European and North Atlantic daily to MULtidecadal climATE variability

EMULATE

EVK2-CT-2002-00161

Third management report: November 2004 to February 2006

Section 2: Executive publishable summary
Cumulative publications list

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

SECTION 2: Executive publishable summary, related to reporting period

Contract n°	EVK2-CT-2002-00161	Reporting period:	November 2004 to February 2005
Title	European and North Atlantic daily to MULtidecadal climATE variability EMULATE		

Objectives:

This reporting period relates primarily to the EMULATE measurable objectives 2 to 4. Initial achievements for all three objectives were briefly reported upon earlier.

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

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

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

Scientific achievements:

Using the daily MSLP dataset developed earlier [Objective 1 for the area (25ºN to 70ºN; 70ºW to 50ºE on a 5º by 5º grid spacing) from 1850], EMULATE has used three different methods of classifying all days into objective circulation types. The results of all three methods are available on the project website, but the most advantageous one appears to be that using Simulated Annealing. This is due to the method producing different counts of days in the various types, unlike traditional clustering which tends to give similar totals for each type. With the emphasis on extremes (later in objective 4), it was clear that there should be dominant and less dominant weather types in terms of their counts. Different types were developed for all four traditional seasons as well for all 2-month 'seasons'.

A large number of climate model simulations (using the Hadley Centre model HadAM3) have been run using observational fields of global sea surface temperature distributions. Six-member ensemble integrations from 1870 and 12-member ensemble integrations from 1950 have been performed. The model surface pressure fields from the longer integrations were then classified and compared with the real-world objective weather typing schemes.

A database of daily maximum and minimum temperatures and precipitation totals was developed from European observational series back as far as possible. 75 (121) series for temperature (precipitation) have near-complete records extending back to 1900. An extensive array of extreme statistics and time series were developed from these daily series, and analysed to determine which aspects of the distributions are changing most rapidly. Similar measures of extremes from the climate model integrations were also calculated and compared with the observational series, for both the standard and the 2-month 'seasons'. Some aspects of the changes in extremes were also related to changes in the circulation types.

Socio-economic relevance and policy implications:

From the analysis of changes in observational extremes, it is clear that temperature change is occurring disproportionately more for some aspects of extremes (e.g. warm or cold and different

extreme thresholds). Also changes are markedly different in northern compared to southern Europe. Changes in temperature extremes are fairly coherent in different regions, while changes in precipitation extremes are much less spatially coherent.

All the extreme indices are available on the web site and will be of interest to stakeholders and other scientists across Europe. At the moment, they are based on the most extensive set of station data yet collected.

The sea level pressure dataset has proved very useful to the analysis of storms in the second half of the 19th century and enabled two groups to locate two shipwrecks.

Conclusions:

The EMULATE web site (http://www.cru.uea.ac.uk/projects/emulate) provides access to a wide range of information on the project, including all publicly-available report and data deliverables. Project outputs have also been disseminated via presentations at scientific conferences and peer-reviewed journal papers.

Keywords:

Climate change, Pressure, Circulation typing, Temperature, Rainfall, Extreme events, Climate Models

EMULATE publications (cumulative list)

Peer Reviewed Articles - published or in press

Authors	Date	Title	Journal/Book	Reference
Ansell, T.J., P.D. Jones, R.J. Allan, D. Lister, D.E. Parker, M. Brunet, A. Moberg, J. Jacobeit, P. Brohan, N.A. Rayner, E. Aguilar, M. Barriendos, T. Brandsma, N.J. Cox, P.M. Della-Marta, A. Drebs, D. Founda, F. Gerstengarbe, K. Hickey, T. Jónsson, J. Luterbacher, Ø. Nordli, H. Oesterle, M. Petrakis, A. Philipp, M.J. Rodwell, O. Saladié, J. Sigro, V. Slonosky, L. Srnec, V. Swail, A.M. García-Suárez, H. Tuomenvirta, X.Wang, H. Wanner, P. Werner, D. Wheeler, E. Xoplaki	2006	Daily mean sea level pressure reconstructions for the European-North Atlantic region for the period 1850-2003.	*J. Climate*	**19**, 2717-2742 http://hadobs.metoffice.com/emslp/anselletal2006.pdf

