Supplementary information

This supplement consists of 6 parts describing the climatologies of reanalyses and LMDZiso (Part A), an investigation of the temporal stability of the correlations (Part B), the analysis of precipitation weighted temperature calculated from daily meteorological records (Part C), and the analysis of NAO-$\delta^{18}O$ relationships from GNIP and Greenland ice core data (Part D). This is complemented by a sensitivity test to the definition of the NAO index either from fixed areas or from the first EOF of circulation (Part E), and finally analyses of JJAS NAO-climate relationships (Part F).

A. Climatologies

- Figure S1 displays the climatologies of CRU-NCEP (1990-2010), ERA-interim(1990-2010) and LMDZiso (1979-2008) for summer (JJAS) and winter (DJFM). We briefly describe here the main differences which can be observed between the reanalyses and LMDZiso datasets: JJAS temperature : consistency of CRU-NCEP and ERA-interim data; cold bias of LMDZiso over high latitude lands.
- DJFM temperature: colder conditions depicted in Siberia in CRU-NCEP, in Greenland for ERA-interim; warm bias of LMDZiso for high latitude lands.JJAS precipitation : CRU-NCEP precipitation is reduced compared to ERA-interim in high latitudes (Alaska, north Canada and Siberia), apart from north Greenland. LMDZiso outputs are more consistent with ERA-interim data, but produce larger precipitation amounts on mountain ranges (e.g. Scandinavia, Alaska).
- DJFM precipitation : generally drier conditions in CRU-NCEP compared to ERA-interim, especially at high latitudes and in eastern Europe/Russia, but wetter conditions over central and North Greenland. LMDZiso precipitation outputs appear more consistent with ERA-interim data, but seem drier in Siberia.

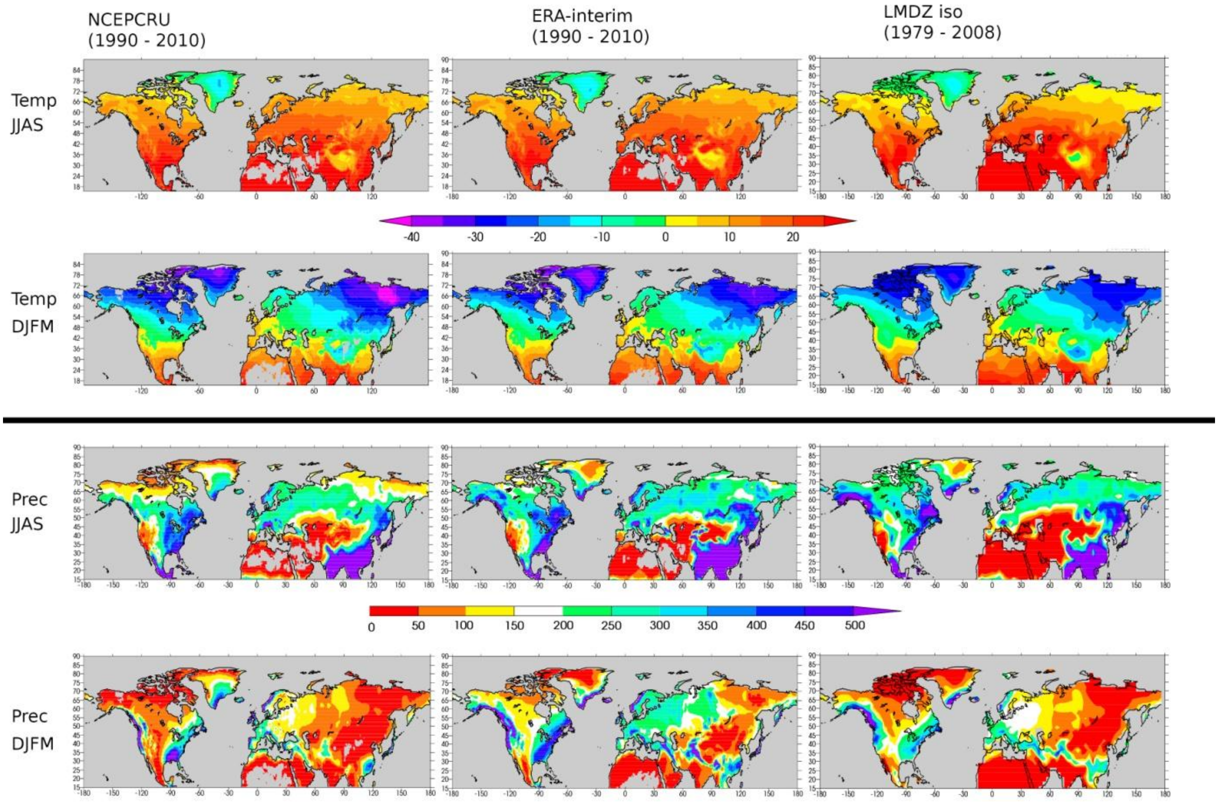


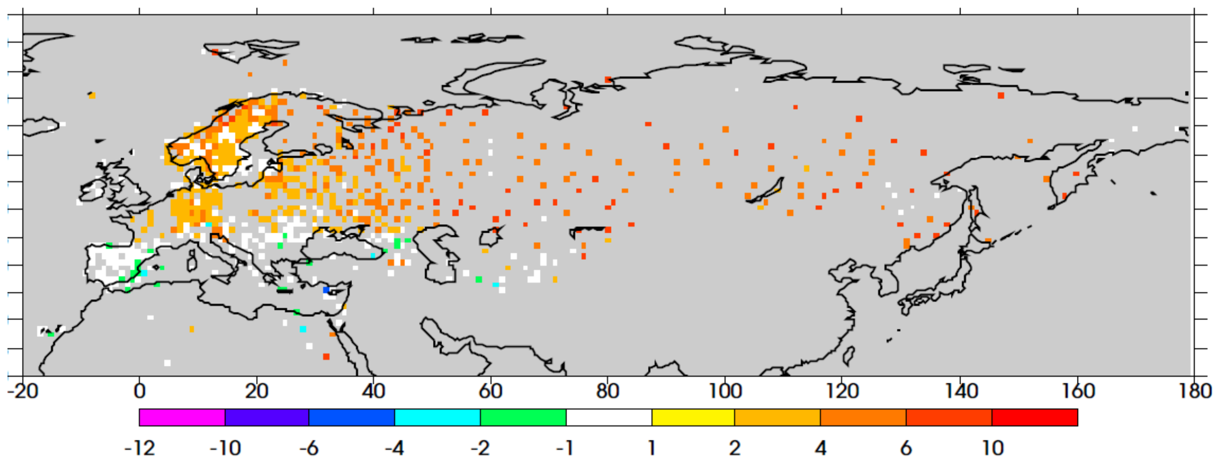
Figure S1. Climatologies of CRU-NCEP, ERA-interim, and LMDZ-iso for different reference periods (respectively 1990-2010 for atmospheric analyses and 1979-2008 for LMDZiso). From top to bottom: temperature (JJAS and DJFM, °C) and precipitation (JJAS and DJFM, mm/season).

