European and North Atlantic daily to MULTidecadal climate variability

EMULATE

EVK2-CT-2001-00161

First annual report: November 2002 to October 2003

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EMULATE home page: http://www.cru.uea.ac.uk/projects/emulate/

SECTION 1: MANAGEMENT AND RESOURCE USAGE SUMMARY, RELATED TO THE REPORTING PERIOD NOVEMBER 2002 TO OCTOBER 2003

1.1 Objectives of the reporting period

The reporting period objectives relate to the first three measurable EMULATE objectives:

(i) Digitize additional daily land station pressure data back to 1850.
(ii) Integrate daily land station data with the I-COADS Data Set.
(iii) Produce the daily gridded MSLP dataset (1850 to present) using the best method.

Thus work has focused on the first EMULATE specific objective:

EMULATE will use already available gridded daily fields for Europe after 1881 adjusted to be consistent with recently produced homogeneous monthly pressure fields. The gridded fields are available to the two UK partners. We will augment these data by digitising daily station pressure data for the 1850-1880 period particularly over Eastern Europe and the Eastern Mediterranean region. Exploratory study indicates that no more than about 40 additional daily MSLP series for 1850-80 will be needed as many long daily series are available from earlier EU and national studies. Over the open ocean, we will use the new blend of the Met Office marine data bank with the recently enhanced International Comprehensive Ocean Atmosphere Data Set (newly named I-COADS) and recently digitized marine data from Norway and other sources. The marine pressure data is a considerable enhancement over data previously available. In addition, daily station data for several eastern North American locations (from Canadian and US colleagues) are required to complete the Atlantic analysis.

Analyses of climatic variability tend to be more effective if they have used data interpolated to a regular grid. This is because interpolation/extrapolation enables both spatially and temporally complete, and more internally consistent, datasets, to be produced which are more amenable to many of the complex multivariate analysis techniques now available. All presently available interpolation methods are based on correlation and covariance matrices and least-squares theory. Most produce similar results, particularly when the relationships between the predictors and predictands are strong. We will intercompare several methods (e.g., simple linear interpolation and more complex optimal interpolation methods which involve principal components of the basic data) to determine the best method and the impacts of any method on resulting analyses. Errors of estimation will be produced for the best method.

1.2 Scientific/technical progress made in different work packages according to the planned time schedule

The schedule of work is shown in Figure 1, while planned/used staff effort is shown in Table 1. Progress on each of the five workpackages (WPs) is outlined below. The schedule of the work means that little progress has been made for WPs 2-4, as apart from WP2 (which began in month-6 of the project), all essentially begin after the delivery of D3 to all partners. Emphasis is here, therefore, given to WP1 and WP5. This section gives the objectives of each WP (from the description of work) and some brief details of progress. More complete descriptions of progress are given under each WP in Section 3 and in the individual partner reports.

WP1: Create daily gridded MSLP fields from 1850

Objectives (from description of work) Daily gridded MSLP fields, which are already available since 1881 but only reliable over western and central Europe, will be improved and extended to cover 25ºN to 70ºN, 70ºW to 50ºE on a 5º by 5º grid with daily estimates of MSLP back to 1850. To achieve this, daily land station pressure data developed during previous EU and national projects will be incorporated. Additional daily data for about 40 stations for 1850 to 1880 will also be acquired and digitised to fill gaps over Eastern Europe, the Eastern Mediterranean, and coastal sites in eastern North America. Over the open ocean, we will use pressures and, if reliable, winds from the new International Marine Climate Data Set. We will remove biases arising from the lack of corrections to ships' barometric pressures for the variation of gravity with latitude. To interpolate sparsely sampled regions, we will compare several techniques, including optimal interpolation methods which use the covariance statistics of the data, and select the technique which best reconstructs sub-sampled recent data. Errors of estimation will be calculated. The analyses will also be guided and verified using homogeneous monthly pressure fields already available from 1871 onwards.

Progress: All the digitization of daily MSLP data is complete. A preliminary version (#1) of the gridded dataset has been produced for 1850-1880 and the final version (#2) will be finished by April 2004. Both versions of the gridded dataset will be developed using Reduced Space Optimal Interpolation (RSOI) techniques developed by MetO.

