

SUPPLEMENTARY MATERIAL

Table S1: SSW onset dates according to the different methods. Dates in bold indicate final warmings (those events where the ZMW becomes easterly but does not return to westerly for at least 10 consecutive days before 30 April, as in Charlton and Polvani (2007)). SSWs listed in the same row indicate the same event and are denoted as common events (See the main text for details).

U&T	EOFz	EOFu	Tanom	Urate	Trate	U60	MOM
12 Feb 1958	30 Jan 1958	27 Jan 1958	8 Feb 1958	27 Jan 1958	5 Feb 1958	31 Jan 1958	-
-	29 Nov 1958	26 Nov 1958	-	-	-	-	-
-	22 Mar 1959	-	-	-	13 Mar 1959	-	-
17 Jan 1960	5 Jan 1960	30 Dec 1959	5 Jan 1960	4 Jan 1960	1 Jan 1960	17 Jan 1960	-
-	-	-	-	-	26 Mar 1960	-	-
-	16 Dec 1960	-	-	-	8 Dec 1960	-	-
-	-	20 Mar 1961	-	28 Feb 1961	4 Mar 1961	-	9 Mar 1961
-	-	-	20 Feb 1962	-	-	-	30 Jan 1962
-	-	-	-	-	-	-	7 Mar 1962
28 Jan 1963	28 Jan 1963	6 Feb 1963	-	24 Jan 1963	21 Jan 1963	28 Jan 1963	-
-	23 Mar 1964	22 Mar 1964	-	-	28 Feb 1964	-	15 Mar 1964
-	-	-	-	5 Jan 1965	-	-	-
-	16 Dec 1965	20 Nov 1965	-	-	-	16 Dec 1965	-
23 Feb 1966	-	19 Feb 1966	-	28 Jan 1966	-	23 Feb 1966	26 Feb 1966
7 Jan 1968	31 Dec 1967	5 Jan 1968	2 Jan 1968	1 Jan 1968	27 Dec 1967	7 Jan 1968	29 Dec 1967
-	-	22 Nov 1968	-	-	-	28 Nov 1968	-
-	-	-	-	-	10 Mar 1969	13 Mar 1969	-
26 Jan 1970	1 Jan 1970	18 Dec 1970	-	29 Dec 1969	28 Dec 1969	2 Jan 1970	5 Jan 1970
18 Jan 1971	13 Jan 1971	15 Jan 1971	-	11 Jan 1971	7 Jan 1971	18 Jan 1971	15 Jan 1971
21 Mar 1971	-	7 Mar 1971	-	-	-	20 Mar 1971	-
-	-	-	-	21 Feb 1972	20 Feb 1972	-	4 Feb 1972
31 Jan 1973	31 Jan 1973	21 Feb 1973	29 Jan 1973	28 Jan 1973	26 Jan 1973	31 Jan 1973	-
-	-	20 Mar 1974	-	20 Feb 1974	23 Feb 1974	-	12 Mar 1974
-	-	-	10 Jan 1975	1 Jan 1975	28 Dec 1974	-	-
-	-	18 Mar 1975	-	26 Feb 1975	-	-	16 Mar 1975
-	-	-	-	-	27 Mar 1976	-	31 Mar 1976
9 Jan 1977	25 Dec 1976	19 Dec 1976	21 Dec 1976	19 Dec 1976	17 Dec 1976	9 Jan 1977	7 Jan 1977
-	-	-	-	-	7 Mar 1977	-	-
-	-	-	31 Jan 1978	-	27 Jan 1978	-	-
-	-	28 Mar 1978	-	-	-	-	25 Mar 1978
-	-	4 Dec 1978	-	21 Jan 1979	-	-	-
22 Feb 1979	23 Feb 1979	-	7 Feb 1979	21 Feb 1979	3 Feb 1979	22 Feb 1979	18 Feb 1979
17 Mar 1980	29 Feb 1980	-	28 Feb 1980	23 Jan 1980	25 Feb 1980	1 Mar 1980	-
-	-	-	31 Jan 1981	24 Jan 1981	1 Feb 1981	-	-
-	-	1 Mar 1981	-	-	-	4 Mar 1981	-
4 Dec 1981	-	-	-	1 Dec 1981	-	4 Dec 1981	-
-	-	-	27 Jan 1982	21 Jan 1982	21 Jan 1982	-	-
-	-	-	-	-	31 Mar 1982	-	-
-	-	-	28 Jan 1983	24 Jan 1983	20 Feb 1983	-	-
-	-	18 Mar 1983	-	-	-	-	-
1 Mar 1984	25 Feb 1984	10 Mar 1984	-	12 Jan 1984	17 Feb 1984	24 Feb 1984	25 Feb 1984