B. Precipitation intermittency bias calculated from daily meteorological observations

There are uncertainties in the quality of precipitation in atmospheric general circulation models (in analyses and LMDZiso). We have explored the precipitation intermittency bias using daily temperature and precipitation data from the European Climate Assessment and Database (ECA&D, http://www.eca.knmi.nl), stations (Klein Tank et al., 2002) for which mean temperature and precipitation are available. More than 1600 station data were used and data gaps were identified.

The structure of the precipitation intermittency bias from direct observations is very similar to the results of CRU-NCEP, ERA-interim and LMDZiso. A visual inspection of the DFJM and JJAS biases points to a strongest similarity with the ERA-interim regional structures and magnitudes of biases (Figures 2a and S2), especially during the summer.

a) DJFM



b) JJAS

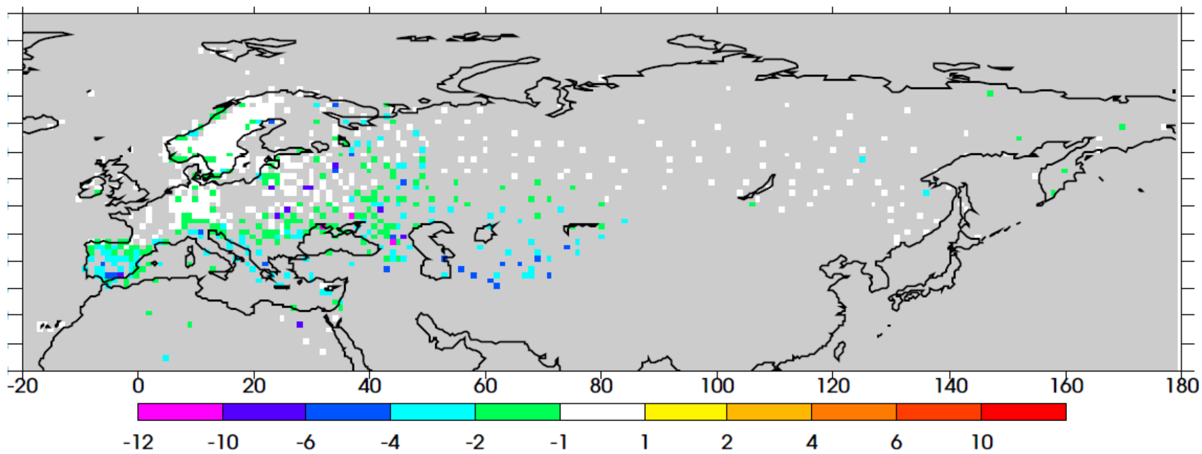


Figure S2. Precipitation intermittency bias, calculated as T_p-T from daily temperature and precipitation from ECA&D stations (same as Figure 2a). The ECA&D database consists of a non homogeneous set of daily meteorological observations from 1622 stations throughout Europe, Russia and the Mediterranean. The longest time series (from Bologna) covers the period 1814-2012. In this plot, a subset of 788 stations has been used so that only one station is represented in each grid-point.

C. NAO-δ^{18}O relationships in GNIP and ice core data

The International Atomic Energy Agency (IAEA) has maintained a Global Network for Isotopes in Precipitation (GNIP) and a database of monthly precipitation water isotope data. We have downloaded all individual stations as in July, 2012 and selected those that offered a sufficient amount of monthly data to quantify the correlation with winter (DJFM) or summer (JJAS) NAO, using the updated instrumental NAO index (Vinther et al., 2003b). Table S1 (DJFM) and S2 (JJAS) describe this selection of data, through the station name and coordinates, the number of monthly data used to quantify seasonal correlations (N_{exist} for $\delta^{18}O$, p, T and T_p), with p the monthly precipitation amount, T the monthly mean surface air temperature and T_p the seasonal temperature, weighted by the monthly precipitation amount. Note that the database is very focused on Europe, where patterns of correlation are consistent with results from atmospheric analyses (Figure 3).

Over this dataset and for DJFM, we observe that the relationship between T_p and NAO is very close to the relationship between T and NAO. This is due to the limited impact of monthly precipitation weighting described from atmospheric models (see Section 2.4), compared to the impact of daily precipitation weighting which cannot be performed on the monthly GNIP data.. The largest, positive correlations between winter NAO, T and $\delta^{18}O$ (R>0.75) are encountered in NW Europe. Correlations between NAO and $\delta^{18}O$ have the same sign as those with temperature, albeit with a slightly reduced strength.

In JJAS, the situation is quite different. First, the results obtained with T_p are less consistent with those obtained with T (R=0.6). Second, there is no consistency between the JJAS NAO-$\delta^{18}O$ correlation and those with T or T_p. We suggest that this is due to the impact of continental recycling and convection which probably induce a larger level of local noise in the precipitation $\delta^{18}O$. While local, significant correlations between JJAS NAO and $\delta^{18}O$ are found for a few stations (e.g. in Spain or Turkey), the results are not consistent with the NAO-T relationships at the same stations.

Table S1. Site location, number of non-missing values, and winter (DJFM) correlations between the NAO, $\delta^{18}O$, precipitation (p), mean surface air temperature (T), mean surface air temperature weighted by monthly precipitation (T_p) variables from the GNIP database. Correlations significant at the 95% confidence level are highlighted in bold. No correlation values are shown for variables with less than 10 non-missing values.