WP2: Derive a set of characteristic atmospheric circulation patterns, and study their variations and trends for each season

Objectives (from description of work) We will assess the skill of several classification techniques, including cluster analysis and linear and nonlinear principal component analysis, in defining characteristic atmospheric circulation patterns at the daily timescale. Nonlinear techniques will enable the positive and negative phases of major atmospheric circulation patterns, such as the North Atlantic Oscillation (NAO), not to be constrained to be opposites. The chosen technique will be applied separately to the daily gridded MSLP fields in each two-month (January-February, etc.) and traditional three-month seasons, because all leading atmospheric circulation modes have seasonally-varying characteristics. A modern training period, such as 1961-1990, for which adequate gridded data are already available, will be used to define the patterns, but we will assess the sensitivity of the results to the choice of training period. The projection of each daily field onto each chosen pattern for the appropriate season will be used to create a database of pattern amplitudes from 1850 to date. Maximum-likelihood statistical tests will be used to assess trends in pattern amplitudes, and a range of non-parametric tests will be used to study changes in the incidence of extreme pattern amplitudes.

Progress: Preliminary analyses have been undertaken with the existing daily MSLP for the EMULATE region for the period since 1881. These analyses have the aim of determining the best classification method, with which to determine patterns on the daily timescale.

WP3: Relate variations and trends in atmospheric circlation and associated surface climate variability over Europe to sea surface temperature patterns, particularly over the North Atlantic

Objectives (from description of work) Various statistical techniques will be used to document seasonal relationships between the atmospheric variables (pressure, temperature, precipitation and drought) and SST using both real-world data and GCM simulations. The temporal stability of the relationships will be assessed, with emphasis on whether late-20th century patterns differ from patterns in the 19th century. The influence of external forcing factors will be considered, and the fraction of variability explained by external forcing versus internal stochastic variability will be determined. A drought database will be developed and analysed.

Progress: Most of the GCM integrations planned are being run and all should be completed by about May 2004. The results from these runs will be made available to partners from the MetO web site.

WP4: Relate variations and trends in atmospheric circulation patterns to prominent extremes in temperature and precipitation

Objectives (from description of work) A set of daily extremes based on temperature and rainfall, of value to society, will be selected after reviewing the existing published literature. Existing analyses of indices of daily extremes in temperature and precipitation for Europe will be extended back to the late 19th century for long homogeneous daily European stations covering the continent. Trends and variations and their statistical significance will be calculated in the indices and related to observed atmospheric circulation changes. The contribution of the more prominent atmospheric patterns derived in Workpackage 2 will be assessed. The results will be compared to data from long simulations of atmospheric models forced with observed SST and sea ice extent, and further integrations with additional anthropogenic forcings to help determine if any anthropogenic influence exists on a European scale, particularly for temperature.

Progress: The principal work undertaken in year-1 has been development of the dataset of daily station temperature and precipitation data for upwards of 100 stations with records back to the 19th century.

WP5: Dissemination and Exploitation of Results

Objectives (from description of work) The co-ordinator will have overall responsibility for ensuring that all EMULATE objectives are met. A scientific steering group (the WP leaders) will ensure the flow of expertise and data between the WPs and that each individual WP objective is met. In addition to the production of scientific papers, a number of specific deliverables (datasets) are planned. These will be made available to the wider community within 6-12 months of being made available to the partners. Annual reports and a final report will be produced.

Progress: The EMULATE project web site has been established at the co-ordinator's location (http://www.cru.uea.ac.uk/projects/emulate). The web site contains some background to the project and the minutes of the first and second annual meetings and maps/lists of the digitized MSLP data and the daily station temperature and precipitation sites collected so far for WP4. Deliverables D2 and D3 will be put onto the site (for partners only) in the next few months. D3 will be made available to other scientists during year-3 of the project. D2 will put up for all to see when D3 is available for the partners.

1.3 Milestones and deliverables obtained

Three of the sixteen EMULATE milestones fall within the reporting period, all of which relate to Measurable Objective 1 (see Section 1.1):

- ***Milestone 1 (M1)*** (1 month into the project): Start-up meeting, web site developed and partners begin to provide databases (Deliverable D1).

