1 Supplementary details

		Winter month groups		
Group-A (14 months)	**Group-B (29 months)**	**Group-C (20 months)**	**Group-D (32 months)**	**Group-E (25 months)**
month=1 year=1963	month=1 year=1960	month=1 year=1960	month=12 year=1963	month=1 year=1964
month=12 year=1963	month=2 year=1960	month=2 year=1960	month=1 year=1964	month=12 year=1965
month=2 year=1965	month=12 year=1961	month=12 year=1961	month=12 year=1965	month=1 year=1966
month=2 year=1969	month=12 year=1962	month=12 year=1962	month=1 year=1966	month=2 year=1966
month=1 year=1970	month=1 year=1963	month=2 year=1964	month=2 year=1966	month=1 year=1969
month=1 year=1973	month=12 year=1963	month=1 year=1966	month=1 year=1969	month=12 year=1972
month=12 year=1981	month=2 year=1964	month=2 year=1966	month=2 year=1969	month=2 year=1973
month=1 year=1996	month=2 year=1965	month=2 year=1968	month=12 year=1972	month=12 year=1982
month=12 year=2002	month=1 year=1966	month=12 year=1968	month=1 year=1973	month=1 year=1983
month=2 year=2005	month=2 year=1966	month=12 year=1970	month=2 year=1973	month=2 year=1983
month=12 year=2009	month=2 year=1968	month=1 year=1971	month=12 year=1982	month=12 year=1986
month=1 year=2010	month=12 year=1968	month=12 year=1976	month=1 year=1983	month=1 year=1987
month=2 year=2010	month=2 year=1969	month=2 year=1978	month=2 year=1983	month=2 year=1987
month=12 year=2010	month=1 year=1970	month=12 year=1978	month=12 year=1986	month=12 year=1987
	month=12 year=1970	month=1 year=1979	month=1 year=1987	month=12 year=1991
	month=1 year=1971	month=1 year=1985	month=2 year=1987	month=1 year=1992
	month=12 year=1976	month=1 year=1987	month=12 year=1987	month=2 year=1992
	month=2 year=1978	month=12 year=1989	month=12 year=1991	month=12 year=1994
	month=12 year=1978	month=12 year=1995	month=1 year=1992	month=12 year=1997
	month=1 year=1979	month=12 year=1996	month=2 year=1992	month=1 year=1998
	month=1 year=1985		month=12 year=1994	month=2 year=1998
	month=1 year=1987		month=12 year=1997	month=12 year=2006
	month=12 year=1989		month=1 year=1998	month=12 year=2015
	month=12 year=1995		month=2 year=1998	month=1 year=2016
	month=12 year=1996		month=12 year=2002	month=2 year=2016
	month=12 year=2009		month=12 year=2006	
	month=1 year=2010		month=12 year=2009	
	month=2 year=2010		month=1 year=2010	
	month=12 year=2010		month=2 year=2010	
			month=12 year=2015	
			month=1 year=2016	
			month=2 year=2016	

Table S1

-ZJI (14 winter months)

12/1981 [-0.02, -0.11]
01/1996 [-0.12, -0.86]
02/2005 [-0.06, 0.46]

3 winter months

01/1963 [-2.12, -0.50]
02/1965 [-1.55, -0.25]
01/1970 [-1.50, 0.48]
12/2010 [-1.85, -1.60]

4 winter months

01/1973 [0.04, 1.92]
12/2002 [-0.94, 1.31]

2 winter months

01/1964 [-0.95, 1.06]
12/1965 [1.37, 1.81]
01/1969 [-0.83, 1.14]
12/1972 [0.19, 2.28]
02/1973 [0.85, 1.34]
12/1982 [1.78, 2.28]
01/1983 [1.59, 2.32]
02/1983 [-0.53, 1.94]
12/1986 [0.99, 1.24]
02/1987 [-0.73, 1.23]
12/1987 [0.32, 1.07]
12/1991 [0.46, 1.62]
01/1992 [-0.13, 1.78]
02/1992 [1.07, 1.74]
12/1994 [2.02, 1.19]
12/1997 [-0.96, 2.32]
01/1998 [0.39, 2.37]
02/1998 [-0.11, 2.03]
12/2006 [1.34, 1.14]
12/2015 [2.24, 2.65]
01/2016 [0.12, 2.56]
02/2016 [1.58, 2.24]