Station	*Longitude*	*Latitude*	*Corr. $\delta^{18}O$*	*N $\delta^{18}O$*	*Corr. P*	*N P*	*Corr. T*	*N T*	*Corr T_p*
ADANA	35.3	37	-0.12	36	-0.11	45	-0.20	43	-0.23
ANKARA	32.9	40	-0.16	41	**-0.4**	42	-0.23	41	-0.11

ANTALYA	30.7	36.9	-0.14	36	**-0.32**	40	**-0.36**	34	-0.16
ASTRAKHAN	48	46.3	**0.37**	16	-0.11	16	**0.43**	15	**0.31**
AVIGNON	4.8	44	**0.34**	12	**-0.52**	12	-	7	-
AZORES	-25.7	37.8	**0.31**	26	-0.27	32	**0.34**	29	**0.32**
BATUMI	41.6	41.7	0.17	10	**-0.36**	9	0.09	9	-0.02
BEEK	5.8	50.9	**0.35**	12	-	8	-	8	-
BERLIN	13.4	52.5	**0.49**	28	**0.37**	27	**0.76**	25	**0.62**
BERN	7.4	47	**0.42**	40	-0.09	39	**0.42**	37	**0.45**
BET DAGAN	34.8	32	0.12	40	0.08	40	**-0.48**	16	-0.20
BRAUNSCHWEIG	10.5	52.3	0.24	29	**0.56**	27	**0.73**	18	**0.64**
CALGARY	-114	51	**0.39**	11	**-0.55**	11	0.07	11	0.10
CHICAGO	-87.8	41.8	**0.48**	17	**0.4**	17	**0.48**	18	0.23
CHIHUAHUA	-106.1	28.6	0.23	13	**0.61**	19	-0.11	21	0.25
CUXHAVEN	8.7	53.9	**0.58**	29	**0.43**	29	**0.84**	17	**0.82**
DANMARKSHAVN	-18.7	76.8	**0.30**	18	-0.13	18	-0.23	17	**-0.33**
EMMERICH	6.6	51.8	**0.43**	27	**0.4**	29	**0.71**	19	**0.77**
FARO	-8	37	0.03	21	-0.18	22	-0.14	19	-0.06
GARMISCH	11.1	47.5	**0.55**	29	0.28	30	**0.36**	18	0.26
GENOA	8.9	44.4	**0.34**	30	**-0.52**	37	0.24	27	-0.08
GIBRALTAR	-5.4	36.2	0.09	41	**-0.52**	48	0.21	38	0.20
GRAZ UNIVERSITAT	15.5	47.1	**0.32**	35	**-0.43**	35	-	1	-
GRIMSEL	8.3	46.6	**0.45**	39	0.23	39	**0.49**	34	**0.42**
GRONINGEN	6.6	53.2	**0.51**	46	**0.35**	44	**0.50**	39	**0.49**
KEYWORTH	-1.1	52.9	**0.36**	12	-0.08	11	-	9	-
KIROV	49.6	58.7	-	9	**0.35**	16	**0.74**	15	**0.69**
KOBLENZ	7.6	50.4	**0.51**	24	**0.51**	23	**0.79**	18	**0.61**
KONSTANZ	9.2	47.7	**0.54**	29	-0.05	30	**0.52**	26	**0.51**
KRAKOW	19.9	50.1	**0.59**	34	0.03	32	**0.69**	33	**0.65**
LEIPZIG	12.4	51.4	**0.42**	19	0.24	33	**0.56**	29	**0.49**
LIPTOVSKY	19.6	49.1	**0.55**	18	**0.29**	18	**0.64**	18	**0.59**
LISTA	6.6	58.1	**0.53**	12	**0.67**	17	**0.62**	14	**0.63**
LJUBLJANA	14.5	46.1	**0.32**	21	**-0.39**	21	**0.38**	21	**0.55**

MADEIRA	-16.9	32.6	**0.40**	13	**-0.89**	13	0.18	11	0.08
MADRID	-3.7	40.4	**0.63**	11	**-0.46**	11	-0.09	10	0.09
MONACO	7.4	43.7	0.25	10	**-0.51**	10	**0.34**	8	**0.45**
NY ALESUND	11.9	78.3	**-0.40**	20	**-0.71**	20	-0.12	19	**-0.34**
OTTAWA	-75.7	45.3	0.00	39	0.03	36	0.17	34	0.20
PENHAS DOURADAS	-7.5	40.4	**0.31**	16	**-0.6**	16	**0.56**	15	**0.49**
PORTALEGRE	-7.4	39.3	0.1	16	**-0.74**	17	**0.48**	15	**0.40**
PORTO	-8.6	41.1	-0.07	16	**-0.53**	17	0.12	16	0.02
REGENSBURG	12.1	49	**0.33**	29	0.18	30	**0.58**	19	**0.45**
REYKJAVIK	-21.9	64.1	**-0.32**	30	**0.34**	34	0.21	32	0.18
SFAX	10.7	34.7	0.26	15	-0.24	16	**-0.35**	11	0.06
SIDI BARRANI	25.6	31.6	0.24	24	**0.43**	26	**-0.44**	23	**-0.43**
ST PETERSBURG	30.3	60	-	9	**0.41**	10	**0.78**	10	**0.78**
STTUTGART	9.2	48.8	**0.44**	38	0.23	41	**0.73**	39	**0.63**
TEHERAN	51.3	35.7	0.01	20	**-0.31**	18	0.08	19	-0.01
THONON	5.9	46.4	**0.53**	38	-0.24	37	**0.42**	37	**0.38**
TRIER	6.7	49.8	**0.54**	28	**0.31**	27	**0.60**	19	**0.57**
TUNIS	10.2	36.8	-0.05	34	-0.25	37	-0.11	35	-0.19
VALENTIA	-9	51.9	0.24	40	0.17	47	**0.71**	38	**0.64**
VERACRUZ	-96.1	19.2	0.04	19	0.17	21	0.17	20	0.07
VIENNA	16.4	48.3	**0.62**	48	-0.16	45	**0.71**	48	**0.68**
VILLACHER	13.7	46.6	-0.05	30	**-0.35**	29	-	0	-
WALLINGFORD	-1.1	51.6	**0.48**	26	0.03	27	**0.63**	25	**0.65**
WASSERKUPPE	10	50.5	**0.73**	28	**0.39**	27	**0.60**	18	**0.37**
WEATHERSHIP F	-48	35	**-0.30**	12	**-0.29**	10	**0.77**	11	**0.47**
ZAGREB	16	45.8	**0.75**	17	-0.28	15	**0.69**	17	**0.68**

Table S2. Same as in Table S1 but for summer (JJAS).