- ***Milestone 2 (M2)*** (6 months into the project): Techniques for blending and interpolation of data tested and agreed (the RSOI method discussed in 1.2 above and detailed in the MetO partner report)

- ***Milestone 3 (M3)*** (12 months into the project): Completion of compilation and gridded pressure data made available to partners (Deliverables D2 and D3).

The start-up meeting (ME1) was held at the University of East Anglia, 18-19 November 2002. Minutes of the meeting are available on the internal web page.

ME2 was held at the University of Würzburg, 23-25 October, 2003. Minutes of this meeting are available on the internal web page.

Three of the 17 EMULATE deliverables are due within the reporting period:

Deliverable No	Deliverable title (brief)	Delivery date	Nature	Dissemination level
D1	Project web site	1	O*	PU
D2	Daily pressure data for additional 40 stations for 1850-1880	6	Da	PU
D3	Daily gridded fields of MSLP over the extratropical North Atlantic and Europe	12	Da	CO

D1: The internal web site was set up on schedule and is being updated on a regular basis. It can be accessed from the public web site and requires a username/password. The public web site (http://www.cru.uea.ac.uk/projects/emulate) was also set up on schedule and is being updated on a regular basis. Information available from this site includes the project summary, objectives, description of work and participating institutes. Other items are: news, dates and summaries of EMULATE meetings, dataset links and other links.

D2: Daily MSLP data have been digitized for 25 stations as part of the project. The data will be put on the public part of the web site after D3 has been completed in April 2004.

D3: Version 1 of the EMULATE gridded MSLP dataset has been produced by the time of ME2. Version 2 (final version) will be completed by April 2004 and will be made available to partners on the internal web site, and on the public web site near the end of the project.

1.4 Deviations from the work plan and/or time schedule and their impact

The digitization of the necessary daily MSLP data has taken slightly longer than anticipated. This has now been complete and the final homogenization of the series is being completed. Version 1 of the gridded MSLP has been produced, but in order to include all the digitized data a second version (#2) will be produced by April 2004. This will not cause any delays in the project as partners have access to version 1 for format purposes and have been devising software and gaining experience with using long daily gridded MSLP (from 1881) already available.

1.5 Co-ordination of the information between partners and communication activities

Co-ordination of information has been achieved *via* discussions at project meetings and on an ongoing basis *via* electronic means (i.e., the project web sites and email). The co-ordinator and WP leaders have a major role in ensuring that this is effective.

The UK Department for Environment, Food and Rural Affairs (DEFRA) made a formal request for access to outputs from EMULATE in order to strengthen the basis for policy/regulatory decisions, particularly with respect to the Climate Convention (UNFCCC) and the UK's Climate Change Programme. All EMULATE partners agreed to this request.

Details of the project have been presented to a number of scientific meetings (see details in Section 2).