01/1960 [-1.29, -0.07]
02/1960 [-1.89, -0.22]
12/1961 [-1.48, -0.16]
12/1962 [-1.32, -0.47]
02/1964 [-1.43, 0.68]
02/1968 [-1.29, -0.86]
12/1968 [-1.40, 0.94]
12/1970 [-1.20, -1.06]
01/1971 [-1.13, -1.60]
12/1976 [-1.60, 0.66]
02/1978 [-2.20, 0.42]
12/1978 [-1.57, 0.11]
01/1979 [-1.38, 0.03]
01/1985 [-1.61, -1.17]
12/1989 [-1.15, -0.01]
12/1995 [-1.67, -1.00]
12/1996 [-1.41, -0.61]

12/1963 [-1.92, 1.47]
02/1969 [-1.55, 1.31]
12/2009 [-1.93, 1.73]
01/2010 [-1.11, 1.51]
02/2010 [-1.98, 1.25]

5 winter months

01/1966 [-1.74, 1.31]
02/1966 [-1.39, 1.00]
01/1987 [-1.15, 1.22]

3 winter months

-NAO (29 winter months)

17 winter months

22 winter months
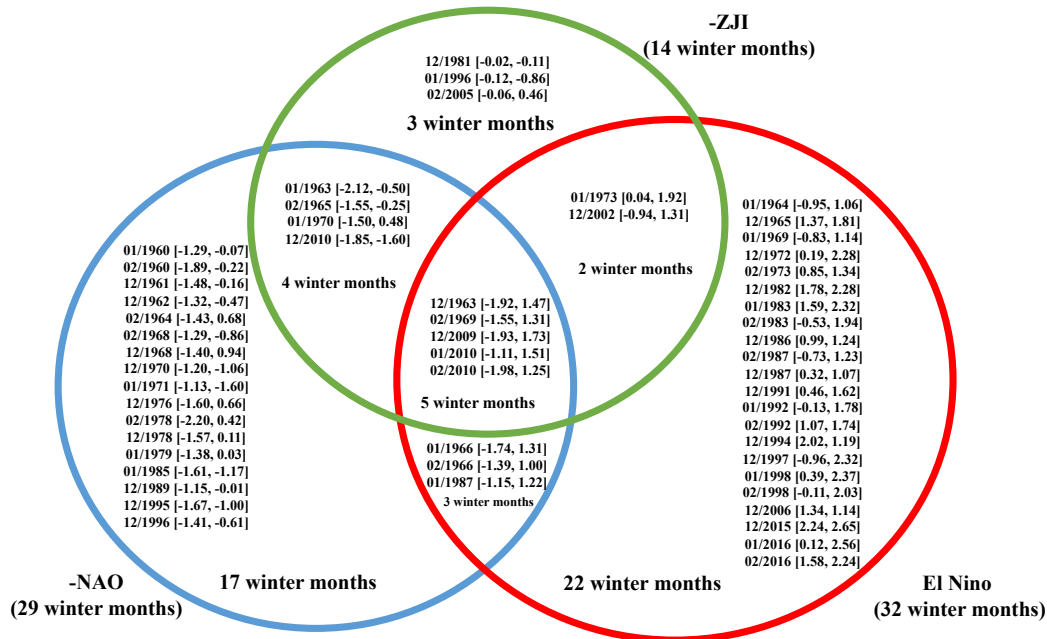
El Nino (32 winter months)

Table S2: Venn diagram of winter groups in Table S1. The winter months are mentioned as: month/year [NAO index, Oceanic Nino Index]