Station	*Longitude*	*Latitude*	*Corr.* $\delta^{18}O$	*N* $\delta^{18}O$	*Corr.* P	*N* P	*Corr.* T	*N* T	*Corr* T_p
ADANA	35.3	37	0.25	30	-0.02	40	**-0.57**	34	-0.04
ANKARA	32.9	40	**0.32**	43	-0.09	42	**-0.46**	38	-0.09

ANTALYA	30.7	36.9	0.11	30	**-0.28**	33	**-0.41**	36	0.03
ASTRAKHAN	48	46.3	0.12	15	**0.37**	15	-0.23	15	-0.11
AVIGNON	4.8	44	0.20	13	-0.25	13	-	6	-
AZORES	-25.7	37.8	0.16	21	-0.11	32	0.04	29	-0.07
BATUMI	41.6	41.7	-0.21	10	0.23	11	**-0.48**	10	**-0.32**
BEEK	5.8	50.9	**0.59**	11	-	7	-	7	-
BERLIN	13.4	52.5	0.07	28	-0.10	25	0.02	24	0.12
BERN	7.4	47	0.01	38	-0.24	37	-0.21	37	-0.27
BET DAGAN	34.8	32	-	3	-0.21	3	0.06	18	-
BRAUNSCHWEIG	10.5	52.3	-0.01	28	**-0.42**	29	0.13	16	0.24
CALGARY	-114	51	**-0.41**	10	0.08	10	-0.18	10	-0.13
CHICAGO	-87.8	41.8	**-0.29**	18	-0.02	18	**-0.47**	17	**-0.34**
CHIHUAHUA	-106.1	28.6	-0.18	24	-0.04	20	-0.03	20	-0.09
CUXHAVEN	8.7	53.9	0.16	27	-0.21	28	0.07	13	0.06
DANMARKSHAVN	-18.7	76.8	**0.59**	19	0.12	19	-0.20	16	**-0.41**
EMMERICH	6.6	51.8	-0.12	26	**-0.30**	28	0.10	15	0.09
FARO	-8	37	**-0.47**	10	-0.15	17	-0.25	17	0.26
GARMISCH	11.1	47.5	-0.17	28	-0.17	29	0.00	16	0.03
GENOA	8.9	44.4	0.00	29	-0.09	31	**-0.29**	27	0.23
GIBRALTAR	-5.4	36.2	0.25	25	-0.10	39	-0.04	39	-0.13
GRAZ UNIVERSITAT	15.5	47.1	-0.14	37	0.26	35	-	1	-
GRIMSEL	8.3	46.6	0.09	39	-0.15	38	0.00	35	0.01
GRONINGEN	6.6	53.2	0.01	45	-0.18	43	0.07	33	-0.09
KEYWORTH	-1.1	52.9	-0.24	10	**0.36**	9	-	9	-
KIROV	49.6	58.7	-	9	**-0.30**	16	-0.02	15	-0.06
KOBLENZ	7.6	50.4	0.1	25	0.05	21	0.25	17	**0.44**
KONSTANZ	9.2	47.7	0.09	28	**-0.4**	30	-0.26	23	**-0.31**
KRAKOW	19.9	50.1	-0.15	33	**-0.38**	34	**-0.31**	31	-0.16
LEIPZIG	12.4	51.4	0.14	18	-0.17	30	-0.15	29	**-0.37**
LIPTOVSKY	19.6	49.1	-0.01	17	-0.22	18	0.03	18	-0.17
LISTA	6.6	58.1	0.07	12	**0.66**	17	0.20	16	0.16
LJUBLJANA	14.5	46.1	-0.01	21	**-0.36**	20	-0.16	20	0.00

MADEIRA	-16.9	32.6	**-0.73**	12	**0.48**	12	-0.18	11	**0.32**
MADRID	-3.7	40.4	**0.32**	10	0.05	11	-	9	0.21
MONACO	7.4	43.7	**-0.55**	11	**0.50**	11	0.15	6	-0.14
NY ALESUND	11.92	78.3	0.11	20	0.16	20	-0.04	17	0.26
OTTAWA	-75.7	45.3	-0.18	37	-0.1	36	-0.13	31	-0.09
PENHAS DOURADAS	-7.5	40.4	-0.12	17	**-0.38**	16	**0.31**	14	0.25
PORTALEGRE	-7.4	39.3	**-0.42**	17	-0.03	17	0.19	13	0.26
PORTO	-8.6	41.1	**0.34**	17	**-0.29**	16	0.13	13	0.13
REGENSBURG	12.1	49	0.16	28	-0.22	29	0.02	15	-0.09
REYKJAVIK	-21.9	64.1	-0.22	30	-0.06	35	-0.13	32	-0.03
SFAX	10.7	34.7	0.11	15	-0.12	16	**-0.36**	9	-0.01
SIDI BARRANI	25.6	31.6	-	1	-0.23	9	**-0.85**	20	-
ST PETERSBURG	30.3	60	-0.07	10	**-0.5**	11	**0.51**	11	**0.63**
STTUTGART	9.2	48.8	0.18	35	-0.11	41	0.23	38	**0.30**
TEHERAN	51.3	35.7	0.25	12	-0.24	13	-0.14	17	**-0.42**
THONON	5.9	46.4	-0.21	39	-0.09	36	-0.05	32	-0.02
TRIER	6.7	49.8	0.02	28	-0.22	28	0.03	16	0.11
TUNIS	10.2	36.8	0.25	23	-0.21	32	**-0.29**	35	0.00
VALENTIA	-9	51.9	0.19	41	-0.02	46	-0.26	37	**-0.35**
VERACRUZ	-96.1	19.2	**-0.42**	23	**0.40**	21	**-0.35**	18	**-0.44**
VIENNA	16.4	48.3	0.10	48	**-0.46**	44	-0.13	40	-0.03
VILLACHER	13.7	46.6	-0.04	30	-0.19	28	-	0	-
WALLINGFORD	-1.1	51.6	0.23	24	-0.09	26	-0.04	23	0.00
WASSERKUPPE	10	50.5	0.10	27	0.01	26	-0.27	17	**-0.28**
WEATHERSHIP F	-48	35	0.05	12	-	9	0.07	12	-
ZAGREB	16	45.8	**0.54**	16	**-0.53**	16	0.08	15	-0.11

Table S3. Site location, period covered by the ice core record, and both winter (DJFM) and summer (JJAS) correlation values between the NAO and the isotopic $\delta^{18}O$ series. Note that the correlations are calculated within the overlapping period with the NAO time series (1824-2010). Correlations significant at the 95% confidence level are highlighted in bold.