Beck, C., J. Jacobeit & P. Jones	2006	Frequency and within-type variations of large-scale circulation types and their effects on low-frequency climate variability in Central Europe since 1780	*International Journal of Climatology*	Accepted (conditionally) http://www.geo.uni-augsburg.de/de/lehrstuehle/phygeo/medien_verzeichnis_2/forschung/emulate/publications/beck_et-al-resubmitted.pdf
Brönnimann, S., Xoplaki, E., Casty, C., Pauling, A. and Luterbacher, J.	2007	ENSO influence on Europe during the last centuries	*Climate Dynamics*	**28**, 181-197 DOI 10.1007/s00382-006-0175-z. http://www.giub.unibe.ch/klimet/docs/climdyn_2006_broennimann_et_al.pdf
Brunet, M., Bañón, M., García, F., Aguilar, E., Saladié, O., Sigró, J., Asín, J., López, D.	2004	An experimental approach to the evalutation and minimisation of the "screen bias", througout dual temperature observations	La meteorología y el clima atlánticos	Publicaciones de la Asociación Española de Meteorología, Badajoz, 93-103 ISBN 84-8320-261-1
Brunet, M., Saladié, O., Jones, P.D., Sigró, J., Moberg, A., Aguilar, E., Walther, A., Lister, D. and López, D.	2006	The development of a new daily adjusted temperature dataset for Spain (1850-2003).	*International Journal of Climatology*	In press
Della-Marta, P. M. and Wanner, H.	2006	A method of homogenizing the extremes and mean of daily temperature measurement	*Journal of Climate*	**19**, 2006, 4179-4197 http://www.giub.unibe.ch/klimet/docs/climdyn_2006_dellamarta_et_al.pdf
Della-Marta, P. M., Haylock, M. R., Luterbacher, J. and Wanner, H.	2006	The length of western European summer heatwaves has doubled since 1880	*Climate Dynamics*	Submitted
Della-Marta, P.M., Luterbacher, J., von Weissenfluh H., Xoplaki, E., Brunet M., and Wanner H.	2006	Summer heat waves over western Europe 1880-2003, their change and relationship to large scale forcings.	*Climate Dynamics*	Submitted
Dünkeloh, A. & J. Jacobeit	2003	Circulation Dynamics of Mediterranean Precipitation Variability 1948-98	*Int. J. Climatol.*	**23**, 2003, 1843-1866
Folland, C.K.	2005	Assessing bias corrections in historical sea surface temperature using a climate model	*Int. J. Climatol.*	**25**, 895 – 911 (Special issue, CLIMAR II Conference)
Hertig, E. & J. Jacobeit	2007	Assessments of Mediterranean precipitation changes for the 21st century using statistical downscaling techniques	*Int. J. Climatol.*	DOI: 10.1002/joc.1597 http://www.cru.uea.ac.uk/cru/projects/emulate/Hertig-Jacobeit-IJC-07.pdf
Jacobeit, J. & A. Dünkeloh	2005	The Eastern Mediterranean Transient in Relation to Atmospheric Circulation Dynamics	*Hydrogeologie und Umwelt*	**33 (5),** 1-8 http://www.geo.uni-augsburg.de/de/lehrstuehle/phygeo/medien_verzeichnis_2/forschung/emulate/publications/udluftfestschrift-jacobeit-duenkeloh.pdf

