Arctic Vortex changes alter the sources and isotopic values of precipitation in northeastern US

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Supplementary table and figures

Table S1: Climate oscillation indices and their correspondence to weighted annual precipitation isotopes at the HBEF.

Index	by Variable	Bivariate r^2 (P value)	Kendall Tau b (Prob>|Tau b|)	Spearman Rho (Prob>|Rho|)	Hoeffding D (Prob>D)
AMO	$\delta^{18}O$	**0.69 (<.0001)**	**-0.71 (<.0001)**	**-0.89 (<.0001)**	**0.42 (<.0001)**
	d- excess value	**0.83 (<.0001)**	**0.77 (<.0001)**	**0.94 (<.0001)**	**0.53 (<.0001)**
	δ^2H	**0.3 (0.0004)**	**-0.43 (<.0001)**	**-0.60 (<.0001)**	**0.12 (<.0001)**
NAO	$\delta^{18}O$	0.02 (0.35)	0.12 (0.254)	0.18 (0.2517)	**0.03 (0.0274)**
	d- excess value	0.035 (0.2274)	-0.12 (0.2718)	-0.18 (0.26)	0.01 (0.1486)
	δ^2H	0.014 (0.7)	0.04 (0.6832)	0.08 (0.631)	0.00 (0.3688)
PNA	$\delta^{18}O$	0.014 (0.44)	-0.06 (0.5578)	-0.10 (0.5439)	0.00 (0.4184)
	d-excess value	0.008 (0.57)	0.004 (0.9666)	0.02 (0.9185)	0.00 (0.4109)
	δ^2H	0.014 (0.44)	-0.04 (0.6908)	-0.05 (0.7292)	0.00 (0.3089)
AO	$\delta^{18}O$	0.0001 (0.94)	-0.04 (0.6832)	-0.08 (0.5931)	0.00 (0.4782)
	d- excess value	0.00085 (0.85)	0.09 (0.4084)	0.13 (0.4065)	-0.01 (0.8108)
	δ^2H	0.0001 (0.93)	-0.04 (0.7298)	-0.08 (0.6018)	0.00 (0.4111)