Station	*Latitude*	*Longitude*	*Initial Year*	*Final Year*	*Winter Corr. $\delta^{18}O$*	*Summer Corr. $\delta^{18}O$*
CRETE[1]	-37.3	71.1	552 AD	1973 AD	**-0.34**	-0.06
DYE3 (stack)[1]	-43.8	65.2	551 AD	1978 AD	**-0.38**	-0.08
GRIP (stack)[1]	-37.6	72.6	551 AD	1979 AD	-0.14	-0.12
MILCENT[1]	-44.6	70.3	1778 AD	1970 AD	**-0.32**	**-0.19**
NEEM[2]	-51.06	77.45	1963 AD	2004 AD	0.02	-0.18
RENLAND[3]	-26.7	71.3	1135 AD	1986 AD	**-0.24**	0.13
SITE A[1]	-35.8	70.6	1778 AD	1970 AD	**-0.29**	-0.01
SITE B[1]	-37.5	70.7	1778 AD	1970 AD	**-0.23**	-0.15
SITE D[1]	-39.6	70.6	1778 AD	1970 AD	**-0.37**	**-0.19**
SITE E[1]	-35.9	71.2	1778 AD	1970 AD	-0.07	0.11
SITE G[1]	-35.8	71.2	1778 AD	1970 AD	**-0.29**	-0.09

[1] (Vinther et al., 2010)[2] Data from the shallow ice core NEEM07S3 (Steen-Larsen et al., 2011)

[3] Unpublished data provided by Bo Vinther

D. Pressure centers of the NAO

In all previous analyses, we have diagnosed an NAO index using the pressure difference between two fixed areas (corresponding to Gibraltar and Reykjavik). Recent studies have showed changes in the position of the NAO centers of action, shifting northward in summer, and west/eastwards at the decadal scale (Folland et al., 2009;Pinto and Raible, 2012).

In order to assess the sensitivity of our correlation analyses to the position of the NAO centers of action, an alternative NAO index has been calculated in LMDZiso as the first principal component of sea level pressure in the North Atlantic (Figure S3). Note that the centers of action (identified as minima and maxima loadings of the first EOF) are indeed not exactly located in the Iberian Peninsula / Iceland, shifting northwards during the summer.

Figures S4 (DJFM) and S5 (JJAS) compare the correlation coefficients obtained for LMDZiso outputs (precipitation, T, T_p and $\delta^{18}O$), using both the classical pressure difference and the alternative leading PC NAO definitions. Basically, the DJFM results appear quite robust with respect to the choice of the index, the PC1 approach enhancing the strength of correlations for Siberia for temperature and isotopes. JJAS results appear more sensitive to the NAO index, with a decreased anticorrelation for Greenland using the PC1 approach, and the emergence of significant correlations in northern Scandinavia and Russia. Even if the centers of action (defined as the location of maximum loadings) are not placed exactly over Iceland and the Iberian Peninsula, both locations remain representative of the dipole behavior in winter and summer.

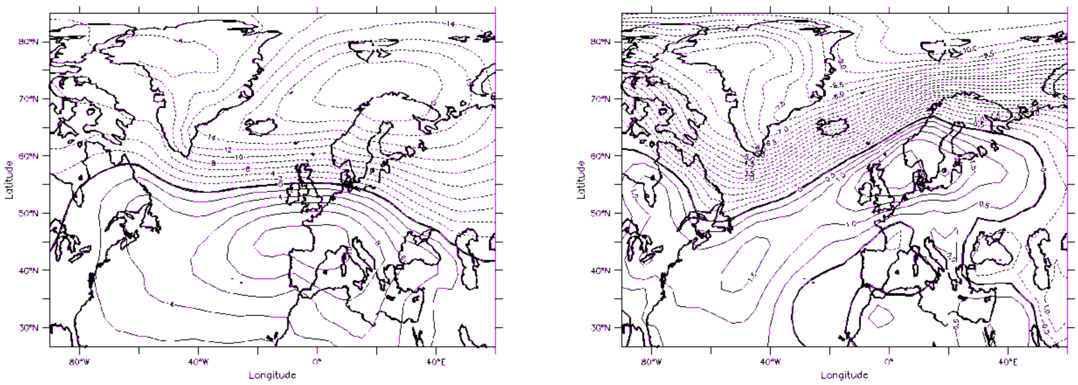


Figure S3. *Spatial structure of the first Empirical Orthogonal Function component calculated from LMDZiso sea level pressure fields for DJFM (left) and JJAS (right).*