Jacobeit, J., A. Dünkeloh & E. Hertig	2004	Die Niederschlagsentwicklung im mediterranen Raum und ihre Ursachen	In: Lozán, J., H. Graßl, P. Hupfer, L. Menzel & C.-D. Schönwiese (Hrsg.)	Warnsignal Klima: Genug Wasser für alle? Hamburg,192-196
Jacobeit, J., A. Philipp & M. Nonnenmacher	2006	Atmospheric circulation dynamics linked with prominent discharge events in Central Europe	*Hydrological Sciences Journal*	**61**(5), 178-197 http://www.geo.uni-augsburg.de/de/lehrstuehle/phygeo/medien_verzeichnis_2/forschung/emulate/publications/hsj-jacobeit-etal.pdf
Jacobeit, J., M. Nonnenmacher & A. Philipp	2003	Atmospärische Zirkulationsdynamik markanter Abflussereignisse in Mitteleuropa	*Terra Nostra*	**6**, 209-213 http://www.geo.uni-augsburg.de/de/lehrstuehle/phygeo/medien_verzeichnis_2/forschung/emulate/publications/TN_6-2003.pdf
Jacobeit, J., R. Glaser, M. Nonnenmacher & H. Stangl	2004	Hochwasserentwicklung in Mitteleuropa und Schwankungen der atmosphärischen Zirkulation	*Geographische Rundschau*	**56**, 26-34
Jacobeit, J., Rathmann, J., Philipp, A. and Jones, P.D.	2009	Central European precipitation and temperature extremes in relation to larger-scale atmospheric circulation types	*Meteorologische Zeittschrift*	**18,** Nº 4, 379-410 http://www.cru.uea.ac.uk/cru/projects/emulate/Met-Z-2009.pdf
Knight, J. R., Allan, R. J., Folland, C. K., Vellinga, M. and Mann, M.E.	2005	A signature of persistent natural thermohaline circulation cycles in observed climate	*Geophysical Research Letters*	**32,** L20708, doi:10.1029/2005GL024233
Knight, J. R., C. K. Folland and A.A. Scaife	2006	Climate impacts of the Atlantic Multidecadal Oscillation	*Geophys. Res. Lett.*	Submitted
Linderholm, H.W.	2006	Growing season changes in the last century - a review.	*Agriculture and Forest Meteorology*	In press
Linderholm, H.W., Walther, A., Chen, D. and Moberg, A.	2006	Twentieth-century trends in the thermal growing season in the Greater Baltic Area.	*Climatic Change*	In press
Lionello, P., Bhend, J., Buzzi, A., Della-Marta, P.M., Krichak, S.O., Jansá, A., Maheras, P., Sanna, A., Trigo, I.F. & Trigo, R.	2006	Cyclones in the Mediterranean Region: Climatology and Effects on the Environment	The Mediterranean Climate: an overview of the main characteristics and issues	Eds. Lionello, P., Malanotte-Rizzoli, P., and Boscolo, R. Elsevier, Amsterdam, the Netherlands, 27-148

Luterbacher, J., E. Xoplaki, C. Casty, H. Wanner, A. Pauling, M. Kuettel, T. Rutishauser, S. Broennimann, E. Fischer, D. Fleitmann, JF. Gonzalez-Rouco, R. García-Herrera, M. Barriendos, FS. Rodrigo, JC. Gonzalez-Hidalgo, MA. Saz, L. Gimeno, P. Ribera, M. Brunet, H. Paeth, N. Rimbu, T. Felis, J. Jacobeit, A. Duenkeloh, E. Zorita, J. Guiot, M. Turkes, MJ. Alcoforado, R. Trigo, D. Wheeler, SFB. Tett, ME. Mann, R. Touchan, DT. Shindell, S. Silenzi, P. Montagna, D. Camuffo, A. Mariotti, T. Nanni, M. Brunetti, M. Maugeri, C. Zerefos, S. De Zolt, P. Lionello, MF. Nunes, V. Rath, H. Beltrami, E. Garnier, and E. Le Roy Ladurie	2006	Mediterranean climate variability over the last centuries: A review	The Mediterranean Climate: an overview of the main characteristics and issues	Eds. Lionello, P., Malanotte-Rizzoli, P., and Boscolo, R. Elsevier, Amsterdam, the Netherlands, 27-148 http://www.giub.unibe.ch/klimet/docs/Luterbacheretal_Elsevier_final.pdf
Moberg A, Jones PD, Lister D, Walther A, Brunet M, Jacobeit J, Alexander LV, Della-Marta PM, Luterbacher J, Yiou P, Chen D, Klein Tank AMG, Saladié O, Sigró J, Aguilar E, Alexandersson H, Almarza C, Auer I, Barriendos M, Begert M, Bergström H, Böhm R, Butler JC, Caesar J, Drebs A, Founda D, Gersengarbe F-W, Micela G, Maugeri M, Österle H, Pandzic K, Petrakis M, Srnec L, Tolasz R, Tuomenvirta H, Werner PC, Linderholm H, Philipp A, Wanner H, Xoplaki E.	2006	Indices for daily temperature and precipitation extremes analysed for the period 1901-2000.	*Journal of Geophysical Research - Atmospheres.*	**111**, D22106 doi:10.1029/2006JD007103. http://www.giub.unibe.ch/klimet/docs/climdyn_2006_moberg_et_al.pdf
Moberg, A. and Jones, P.D.	2005	Trends in indices for extremes in daily temperature and precipitation in central and western Europe 1901-1999.	*Int. J. Climatol.*	**25**, 1149-1171.
Parker, D.E., L.V. Alexander, and J. Kennedy	2004	Global and regional climate in 2003.	*Weather*	**59**, 145-152.
Pfister, C., Weingartner, R., and Luterbacher, J.	2006	Reconstruction of extreme hydrological winter droughts over the last 450 years in the Upper Rhine basin. A methodological approach	*Hydrolog. Sci. J.*	**51**, 966-985.