ERA5 Cold extreme days El Nino months

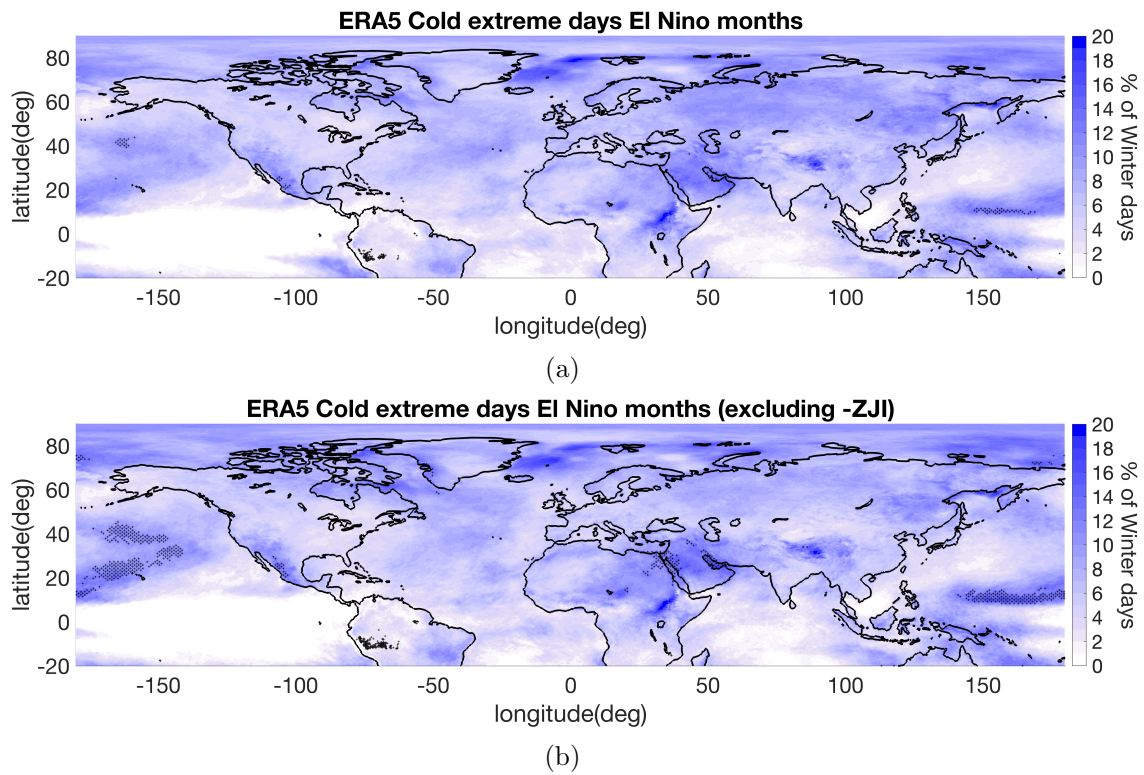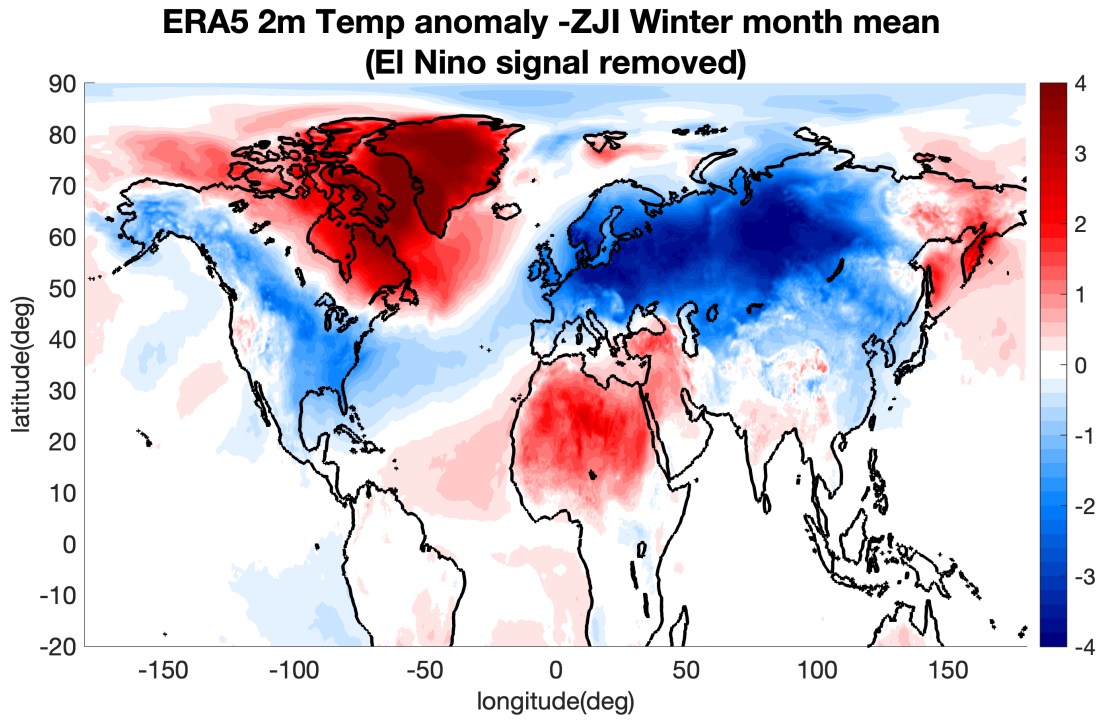