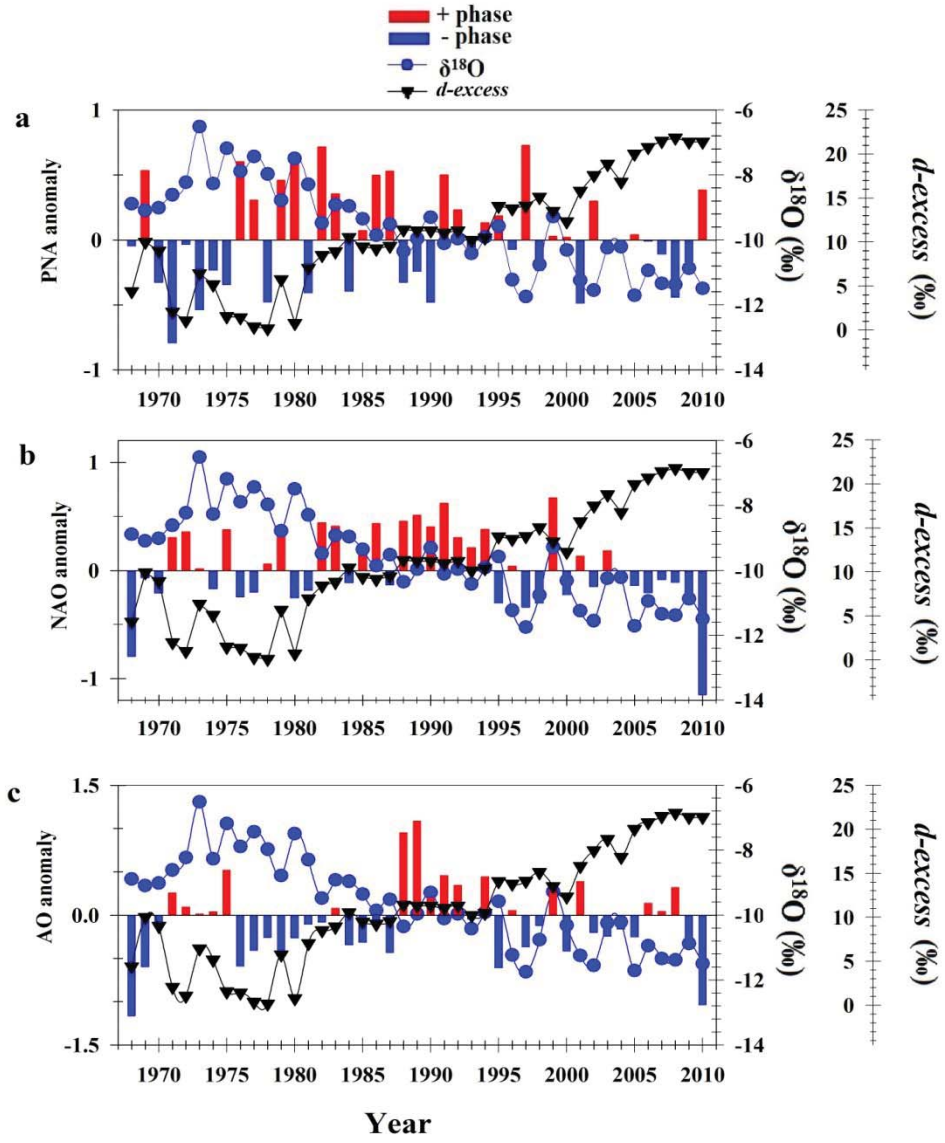

Figure S2: **HBEF precipitation water isotopes and *d-excess* value response during different climate oscillations throughout the study period.** (a) averaged monthly to annual, PNA anomalies based on modified pointwise method http://www.cpc.ncep.noaa.gov/products/precip/CWlink/pna/nao.shtml (b) monthly mean to annual , NAO index since January 1950 same date source of PNA. (c) monthly mean to annual AO at around 55°N latitude(http://www.ncdc.noaa.gov/teleconnections/ao/).