Philipp, A. & J. Jacobeit	2003	Das Hochwasserereignis in Mitteleuropa im August 2002 aus klimatologischer Perspektive.	*Petermanns Geographische Mitteilungen*	**147**, 2003/6, 50-52 http://www.geo.uni-augsburg.de/de/lehrstuehle/phygeo/medien_verzeichnis_2/forschung/emulate/publications/PGM_Heft_6-2003.pdf
Philipp, A., J. Jacobeit & P.M. Della-Marta	2006	Classifying reconstructed daily pressure patterns for the period 1850 to 2003 in the North-Atlantic-European Region by Simulated Annealing Clustering	Proceedings of COST733 Meeting Utrecht, EMS 5th Annual Meeting 2005	In press http://www.geo.uni-augsburg.de/de/lehrstuehle/phygeo/medien_verzeichnis_2/forschung/emulate/publications/cost733-utrecht2005contrib-philipp-et-al.pdf
Philipp, A., P.M. Della Marta, J. Jacobeit, D. Fereday, P.D. Jones, A. Moberg & H. Wanner	2006	Long-term variability of daily North-Atlantic–European Pressure Patterns since 1850 classified by Simulated Annealing Clustering	*Journal of Climate*	In press http://www.geo.uni-augsburg.de/de/lehrstuehle/phygeo/medien_verzeichnis_2/forschung/emulate/publications/long-term-variability_philipp-et-al_2006_joc-submitted.pdf
Scaife, A.A., C.K. Folland, L. Alexander, A. Moberg & J.R. Knight	2007	European Climate Extremes and the North Atlantic Oscillation	*Journal of Climate*	Submitted
Scaife, A., Knight, J. R., Vallis, G. K., Folland, C.K.	2005	A stratospheric influence on the winter NAO and North Atlantic	*Geophysical Research Letters*	**32,** L18715, doi:10.1029/2005GL023226
van der Schrier, G., Briffa, K.G., Jones, P. D. And Osborn, T.J.	2006	Summer moisture availability across Europe	*Journal of Climate*	In press
Trigo R., E. Xoplaki, E Zorita, J. Luterbacher, So. Krichak, P. Alpert, J. Jacobeit, J. Sáenz, J. Fernández, F. González-Rouco, R. Garcia-Herrera, X. Rodo, M. Brunetti, T. Nanni, M. Maugeri, M. Türkes, L. Gimeno, P. Ribera, M. Brunet, I. Trigo, M. Crepon, A. Mariotti.	2006	Relations between Variability in the Mediterranean Region and Mid-Latitude Variability	The Mediterranean Climate: an overview of the main characteristics and issues	Eds. Lionello, P., Malanotte-Rizzoli, P., and Boscolo, R. Elsevier, Amsterdam, the Netherlands, 179-226 http://www.geo.uni-augsburg.de/de/lehrstuehle/phygeo/medien_verzeichnis_2/forschung/emulate/publications/Trigo-etal-MedClivar.pdf
Walther, A. and Linderholm, H.W.	2006	A comparison of growing season indices for the Greater Baltic Area.	*International Journal of Biometeorology*	In press
Wanner, H., C. Beck, R. Brazdil, C. Casty, M. Deutsch, R. Glaser, J. Jacobeit, J. Luterbacher, C. Pfister, S. Pohl, K. Sturm, P.C. Werner & E. Xoplaki	2004	Dynamic and socioeconomic aspects of historical floods in Central Europe	*Erdkunde*	**58**, 1-16
Yiou, P. & Nogaj, M.	2004	Climatic extremes and weather extremes: Where and when?	*Geophys. Res. Lett.*	**31,** L07202, doi:10.1029/2003-GL019119
Yiou, P., Nogaj, M., Kageyama, M., Braconnat, P., Le Clainche, Y. And Marti, O.	2004	Impact of the thermohaline circulationon on North American Climate Variability	*J. Clmiate.*	Submitted