1 Jan 1985	30 Dec 1984	26 Dec 1984	31 Dec 1984	28 Dec 1984	26 Dec 1984	1 Jan 1985	25 Dec 1984
-	-	-	-	14 Feb 1986	13 Feb 1986	-	7 Jan 1986
-	-	-	-	-	-	-	21 Mar 1986
24 Jan 1987	23 Jan 1987	21 Jan 1987	18 Jan 1987	20 Jan 1987	19 Jan 1987	23 Jan 1987	20 Jan 1987
8 Dec 1987	6 Dec 1987	1 Dec 1987	-	2 Dec 1987	18 Nov 1987	8 Dec 1987	10 Dec 1987
14 Mar 1988	-	-	-	20 Feb 1988	7 Mar 1988	14 Mar 1988	-
21 Feb 1989	19 Feb 1989	12 Mar 1989	12 Feb 1989	24 Jan 1989	8 Feb 1989	21 Feb 1989	-
-	-	-	9 Feb 1990	7 Feb 1990	4 Feb 1990	-	-
-	-	5 Feb 1991	28 Jan 1991	11 Dec 1990	17 Jan 1991	-	-
-	-	-	18 Jan 1992	11 Jan 1992	8 Jan 1992	-	-
-	-	-	-	-	-	-	22 Mar 1992
-	-	-	-	11 Feb 1993	-	-	-
-	2 Jan 1994	30 Dec 1993	30 Dec 1993	29 Dec 1993	27 Dec 1993	-	-
-	-	-	-	-	24 Mar 1994	-	-
-	-	-	29 Jan 1995	19 Jan 1995	24 Jan 1995	-	2 Feb 1995
-	-	-	-	-	20 Mar 1995	-	-
-	-	-	-	13 Feb 1996	14 Feb 1996	-	-
-	-	17 Nov 1996	-	12 Jan 1997	-	-	-
-	-	26 Dec 1997	26 Dec 1997	3 Dec 1997	17 Dec 1997	-	-
-	6 Jan 1998	-	-	-	30 Jan 1998	-	-
-	-	30 Mar 1998	-	-	-	-	-
15 Dec 1998	14 Dec 1998	12 Dec 1998	-	14 Dec 1998	11 Dec 1998	15 Dec 1998	15 Dec 1998
26 Feb 1999	27 Feb 1999	27 Feb 1999	26 Feb 1999	23 Feb 1999	19 Feb 1999	26 Feb 1999	24 Feb 1999
20 Mar 2000	-	-	-	-	10 Mar 2000	20 Mar 2000	-
-	-	18 Nov 2000	20 Dec 2000	-	7 Dec 2000	-	-
11 Feb 2001	13 Feb 2001	4 Feb 2001	-	31 Jan 2001	25 Jan 2001	11 Feb 2001	15 Mar 2001
31 Dec 2001	25 Dec 2001	29 Dec 2001	27 Dec 2001	23 Dec 2001	19 Dec 2001	31 Dec 2001	-
18 Feb 2002	-	-	-	12 Feb 2002	11 Feb 2002	18 Feb 2002	21 Mar 2002
18 Jan 2003	18 Jan 2003	-	31 Dec 2002	14 Jan 2003	26 Dec 2002	18 Jan 2003	17 Jan 2003
-	-	-	-	-	28 Mar 2003	-	-
-	3 Jan 2004	30 Dec 2003	20 Dec 2003	16 Dec 2003	15 Dec 2003	5 Jan 2004	2 Jan 2004
-	-	-	-	-	-	-	-
-	-	15 Mar 2005	-	26 Jan 2005	20 Feb 2005	-	11 Mar 2005
21 Jan 2006	21 Jan 2006	10 Jan 2006	12 Jan 2006	21 Jan 2006	9 Jan 2006	21 Jan 2006	17 Jan 2006
-	-	-	-	-	31 Dec 2006	-	-
24 Feb 2007	-	-	-	21 Feb 2007	20 Feb 2007	24 Feb 2007	-
-	-	-	25 Jan 2008	22 Jan 2008	20 Jan 2008	-	-
22 Feb 2008	24 Feb 2008	-	-	-	-	22 Feb 2008	18 Feb 2008
25 Jan 2009	23 Jan 2009	25 Jan 2009	-	22 Jan 2009	17 Jan 2009	25 Jan 2009	18 Jan 2009
-	-	21 Nov 2009	-	-	-	-	-
-	-	26 Jan 2010	-	22 Jan 2010	18 Jan 2010	9 Feb 2010	-
-	-	22 Mar 2010	-	-	-	24 Mar 2010	-
-	-	-	-	-	28 Jan 2011	-	-
-	-	9 Feb 2012	18 Jan 2012	11 Jan 2012	12 Jan 2012	-	7 Mar 2012
-	-	-	-	1 Dec 2012	-	-	-
-	6 Jan 2013	23 Dec 2012	6 Jan 2013	5 Jan 2013	1 Jan 2013	6 Jan 2013	-
-	-	-	-	-	13 Mar 2014	-	-