1.6 Difficulties encountered at management and co-ordination level and solutions

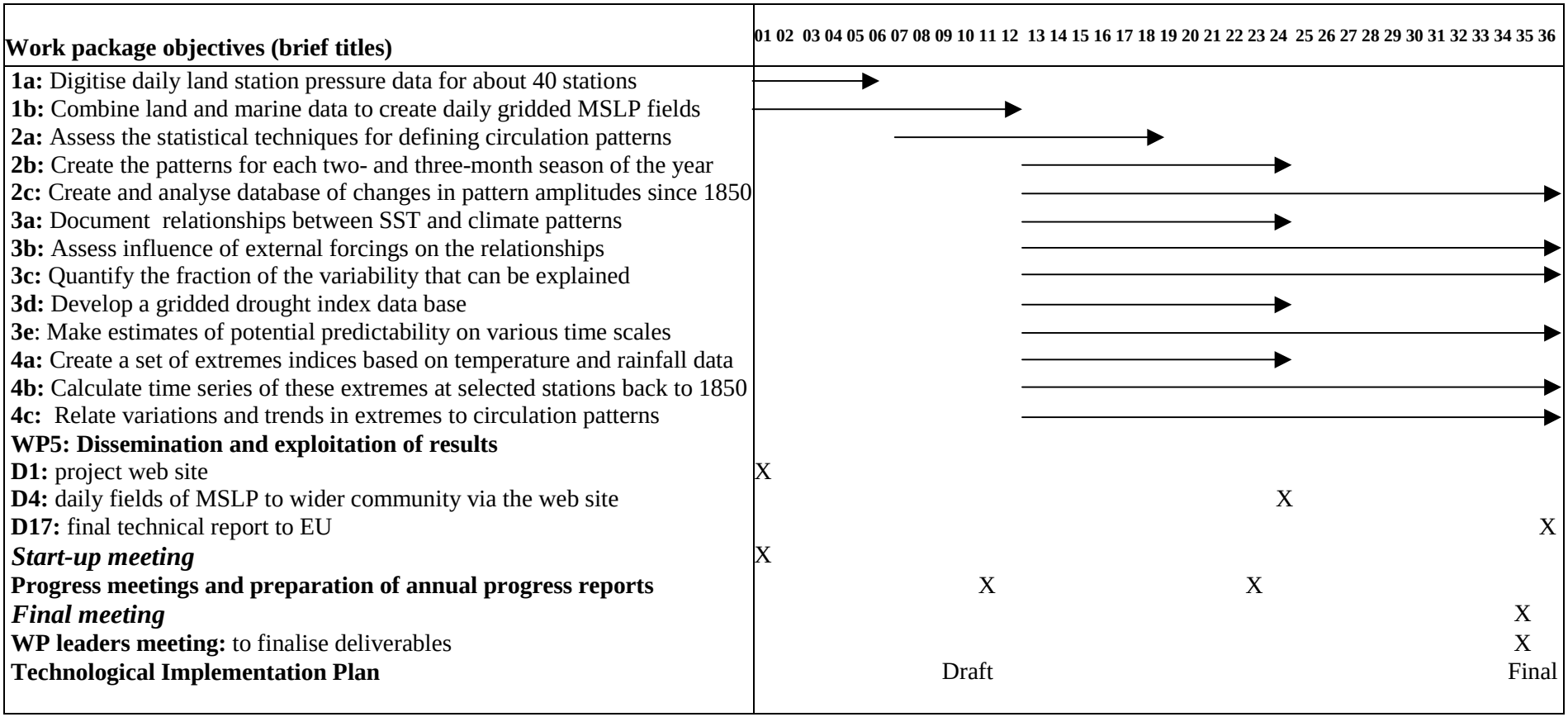
No difficulties have been encountered at the management and co-ordination level. The third EMULATE progress meeting will be held in Tarragona during the week of 20-24 September 2004.

Table 1: Comparison between planned and used funded staff effort by Work Packages and partners

Package	Partner	Proposed input				Actual input			
		Year 1	Year 2	Year 3	Total	Year 1	Year 2	Year 3	Overall Total
WP1	UEA	11	0	0	11	9	-	-	9
	MetO	10	0	0	10	7.3	-	-	7.3
	UWUERZ	2	0	0	2	0.5	-	-	0.5
	CEA	2	0	0	2	0.5	-	-	0.5
	URV	1.5	0	0	1.5	1.5	-	-	1.5
	UBERN	1	0	0	1	1	-	-	1
	SU	0	0	0	0	0	-	-	0
	UGOT	0	0	0	0	0	-	-	0
	TOTAL	27.5	0	0	27.5	19.8	-	-	19.8
WP2	UEA	0	6	0	6	0	-	-	0
	MetO	2	10	0	12	0.7	-	-	0.7
	UWUERZ	6.33	8.67	0	15	5	-	-	5
	CEA	0	4	4	8	0.5	-	-	0.5
	URV	0	0	0	0	0	-	-	0
	UBERN	0	7	0	7	4	-	-	4
	SU	0	1	1	2	0	-	-	0
	UGOT	0	0	0	0	0	-	-	0
	TOTAL	8.33	36.67	5	50	10.2	-	-	10.2
WP3	UEA	0	5	0	5	0	-	-	0
	MetO	3	6	12	21	4	-	-	4
	UWUERZ	0	0	3	3	0	-	-	0
	CEA	0	4	3.4	7.4	0.5	-	-	0.5
	URV	0	6	7	13	0	-	-	0
	UBERN	0	0	7	7	1	-	-	1
	SU	0	0	2	2	0	-	-	0
	UGOT	0	0	0	0	0	-	-	0
	TOTAL	3	21	34.4	58.4	5.5	-	-	5.5
WP4	UEA	0	0	6	6	0	-	-	0
	MetO	0	0	3	3	0	-	-	0
	UWUERZ	0	4.67	9.33	14	3.2	-	-	3.2
	CEA	0	2	2	4	0.5	-	-	0.5
	URV	0	6.5	5.5	12	0	-	-	0
	UBERN	0	0	4.5	4.5	0	-	-	0
	SU	0	6.8	4.7	11.5	0	-	-	0
	UGOT	0	9	0	9	0	-	-	0
	TOTAL	0	29	35	64	3.7	-	-	3.7