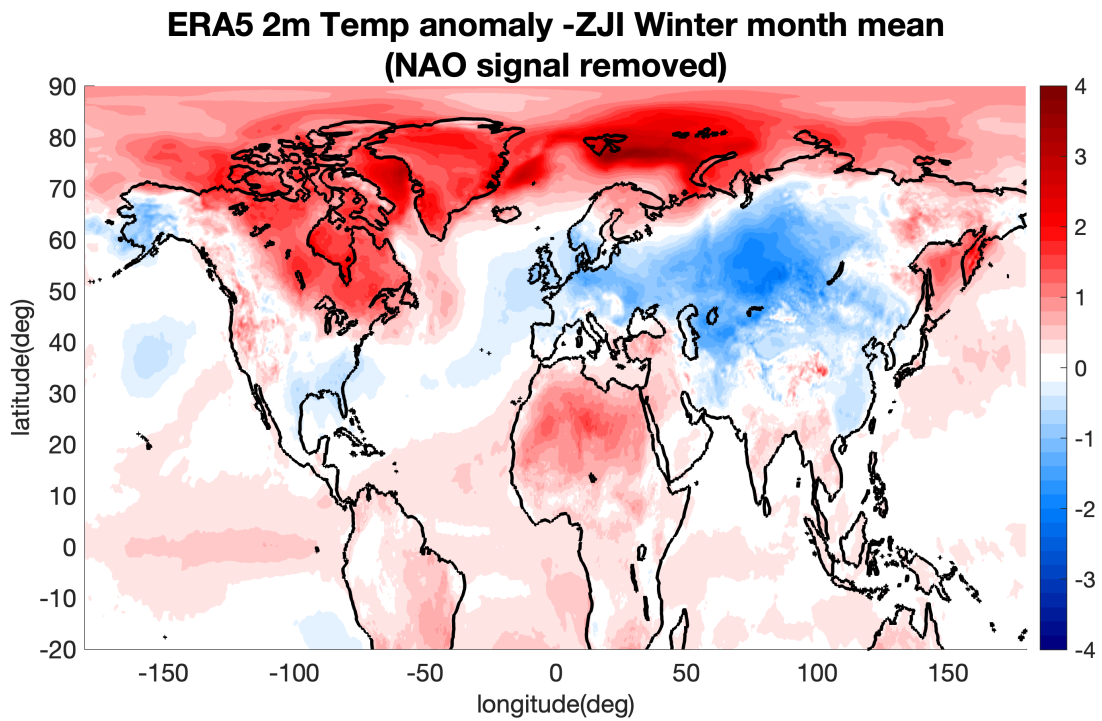**ERA5 Cold extreme days El Nino months (excluding -ZJI)**