Non refereed literature

Author/Editors	Date	Title	Event	Reference	Type
Alexander, L. and J. Caesar	2005	Global observed changes in extremes of temperature and precipitation	Royal Met Soc 2005 Conference, Exeter, 12-16 Sept 2005.	Abstract C63	O
Alexander, L., Ansell, T., D. Fereday, T. Jonsson and S.Tett	2005	Mechanisms of change for severe storms over the UK	Royal Met Soc 2005 Conference, Exeter, 12-16 Sept 2005.	Absract C95	O
Allan, R. J. and T.J. Ansell	2005	New daily and monthly historical gridded mean sea level pressure reconstructions for the North Atlantic-European sector (EMSLP3) and the globe (HadSLP2): 1850 to 2003	EGU 2005, Vienna, Austria, 24-29 April 2005.		O
Ansell, T.	2003	Development of a daily gridded MSLP data set over the North Atlantic region using I-COADS	CLIMAR 2 (November) Workshop in Brussels		O
Ansell, T.	2004	Development of a daily gridded MSLP data set over the North Atlantic European region from 1850-2002	C20C (April) Workshop in Trieste		O
Ansell, T., R. J. Allan, D. E. Parker, P. Brohan and N. Rayner	2003	Development of a daily gridded MSLP data set over the North Atlantic region using ICOADS	Second JCOMM Workshop on Advances in Marine Climatology, Brussels, 17-22 November 2003	Proceedings of CLIMARII, WMO/TD 1199, JCOMM Technical Report 22.	O
Ansell, T., R. J. Allan, D. E. Parker, P. D. Jones and D. Lister	2003	Creation of daily historical mean sea level pressure fields in the EU EMULATE project	Royal Meteorological Society Conference, Norwich, 1 - 5 September 2003		O
Ansell, Tara, David Lister, Rob Allan, David Parker, Nick Rayner, Philip Brohan & Phil Jones + emulate consortium	2004	Development of a daily gridded MSLP data set over the North Atlantic - European region from 1850-2002	Third International Climate of the Twentieth Century Workshop, Trieste, Italy, 19-23 April, 2004.	Proceedings – on line	O
Bhend, J.	2005	North Atlantic and European Cyclones: Their Variability and Change from 1881 to 2003		Masters Thesis, Institute of Geography, University of Bern.	T
Bhend, J., Della-Marta, P.M., Wanner, H.	2005	North Atlantic storm track variability as shown in EMULATE SLP data from 1850 to 2003	EGU General Assembly 2005, Vienna, Austria, 24 - 29 April 2005.		O
Brunet, M., Bañón, M., García, F., Aguilar, E., Saladié, O., Sigró, J., Asín, J., López, D.	2004	An experimental approach to the evalutation and minimisation of the "screen bias", througout dual temperature observations	La Meteorología y el clima atlánticos, 5º Encuentro Hispano-Luso de Meteorología: La Meteorología y Climatología en los sectores público y privado, Badajoz 11 al 13 de febrero 2004, Seville	XXVIII Jornadas Científicas., pp. 35-36.	O/P