		Year 1	Year 2	Year 3	Total	Year 1	Year 2	Year 3	Overall Total
WP5	UEA	1	1	6	8	1	-	-	1
	MetO	0	0	1	1	0	-	-	0
	UWUERZ	0	1	2	3	0	-	-	0
	CEA	0	1	1	2	0	-	-	0
	URV	0	0	0	0	0	-	-	0
	UBERN	0	0	1	1	0	-	-	0
	SU	0.7	0.6	0.7	2	0	-	-	0
	UGOT	0	0	1	1	0	-	-	0
	TOTAL	1.7	3.6	12.7	18	1	-	-	1
PROJECT	UEA	12	12	12	36	10	-	-	10
TOTALS	MetO	15	16	16	47	12	-	-	12
	UWUERZ	8.33	14.33	14.33	37	8.7	-	-	8.7
	CEA	2	11	10.4	23.4	2	-	-	2
	URV	1.5	12.5	12.5	26.5	1.5	-	-	1.5
	UBERN	1	7	12.5	20.5	6	-	-	6
	SU	0.7	8.4	8.4	17.5	0	-	-	0
	UGOT	0	9	1	10	0	-	-	0
	TOTAL	40.53	90.23	87.13	217.9	40.2	-	-	40.2

Figure 1: Schedule of work



No modifications have been made to the scheduling of the five WPs or the Milestones. The original deliverable dates are shown here. There has been some slippage in D2-D3 (see Sections 1.3 and 1.4), but no changes to the scheduling of the remaining deliverables are necessary.

SECTION 2: Executive publishable summary, related to reporting period

Contract n°	EVK2-CT-2001-00161	Reporting period:	November 2002 to October 2003
Title	European and North Atlantic daily to multidecadal climate variability EMULATE		

Objectives:

The reporting period objectives relate to the first three measurable EMULATE objectives:

1. Digitize additional daily land station pressure data back to 1850.
2. Integrate daily land station data with the I-COADS Data Set.
3. Produce the daily gridded MSLP dataset (1850 to present) using the best method.

Scientific achievements:

An initial version of the gridded MSLP dataset for 1850-1880 has been produced. The final version of this will be completed in April 2004. The gridded MSLP dataset has been produced by combining all the MSLP data digitized as part of the project, daily data obtained from colleagues, already existing gridded MSLP data using the RSOI software developed at MetO. Some preliminary work has been undertaken on circulation typing to address issues of the best methods to use at the daily timescale. A large dataset of daily temperature and precipitation data has been developed with over 100 series extending back to the 19th century.

Socio-economic relevance and policy implications:

Work in WP4 has focused on indices of extremes which are likely to be of interest to stakeholders and policy makers. Contacts have been developed with a number of scientists at national and regional levels, with respect to the best indices of extremes to use.

Conclusions:

The public EMULATE web site (http://www.cru.uea.ac.uk/cru/projects/EMULATE/) already provides a wide range of information on the project. Other deliverables will be added as they become available. The internal web site provides a major working resource for EMULATE participants, including vital data sets, methodological documents and draft deliverables.

Keywords:

Pressure, North Atlantic, daily variability, temperature, precipitation, extremes, circulation typing

Peer Reviewed Articles – published or in press:

Authors	Date	Title	Journal	Reference

Non refereed literature:

Authors / Editors	Date	Title	Event	Reference	Type
Ansell, T	2003	Creation of daily historical mean sea level pressure sields in the EU EMULATE project	Royal Meteorological Society Conference 2003	Oral presentation during Session 2 of the Royal Meteorological Society 2003 Conference, September 1st-5th, University of East Anglia, Norwich	O
Jacobeit, J. & Philipp, A.	2002	European and North Atlantic daily to multidecadal climate variability: the EU-Project EMULATE	21st meeting of the study group on climate research of the German Geographical Society	Abstract and oral presentation at the 21st meeting of the study group on climate research of the German Geographical Society, Berlin, November 2002	O
Jacobeit, J., Nonnenmacher, M. & Philipp, A.	2003	Atmosphärische Zirkulationsdynamik markanter Abflussereignisse in Mitteleuropa	6th German Climate Conference , Potsdam, September 2003	Proceedings of the 6th German Climate Conference in Potsdam, September 2003. Terra Nostra, 2003/6, pp209-213	O/P
Philipp, A., Nonnenmacher, M. & Jacobeit, J.	2003	Atmosphärische Zirkulationsdynamik markanter Abflussereignisse in Mitteleuropa	22nd meeting of the study group on climate research of the German Geographical Society, Gladenbach, October 2003	Abstract and oral presentation at the 22nd meeting of the study group on climate research of the German Geographical Society, Gladenbach, October 2003	O

O = Oral presentation, P = Proceedings, D = Dissertation

Publications associated with conferences held during the reporting period only are shown. Presentations to be given at the 2004 EUG Assembly are not, for example, listed.

Workpackage 1: Create daily gridded MSLP fields from 1850
WP leader: Phil Jones (UEA)

3.1.1. Objectives

The objectives of WP1 are:

- Digitize additional daily land station pressure data back to 1850.
- Integrate daily land station data with the I-COADS Data Set
- Produce the daily gridded MSLP dataset (1850 to present) using the best method.

3.1.2. Methodology and scientific achievements related to Work Packages including contribution from partners

Daily Data Digitization

Daily pressure data have been digitized from 25 stations as part of EMULATE. Table 2 lists the station co-ordinates and years of records digitized. The majority of the stations have been digitized by UEA, but important contributions have been made by MetO and URV. The Norweigan Meteorological Institute (DNMI) helped with the Bergen, Trondheim and Vardo records. The Montreal series from eastern Canada was provided by provided by Vicky Slonosky (Ouranos Project, Montreal). Additionally some partners have managed to gain access to some daily pressure series through contacts with colleagues across Europe. These records are listed in Table 3, to distinguish them from those specifically digitized as part of the project.

Station	Latitude (°N)	Longitude (°E)	Period(s)
Archangel	64.5	40.73	1870-80
Astrakhan	46.27	48.03	1866, 1868-80
Bergen	60.40	5.30	1850-67
Bermuda	32.37	-64.68	1852-62, 1866-80
Bodo	67.30	14.40	1868-80
Corfu	39.45	19.92	1852-61, 1870-73, 1876-79
Halifax, N.S.	44.65	-63.62	1850-66, 1868-80
Kazan	55.78	49.18	1855-58, 1870-80
Kem	64.98	34.78	1866-73, 1875-80
Kiev	50.4	30.45	1869-71, 1873-80
Kostroma	57.73	40.78	1850-68
Lougan	48.6	39.3	1850-80
Malta	35.85	14.48	1852-55, 1857-61, 1866-80
Moscow	55.75	37.57	1866-80
Nikolaev	46.58	31.58	1858-80
Orenburg	51.68	55.1	1850-1876
Prague	50.08	14.42	1850-1880
Riga/Mitau	56.97	24.05	1850-1880
Scutari	41.00	29.05	1866-80
Sevastopol	44.6	33.5	1865-68, 1870, 1873-79
St. Johns, NFL	47.58	-52.70	1852-62, 1866-70, 1873-76
St. Petersburg	59.97	30.3	1850-80
Tbilisi	41.68	44.95	1850-80
Vardo	70.40	31.10	1867-80
Vilnius	54.63	25.1	1867-80

Table 2: The daily pressure series digitized, for the period 1850-80.