(a)

(b)

Figure S1: The distribution of the percentage of cold extreme days for (a) El Nino winter months (b)El Nino winter months excluding merged jet months. The regions marked in (∗) represent regions significant at 99% using Monte Carlo simulation.

ERA5 2m Temp anomaly -ZJI Winter month mean (El Nino signal removed)

(a)

ERA5 2m Temp anomaly -ZJI Winter month mean (NAO signal removed)

(b)

Figure S2: Composite for anomalous detrended 2m surface temperature (K) composite for -ZJI winter months after regressing out (a) El Nino signals (b) NAO signals
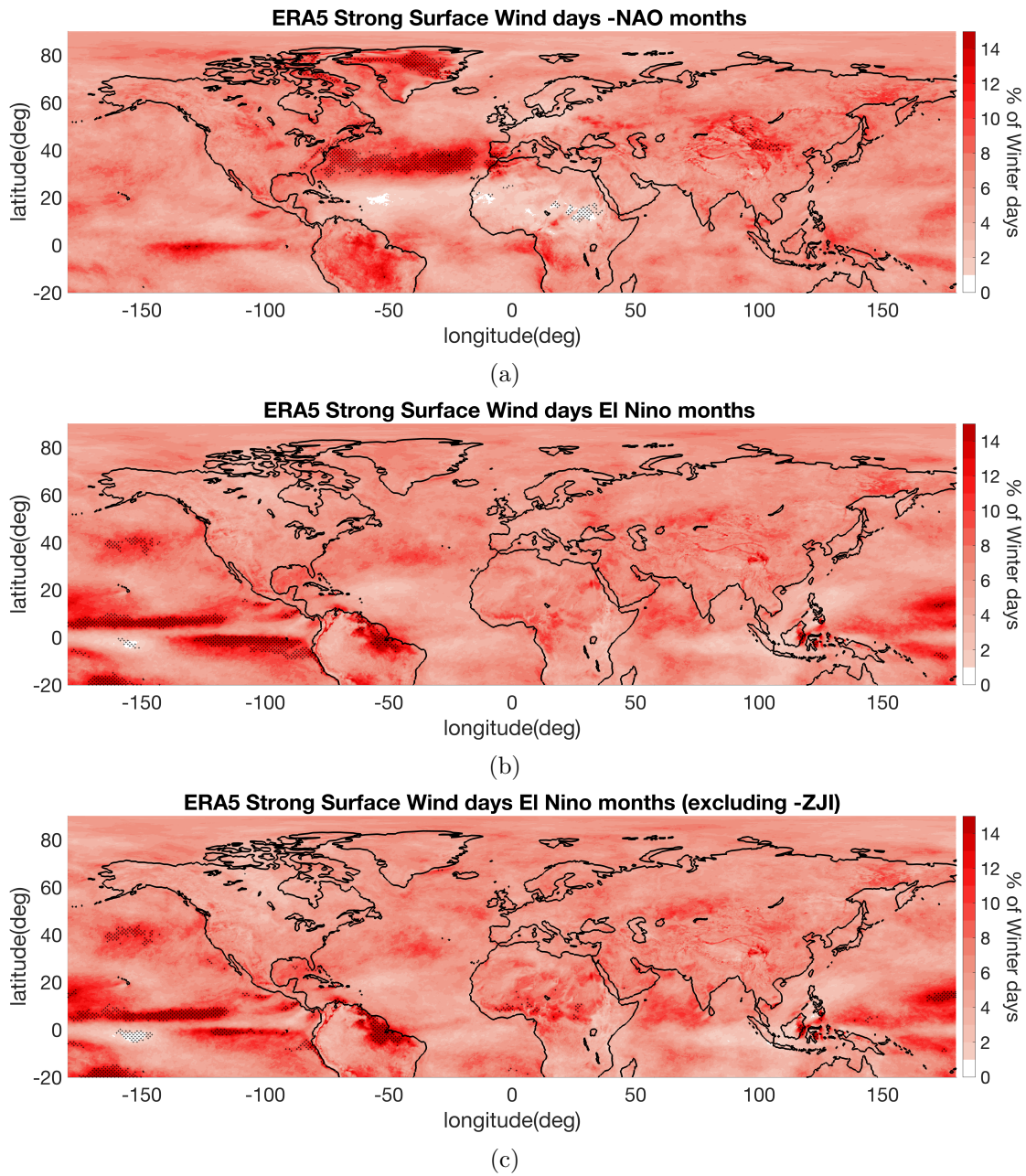
ERA5 Strong Surface Wind days -NAO months