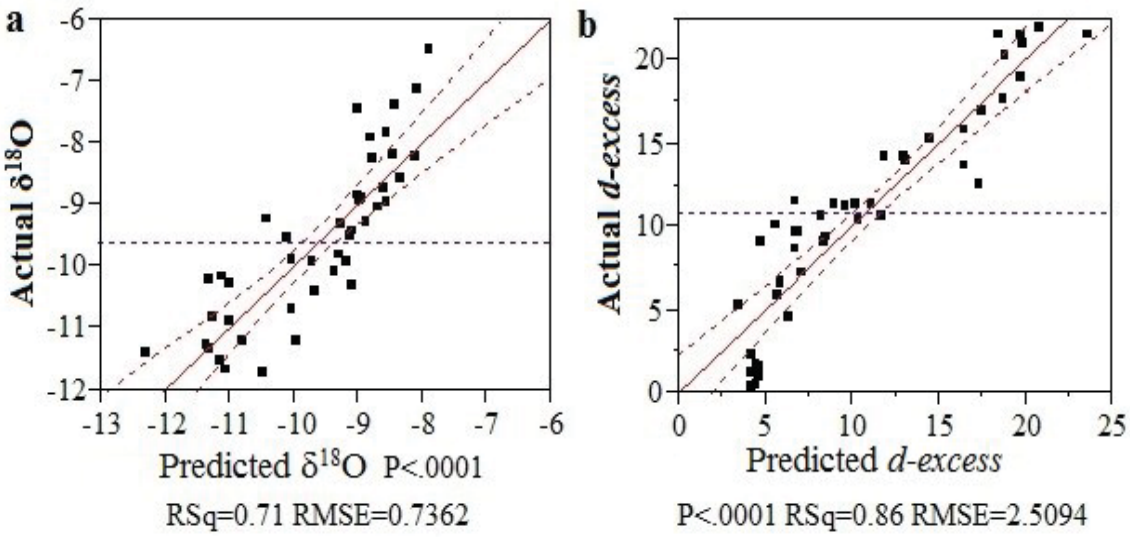

Figure S3: **Plot of predicted vs measured δ^{18}O and *d- excess* values.** The δ^{18}O plot based on the step 2 equation relating δ^{18}O values to AMO and surface air temperature. The *d-excess* plot is based on the step 4 equation relating *d-excess* to AMO, precipitation and AO. The equation explains 70% and 84% of the variability in measured precipitation δ^{18}O and *d-excess* values, respectively.

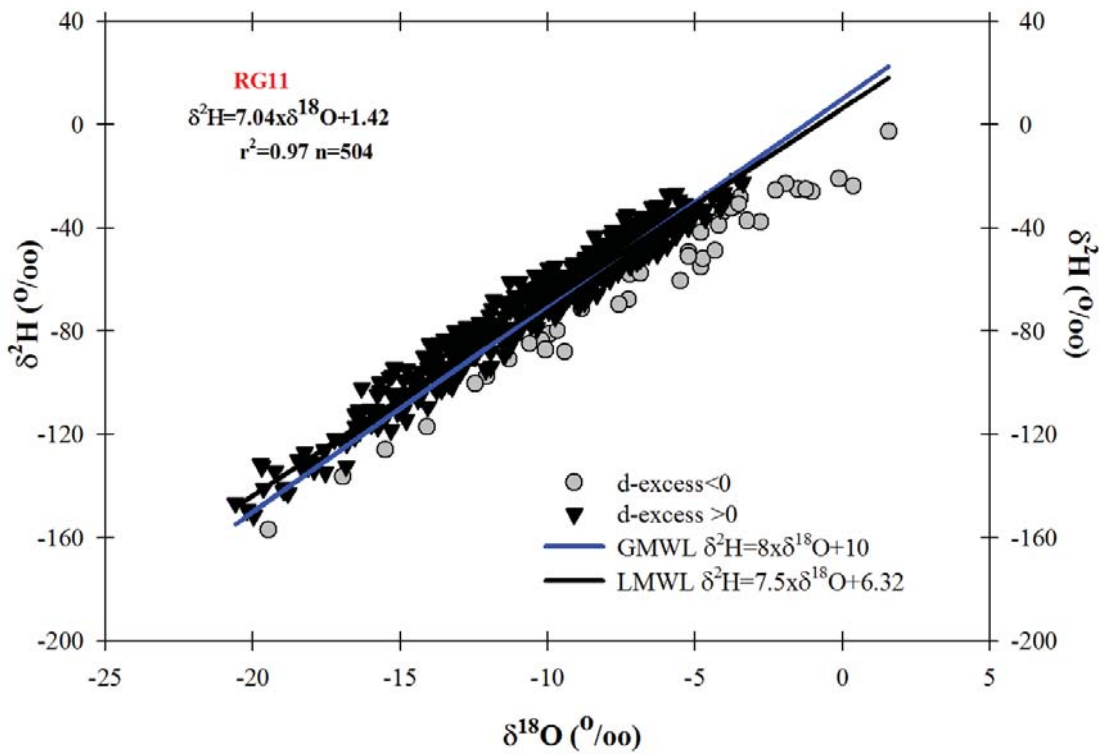

Figure S4: **A lines represent the Ottawa, Ontario line (LMWL) and global meteoric line (GMWL). Monthly δ values for RG 11.** The HBEF samples may be exhibiting some evaporative effects and hence were skewed slightly as indicated by the respective slopes of the HBEF samples (7.0) versus the Global (8.0) and 7.5 for the Ottawa precipitation samples.