Brunet, M., Sigró, J., Saladié, O., Aguilar, E., Jones, P.D., Moberg, A., Walther, A. and López, D.	2005	Long-term change in the mean and extreme state of surface air temperature over Spain (1850-2003)	European Geosciences Union - General Assembly 2005 24-29 April 2005 Vienna (Austria)	Geophysical Research Abstracts, 7, 6010309.	O
Brunet, M., Sigró, J., Saladié, O., Aguilar, E., Jones, P.D., Moberg, A., Walther, A. and López, D.	2005	Spatial patterns of long-term Spanish temperature change	European Geosciences Union - General Assembly 2005 24-29 April 2005 Vienna (Austria)	Geophysical Research Abstracts, 7, 6121375.	O
Caesar, J., Alexander, L. and T. Ansell	2005	Climate extremes: Observational data sets for climate change studies and monitoring	EGU 2006, Vienna, Austria, 3-7 April 2006.		P
Chen, D., Walther, A., Moberg, A., Jones, P. D., Jacobeit, J., Lister,D.	2006	Trend atlas of the EMULATE indices: Extreme temperature and precipitation climates over Europe	Earth Sciences Centre, Report C73. ISSN 1400-383X, Göteborg		R
Della-Marta, P.M.	2005	Extreme Temperature Events in Western Europe from 1880-2003		PhD Thesis, Institute of Geography, University of Bern, 2005.	T
Della-Marta, P.M., Bhend, J., Wanner, H.	2005	North Atlantic and European cyclones. Their variability and change from 1881- 2003	IAMAS 2005, Beijing, China, 2 - 11 August 2005.		O
Della-Marta, P.M., Haylock,M., Xoplaki, E., Luterbacher, J., and Wanner, H.	2004	Relationships between the statistical dynamics of cyclones and indices of extreme events over Europe.	EGU, Nice	Extended Abstract	O
Della-Marta, P.M., Luterbacher, J., Xoplaki E., Wanner, H.	2005	European summer heat waves since 1880: Their changes and relationship to atmospheric circulation, SSTs and Precipitation	IAMAS 2005, Beijing, China, 2 - 11 August 2005.		O
Della-Marta, P.M., Luterbacher, J., Xoplaki, E., Wanner, H.	2005	Summer heat waves over Europe since 1880, their changes and relationship to atmospheric circulation	EGU General Assembly 2005, Vienna, Austria, 24 - 29 April 2005.		O
Della-Marta, P.M., Moberg, A.,Luterbacher, J., Wanner, H.	2005	A potential new method of homogenising daily temperature data	EGU General Assembly 2005, Vienna, Austria, 24 - 29 April 2005.		O
Della-Marta, P.M., Wanner, H.	2005	The Higher Order Moments method of homogenising daily temperature data	IAMAS 2005, Beijing, China, 2 - 11 August 2005.		O
Fereday, D, Knight, J, Scaife, A, Folland, C, Philipp, A, Jacobeit, J; Della-Marta, P.	2005	European atmospheric circulation types and their links with sea-surface temperature	EGU General Assembly 2005, Vienna, Austria, 24 - 29 April 2005.		O
Fereday, D., P. Della-Marta, C. Folland, J. Jacobeit, J. Knight, A. Philipp and A. A. Scaife	2005	Atmospheric circulation types and their links to sea surface temperature	Royal Met Soc 2005 Conference, Exeter, 12-16 Sept 2005.	Abstract C48	O

Folland, C., J. Knight, D. Fereday, A. A. Scaife, J. Hurrell, and P. Baines	2005	Are summer climate variations in north west Europe and West Africa linked?	Sixth CRCES Workshop on Decadal Climate Variability, Warrenton, Virginia, USA, 17-20 October 2005		O
Folland, C., J. Knight, D. Rowell and J. Hurrell	2005	Links between summer rainfall variations in north west Europe and the West African monsoon	IAMAS 2005 Scientific Assembly, Beijing, China, August 2005.		O
Folland, C., L. Alexander and J. Caesar	2005	of surface extremes data sets and their analysis for IPCC assessment reports	IAMAS 2005 Scientific Assembly, Beijing, China, August 2005.		
Folland, C.K.	2003	Assessing bias corrections in historical sea surface temperature using a climate model	Second JCOMM Workshop on Advances in Marine Climatology, Brussels, 17-22 November 2003	Proceedings of CLIMARII, WMO/TD 1199, JCOMM Technical Report 22.	O
Folland, C.K., 2005	2005	Assessing bias corrections in historical sea surface temperature using a climate model	Royal Met Soc 2005 Conference, Exeter, 12-16 Sept 2005.	Abstract C59	O
Folland, C.K., D. Fereday, J. Knight, A. Colman and A. A. Scaife	2005	Interannual to interdecadal variations in the summer North Atlantic Oscillation and SST influences	Special Climate of the 20th Century workshop, Prague, Czech Repub., 4-6 July,2005.		O
Folland, C.K., J. Knight, D. Rowell and J. Hurrell	2005	Are summer climate variations in north west Europe and West Africa linked?	85th American Met. Soc. Annual Meeting, SanDiego,California, USA, 9-13 Jan 2005.		O
Hurrell, J., and C.K. Folland	2004	North west European high summer climate variability, the West African monsoon and the summer North Atlantic Oscillation	Third International Climate of the Twentieth Century Workshop, Trieste, Italy, 19-23 April, 2004.	Proceedings – on line	O
Jacobeit, J. & A. Philipp	2002	Projekt-Kurzvorstellung: European and North Atlantic daily to multidecadal climate variability (EMULATE)	Arbeitskreis Klima in Berlin 2002	Abstract http://www.geo.uni-augsburg.de/de/lehrstuehle/phygeo/medien_verzeichnis_2/forschung/emulate/publications/akklima-02.pdf	O
Jacobeit, J., A. Dünkeloh & E.Hertig	2004	Recent and possible future changes in Mediterranean precipitation.	Geophysical Research Abstracts	**6**, No. EGU04-A-04027	O
Jacobeit, J., J. Rathmann & A. Philipp	2006	Large-scale atmospheric circulation patterns in relation to Central European temperature and precipitation extremes	Workshop on Climate Variability and Extremes During the Past 100 Years in Gwatt (Switzerland) July 2006)	Abstract http://www.geo.uni-augsburg.de/de/lehrstuehle/phygeo/medien_verzeichnis_2/forschung/emulate/publications/Thun-Jacobeitetal.pdf	O
Knight, J., R. Allan, C. Folland, M. Mann and M. Vellinga	2005	The Atlantic multidecadal oscillation: a signature of thermohaline circulation cycles in observed climate	Royal Met Soc 2005 Conference, Exeter, 12-16 Sept 2005.	Abstract C45	O
Knight, J., R. Allan, C. Folland, M. Vellinga and M. Mann	2005	The Atlantic Multidecadal Oscillation: a signature of thermohaline circulation cycles in observed climate	AGU Fall Meeting, San Francisco, USA, 5-9 Dec 2005.		O