(a)

ERA5 Strong Surface Wind days El Nino months

(b)

ERA5 Strong Surface Wind days El Nino months (excluding -ZJI)

(c)

Figure S3: The distribution of the percentage of strong surface wind days for (a) negative NAO winter months (b)El Nino winter months (c) El Nino winter months excluding merged jet months. The regions marked in (∗) represent regions significant at 99% using Monte Carlo simulation.
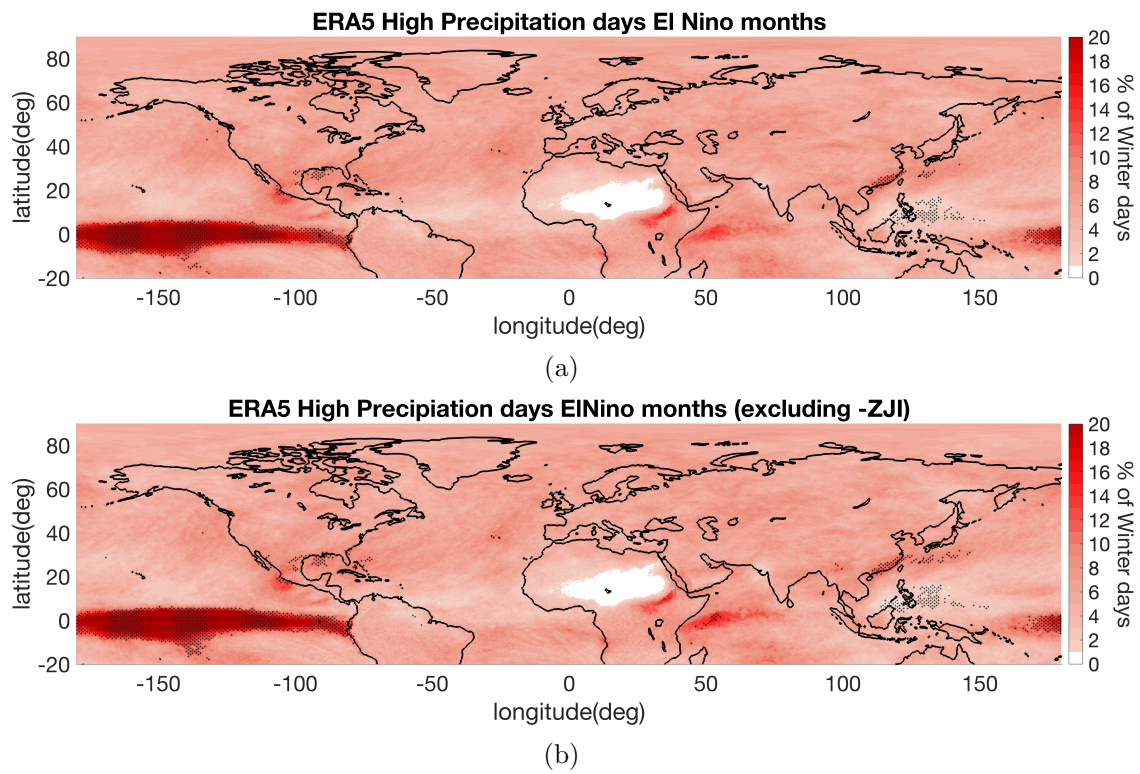
ERA5 High Precipitation days El Nino months

(a)

ERA5 High Precipiation days ElNino months (excluding -ZJI)

(b)

Figure S4: The distribution of the percentage of high precipitation days for (a) El Nino winter months (b)El Nino winter months excluding merged jet months. The regions marked in (∗) represent regions significant at 99% using Monte Carlo simulation.