Station	Latitude (°N)	Longitude (°E)	Period
Aberdeen	57.16	-2.10	1861-1995
Armagh	54.35	-6.65	1850-2001
Barcelona	41.28	2.06	1850-2002
Bergen-Florida	60.38	5.33	1868-2002
Bern	46.91	7.50	1864-2002
Biarritz	43.48	-1.55	1860-1880
Brest	48.45	-4.16	1861-1881
Cadiz	37.46	-6.28	1850-2002
De Bilt	52.10	5.18	1848-2001
Durham	54.76	-1.58	1850-1997
Galway	53.28	-9.01	1861-1952
Gibraltar	36.10	-5.35	1821-1957
Goeteborg	57.70	11.98	1860-2002
Grand St Bernard	45.86	7.16	1866-2002
Haernoesand	62.61	17.93	1860-1994
Hammerodde	55.30	14.78	1874-1996
Haparanda	65.81	24.13	1860-2002
Harnosand	62.61	17.93	1860-1880
Helsinki	60.16	24.95	1850-2001
Hohenpeissenberg	47.80	11.00	1850-2002
Innsbruck	47.30	11.40	1877-2002
Jena	50.90	11.60	1850-2000
La Coruna	43.16	-8.50	1865-2002
London	51.46	0	1861-1880
Lund	55.70	12.20	1864-2001
Madrid	40.40	-3.71	1853-2002
Milan	45.46	9.18	1850-1998
Montreal	45.50	-73.58	1850-1873
Nordby	55.43	8.40	1874-2002
Oksoey Fyr	58.06	8.05	1870-2002
Padua	45.40	11.85	1850-1997
Plymouth	50.36	-4.11	1861-1881
Reykjavik	64.13	-21.93	1850-2001
Rochefort	45.93	-0.93	1863-1881
Salzburg	47.80	13.00	1874-2002
Sion	46.21	7.33	1864-2002
Stockholm	59.33	18.05	1880-1994
Stykkisholmur	65.08	-22.73	1874-1995
Torshavn	62.01	-6.76	1874-2002
Toulon	43.10	5.93	1868-1881
Uppsala	59.85	17.63	1850-1998
Valentia	51.90	-10.36	1861-1892
Vestervig	56.76	8.31	1874-1996
Vienna	48.20	16.40	1872-2002
Visby	57.63	18.28	1860-2002

Table 3: The daily pressure series acquired through contacts with colleagues.

Gridded version of the MSLP dataset

Although the majority of the resources have been used to locate and digitize the daily MSLP data, the principal objective of WP1 is the construction of the gridded dataset at 5º resolution from 25ºN to 70ºN, 70ºW to 50ºE, back to 1850. For ME2 (in Würzburg October 23-25) a preliminary version has been produced. The meeting minutes describe all the issues that arose in the development, the details of which are given in the first annual report of MetO. Here, the principal issues are discussed:

(i) Homogeneity of the digitized daily series. This is still ongoing and relates to the consistency of each station's record over its duration and the elimination of outliers (either introduced during digitization or mis-recorded values in the original documents).

(ii) Potential problems with I-COADS data during the 1850s. MSLP data during this decade appear 1-2hPa too low.

Despite these problems, a first version of the dataset (Deliverable D3) was produced for the period 1850-1880. As not all digitized data were available before this version was produced a second and final version will be developed by about April 2004. The first version will be made available to partners to begin their initial work for WP2.

3.1.3. Socio-economic relevance and policy implications

The main focus of WP1 in the first year of the project has been on the tools and data sets required for use by the EMULATE partners. Contacts have also been established between the co-ordinator and the UK Department of Environment, Food and Rural Affairs, who have requested to be informed of annual reports.

3.1.4 Discussion and conclusion

Although the collation of observed data series has been more time consuming than envisaged and there have been some delays in the availability of model output, this has not caused any major problems for the EMULATE work schedule (see Section 1.4).

The internal web site and email have provided essential electronic tools (together with progress reports and the two project meetings), for project management over the first year of the project. The co-ordinator has been assisted by the WP leaders. At both meetings, additional scientists were present and the contribution of Dr. Vicky Slonosky (Ouranos project, Montreal, Canada) has been especially useful.

3.1.5 Plan and objectives for the next period

Complete the second version of the gridded MSLP dataset by April 2004 and to write up the scientific paper describing the dataset**.**

Workpackage 2: Derive a set of characteristic atmospheric circulation patterns, and study their variations and trends for each season
WP leader: Jucundus Jacobeit (UWUERZ)

3.2.1. Objectives

The objectives of WP2 are:

- Define leading atmospheric circulation patterns for two-month and three-month seasons.
- Create a database of quantitative changes in pattern amplitudes since 1850.
- Assessments of trends in pattern amplitudes and in the incidence of their extremes.
- Characterise within-pattern variability.