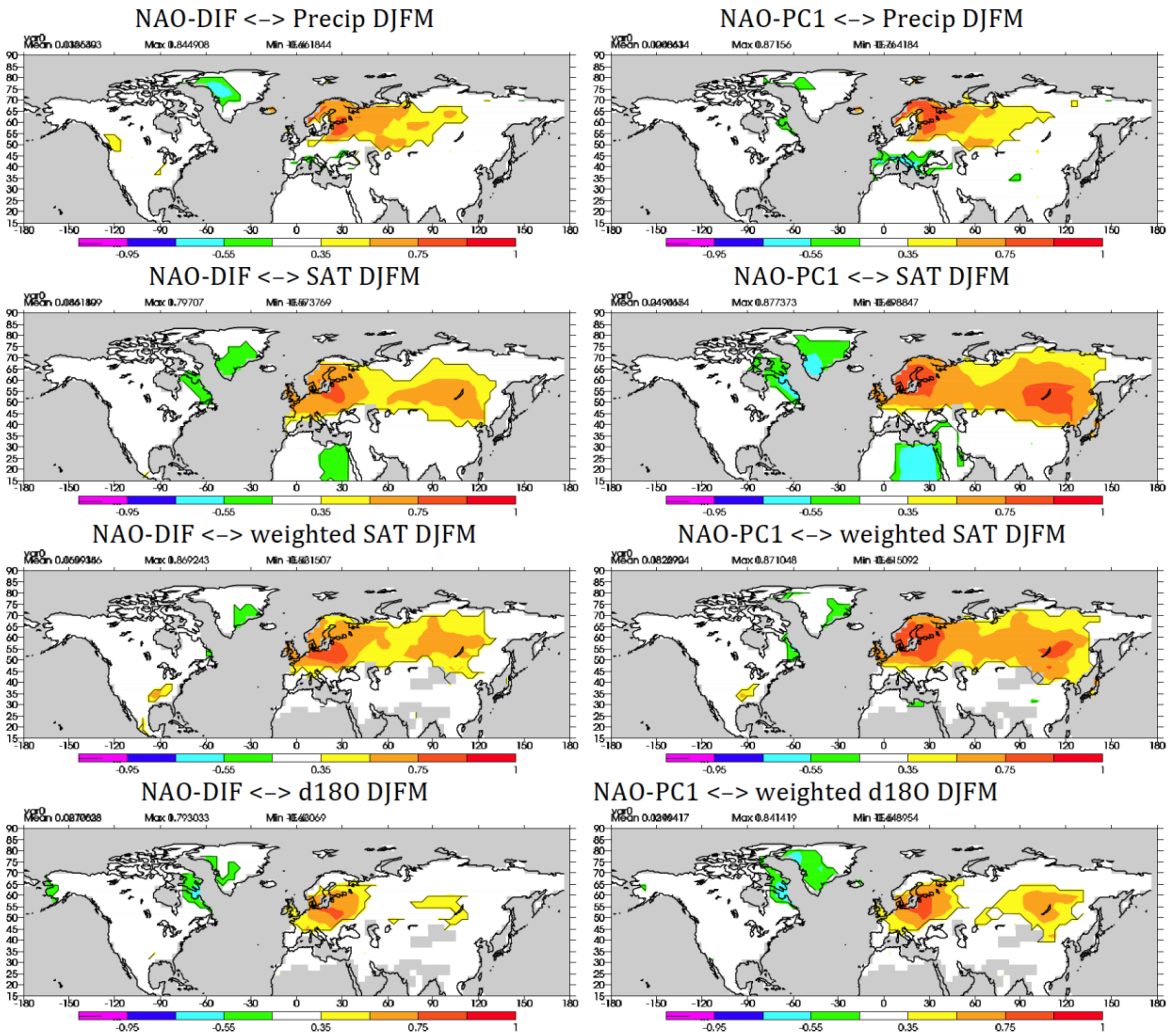


Figure S4. *Comparison between the correlation coefficients between the classical DJFM NAO index (left) and the DJFM NAO-PC1 index (right) and DJFM LMDZiso precipitation (first line), temperature (second line), precipitation weighted temperature (third line) and $\delta^{18}O$.*

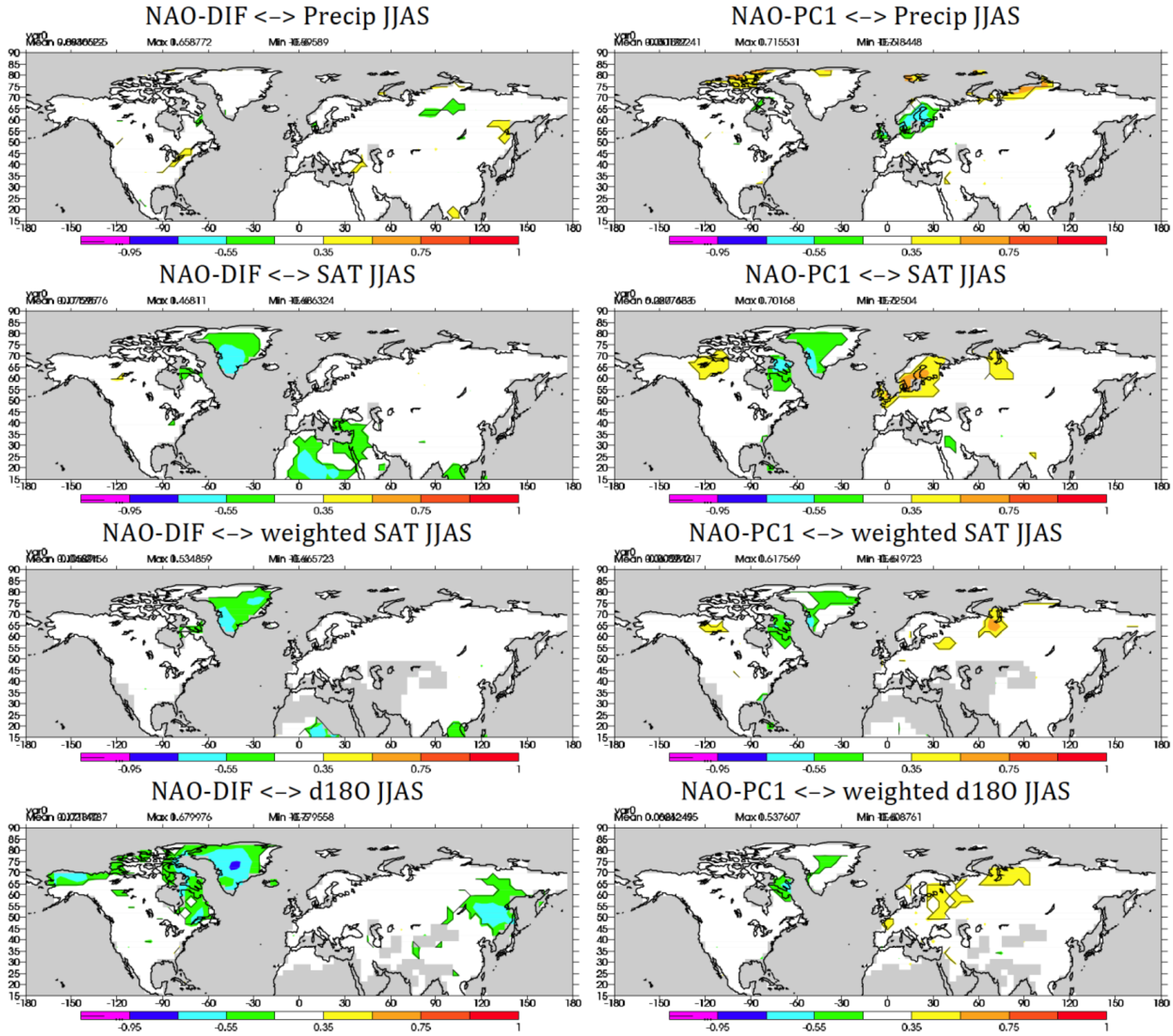


Figure S5*. Same as Figure S4 but for JJAS.*

E. <u>Temporal stability of correlations</u>

Figure S6 investigates the stability of winter NAO-climate (temperature, precipitation, and precipitation-weighted temperature) relationships throughout different time periods. We compared three bi-decadal intervals: 1990-2010 (previously chosen for comparison with ERA-interim), and the new periods 1970-1990 and 1950 – 1970. This latter period is characterised by a weak negative NAO mean state, while the other two show strong positive mean NAO values. The main similarities and discrepancies among the NAO correlations in the three decadal intervals are now briefly summarised:

- For precipitation, the correlation patterns appear robust in Southern Europe but time dependent in Russia, Eastern Siberia, North America and Greenland.

- For temperature, the correlation patterns are robust through time, with persistent positive correlations with Eastern North America, Northern Europe and negative correlations with temperature in Greenland, NE America and North Africa / Middle East. However, no significant correlations are observed over Eastern Greenland and Siberia for the first time interval (1950-1970). We note that the quality of the reanalyses may be weaker for this period, prior to the satellite data assimilation.
- For precipitation-weighted temperature, the patterns of correlation are robust through time and similar to those observed for the raw temperature, with negative correlations in West Greenland, NE America, E Siberia and positive correlations with Eurasia. The magnitude of the correlation is smaller than for temperature, and more stable through time with the exceptions of Eastern North America and Russia/Siberia.

The summer is characterised by smaller and less stable NAO-climate relationships, as illustrated in Figure 7. Both the location and sign of correlation coefficients appear to vary through our three time intervals, despite rather similar mean summer NAO values.