Knight, J., R. Allan, C. Folland, M. Vellinga and M. Mann, 2005	2005	The Atlantic multidecadal oscillation: an internal mode of climate variability in the Northern Hemisphere	EGU 2005, Vienna, Austria, 24-29 April 2005.		O
Knight, J., R. Allan, C.K. Folland, M. Vellinga, and M. Mann	2003	The Atlantic Multidecadal Oscillation and the thermohaline circulation: a global-scale ocean-atmosphere mode simulated in a 1400 year coupled model calculation	IUGG Sapporo, Japan, June 30- July 11	Abs. Week A, 2003, p A121.	O
Knight, J., R. Allan, C.K. Folland, M. Vellinga, and M. Mann	2003	The Atlantic Multidecadal Oscillation and the thermohaline circulation: A global-scale ocean-atmosphere mode simulated in A 1400 Year coupled model calculation	Royal Meteorological Society Conference, Norwich, 1 - 5 September 2003		O
Knight, J., R. Allan, C.K. Folland, and M. Vellinga	2003	Quasi-periodic natural variations in the thermohaline Circulation and climate in a 1400 year coupled model calculation	14th Symposium on Global Change and Climate Variations, 83rd Annual Meeting of the American Meteorological Society, Long Beach, California, USA, Feb 2003.		O
Knight, J., R. Allan, C.K. Folland, M. Vellinga and M. Mann	2004	The Atlantic Multidecadal Oscillation: a signature of persistent natural thermohaline circulation cycles in observed climate	Third International Climate of the Twentieth Century Workshop, Trieste, Italy, 19-23 Apr., 2004.	Proceedings – on line	O
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Philipp, A. & J. Jacobeit	2004	Klassifikation täglicher Luftdruckfelder im atlantisch-europäischen Sektor 1850 bis 2003	Arbeitskreis Klima in Eltville 2004	Abstract http://www.geo.uni-augsburg.de/de/lehrstuehle/phygeo/medien_verzeichnis_2/forschung/emulate/publications/akklima-abstract_philipp-jacobeit.pdf	O
Philipp, A., J. Jacobeit, P.M. Della-Marta & D. Fereday	2005	Classification of reconstructed daily pressure patterns for the period 1850 to 2003 in the North-Atlantic-European Region	EGU General Assembly in Vienna 2005	Poster http://www.geo.uni-augsburg.de/de/lehrstuehle/phygeo/medien_verzeichnis_2/forschung/emulate/publications/poster-egu2005vienna_philipp-et-al.pdf	P
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D = Dissertation, O = Oral presentation, P = Poster, Pr=Proceedings, R=Report, T=Thesis

Further (EMULATE-related) works by members of the EMULATE consortium are in various stages of progress. Most of the ongoing work has been enabled by the completion of EMULATE Deliverables (and inspired by scheduled research and discussions), but was not a part of the original work schedule. Further publications relating to these works (including peer reviewed articles and reports) will be produced and appropriate links will be made to the website. An example of this work is the production of a Trend Atlas (by members of the WP4 group), which will look at trends in modelled output and will be designed to illustrate the anthropogenic component (thus complementing the contents of D16) of the trends seen in observed climate series (see D14).