3.2.2. Methodology and scientific achievements related to Work Packages including contribution from partners

This WP began during year-1. The main focus has been on methodological experiments to compare different approaches with respect to their suitability for the forthcoming work on the EMULATE gridded MSLP data for 1850-2002. Various principal-component based, clustering and compositing techniques have been evaluated. Whilst several issues have been decided upon and some options discarded, no definitive techniques have yet been identified.

3.2.3. Socio-economic relevance and policy implications

Nothing to report as yet, although the issue of extremes and of spells is crucial to defining the techniques for atmospheric circulation typing.

3.2.4 Discussion and conclusion

No definitive conclusions at the moment, but there was much discussion of the techniques to be used during ME2. At both meetings, additional scientists were present and the contribution of Prof. Ian Joliffe (University of Aberdeen) has been especially useful.

3.2.5 Plan and objectives for the next period

Atmospheric circulation typing will continue at a number of the partner institutes during year and the final schemes to be used will be determined during ME3 in Tarragona in September 2004.

Workpackage 3: Relate variations and trends in atmospheric circulation and associated surface climate variability over Europe to sea surface temperature patterns, particularly from the North Atlantic

WP leader: Chris Folland (MetO)

3.3.1. Objectives

- Assessment of the relationship between both SST and North Atlantic and European atmospheric circulation patterns and surface temperature and precipitation variability, through the seasonal cycle.
- Gridded database of drought severity across Europe.
- Assessment of the relative influence of external forcing factors (natural and anthropogenic) and internal climate variability and their seasonal differences, mainly through the use of climate models.

3.3.2. Methodology and scientific achievements including contribution from partners

All model integrations will be completed by May 2004. These include runs with and without changes in past forcing, each involving a number of ensemble members.

3.3.3. Socio-economic relevance and policy implication

Nothing to report as yet.

3.3.4. Discussion and conclusion

This WP officially starts in year-2, but the climate model integrations have all been started and should be complete by the spring of 2004 (see above).

3.3.5. Plan and objectives for the next period

Complete the climate model integrations and place the results on the MetO web/ftp site for other project members to use. All to begin analyse the model results.

Workpackage 4: Relate variations and trends in atmospheric circulation patterns to prominent extremes in temperature and precipitation

WP leader: Anders Moberg (SU)

3.4.1. Objectives

- Determination of a selection of extreme climate indices for Europe and assessment of changes in these indices since 1850.
- Determine the significance of atmospheric circulation for the extreme indices.
- Ascertain whether extremes of climate had different characteristics in the late 20th century from those evident in the late 19th and early 20th centuries and determine the likely magnitude of human influences.

3.4.2. Methodology and scientific achievements including contribution from partners

Based on contacts with scientific colleagues across Europe and national meteorological services a network of over 100 stations with daily temperature and precipitation data has been developed. Some initial work on homogeneity issues has identified a number of potential problems which need to be addressed.

3.4.3. Socio-economic relevance and policy implications

At ME2 a number of potential indices (based on the long daily temperature and precipitation series) were discussed. It is recognized that these indices should not only be of scientific value, but should also have societal relevance.

3.4.4. Discussion and conclusion

This WP officially begins in year-2 of the project, but the initial work undertaken has put this aspect of the project ahead of schedule.

3.4.5. Plan and objectives for the next period

Early in year-2 the network will be finalized and the homogeneity issues addressed. E-mail discussion of the extreme climate indices will determine the final selection and where necessary additional software written for their calculation.

Workpackage 5: Dissemination and Exploitation of Results

WP leader: Phil Jones (UEA)

3.5.1. Objectives

- To ensure that EMULATE is managed effectively and efficiently so that all the project objectives are met.
- To ensure the effective dissemination and exploitation of the project results and deliverables.

3.5.2. Methodology and scientific achievements including contribution from partners

The web page is up and running and providing the main access by other scientists to the project.

3.5.3. Socio-economic relevance and policy implications

Nothing yet to report.

3.5.4. Discussion and conclusion

Nothing yet to report.

3.5.5. Plan and objectives for the next period

This report and the minutes of WP2 will be placed on the external pages of the web site and the data deliverables D2 and D3 on the internal pages.

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