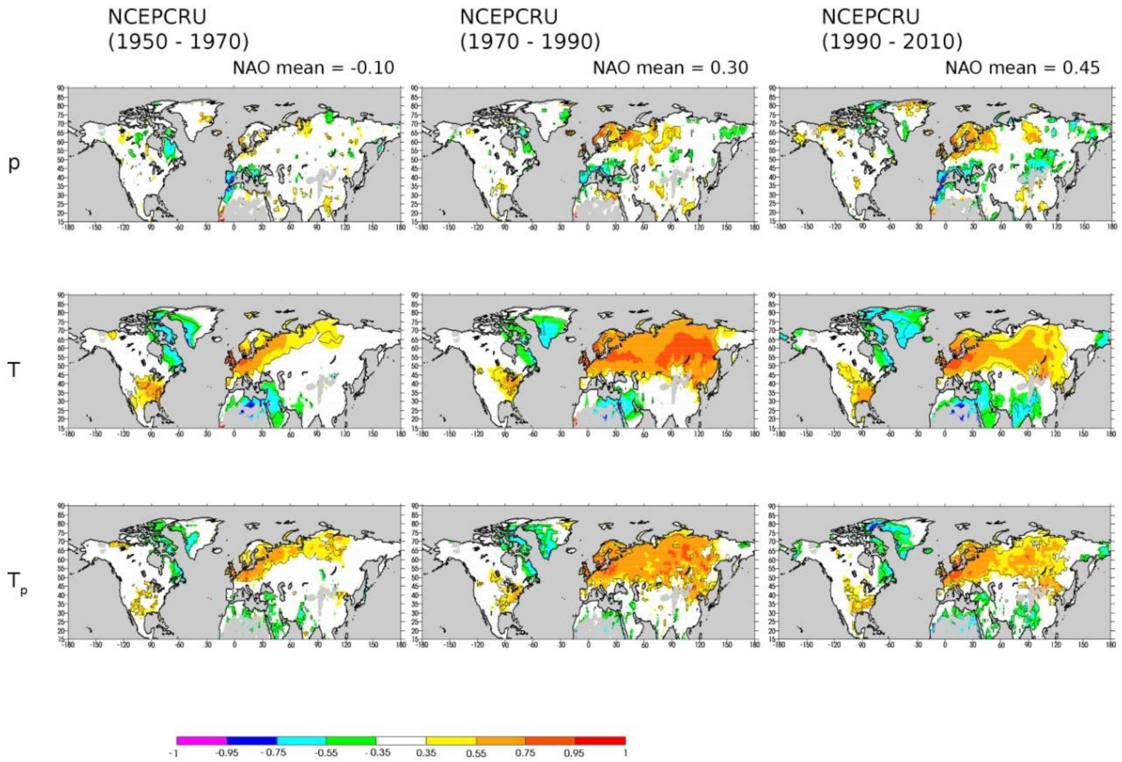


Figure S6: Same as Figure 3 but focused on the DJFM NAO correlations for three different time intervals in CRU-NCEP: 1950-1970, 1970-1990 and 1990-2010.

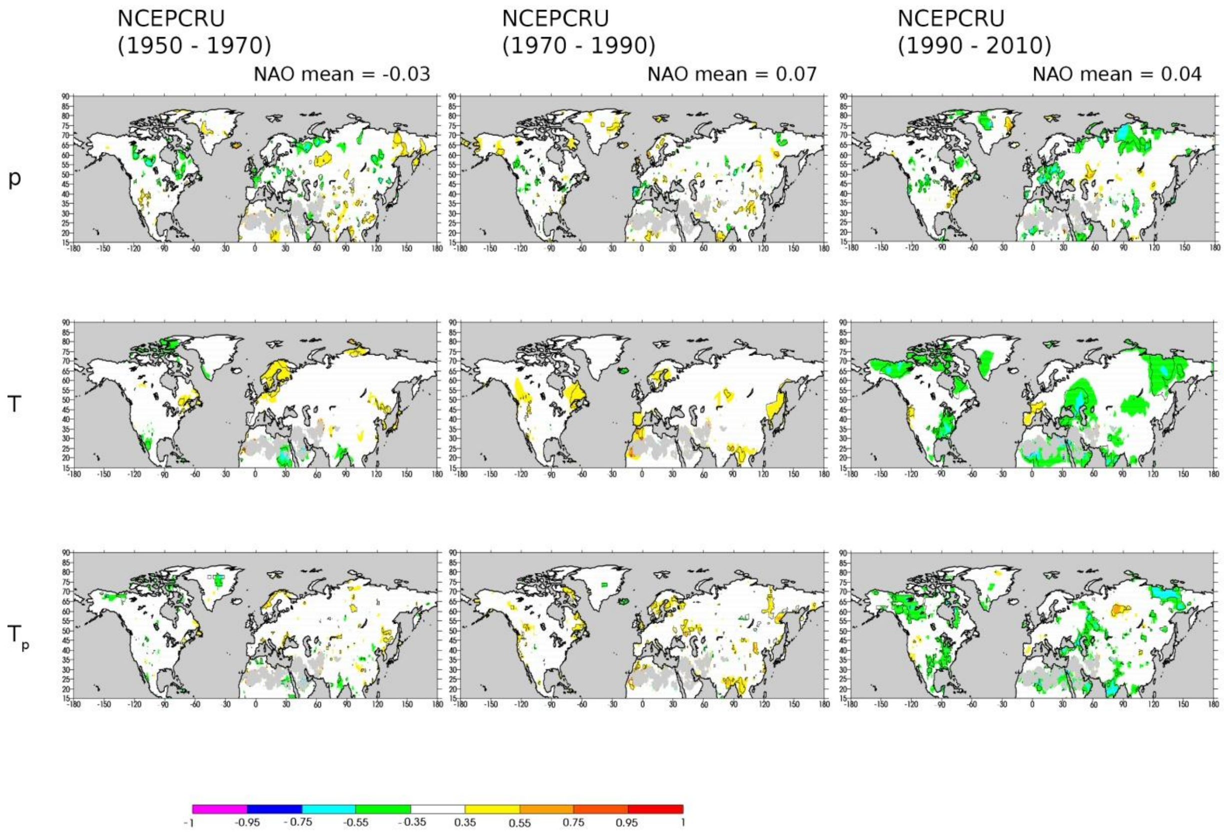


Figure S7: Same as Figure S6 but for the summer NAO correlations.

