures available