F. JJAS relationships between NAO, T_p and $\delta^{18}O$

In this section, the analyses of NAO-climate correlations that is described in the main text for DJFM is expanded to JJAS. Figure S8 shows that significant summer correlations between precipitation and NAO are detected from reanalyses in only few local areas, especially western Europe, northern Québec, and northern Siberia; LMDZiso only produces a very small patch of significant negative correlation in this area. Correlations between summer temperature and NAO are detected in larger areas (Greenland, extreme North America, eastern Europe and east Siberia) in reanalyses; LMDZiso produces a large anticorrelation for Greenland, as does ERA-interim. While more noisy, the same pattern is detected for precipitation weighted temperature. LMDZiso shows strong anticorrelations between JJJAS NAO and precipitation $\delta^{18}O$ (R<-0.35) in NE America (Québec/Labrador/Baffin Bay area), Alaska, E. Siberia and Greenland, where the strongest signal is simulated. The imprint of NAO in LMDZiso $\delta^{18}O$ is therefore stronger than for precipitation weighted temperature, suggesting that changes in air mass origin also affect the distillation history. These results are consistent with earlier studies had highlighted the impact of summer NAO on NW European climate (temperature, precipitation and cloudiness) (Folland et al., 2009) and Greenland climate and water stable isotopes (Vinther et al., 2003a;Vinther et al., 2010). The LMDZiso results are finally compared in Figure S9 with the GNIP / Greenland ice core database described in section 2.3. Note that the instrumental data do not support the high negative NAO- d18O correlations over central Greenland in LMDZ.

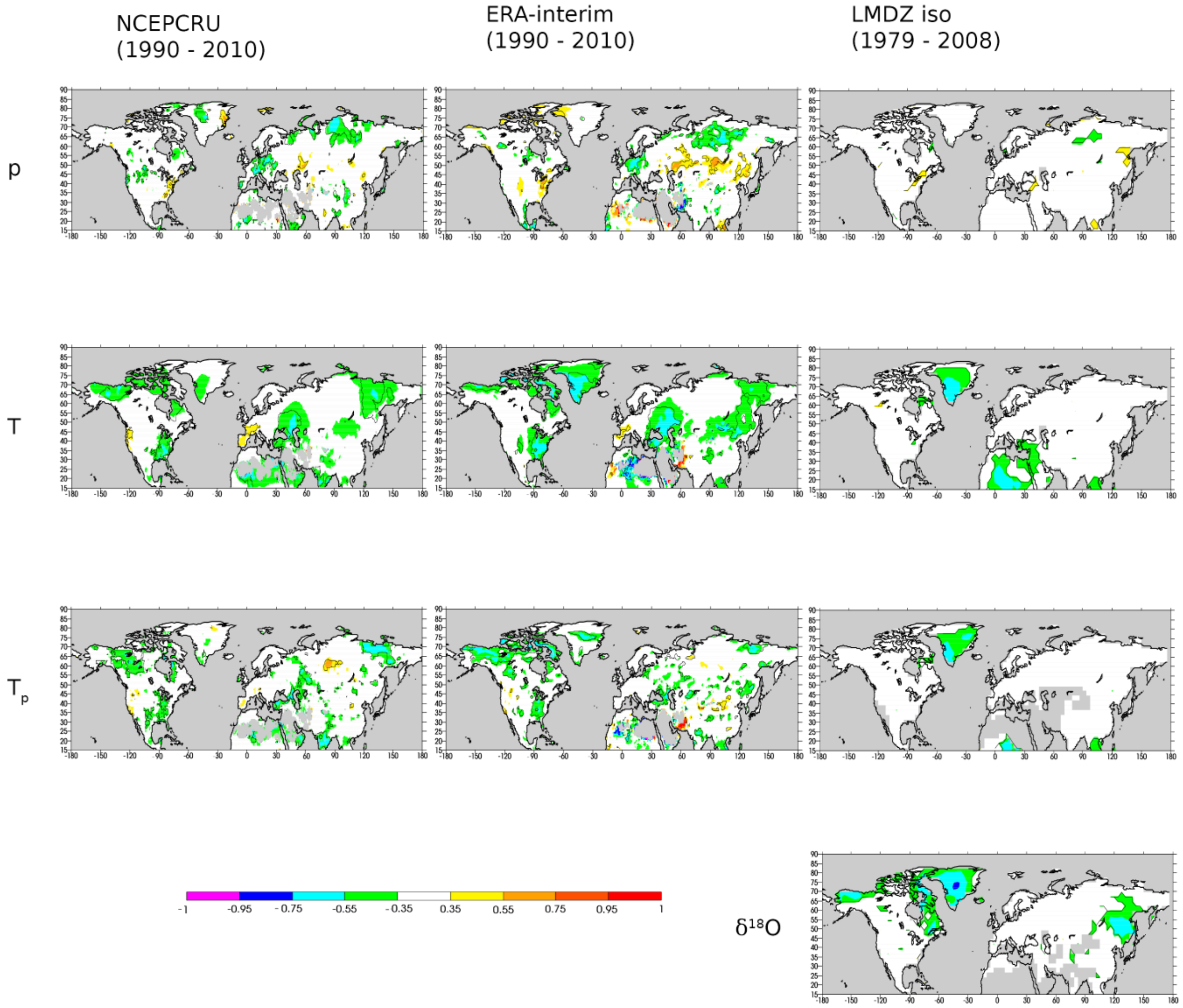


Figure S8: *same as Figure 3 but for JJAS.*

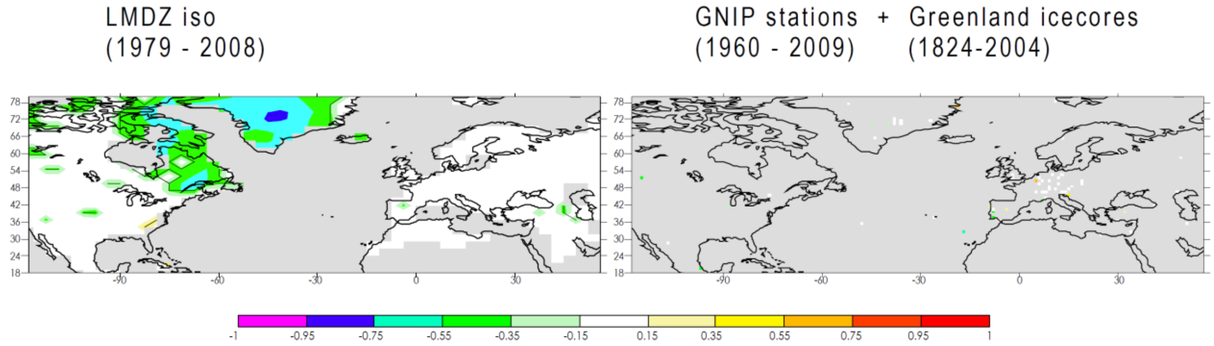


Figure S9: *same as Figure 4 but for JJAS.*

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