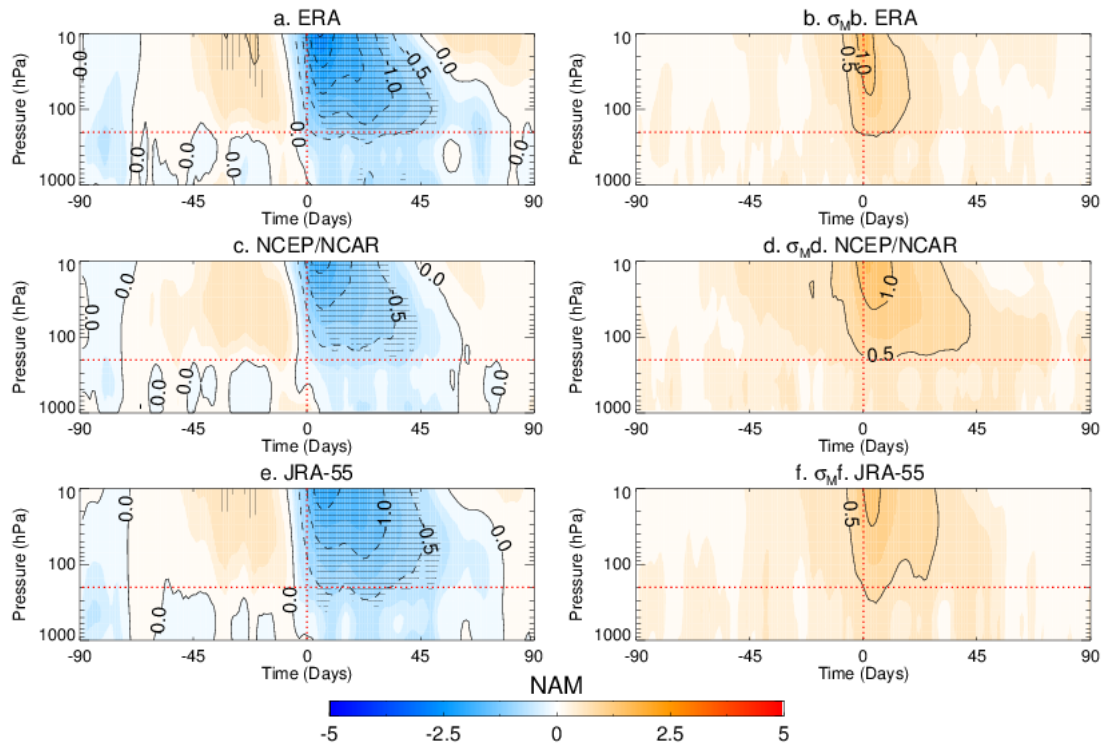


FIG. S1. Left: Multi-method means (MMM) of the time-height NAM index composites (in standard deviation units) for the: (a) ERA; (c) NCEP/NCAR; and (e) JRA-55 reanalysis from 1958 to 2014. Right: Inter-method standard deviation (σ_M) of the time-height NAM composites for the: (b) ERA; (d) NCEP/NCAR; and (f) JRA-55 reanalysis. The abscissa denotes days relative to the SSW onset date. The red horizontal line indicates the 200 hPa pressure level (i.e., approximately the extratropical tropopause). Hatched areas indicate regions where more of 75% of the methods agree in the sign and significance of the NAM signal. MOM definition is not included in the composites.

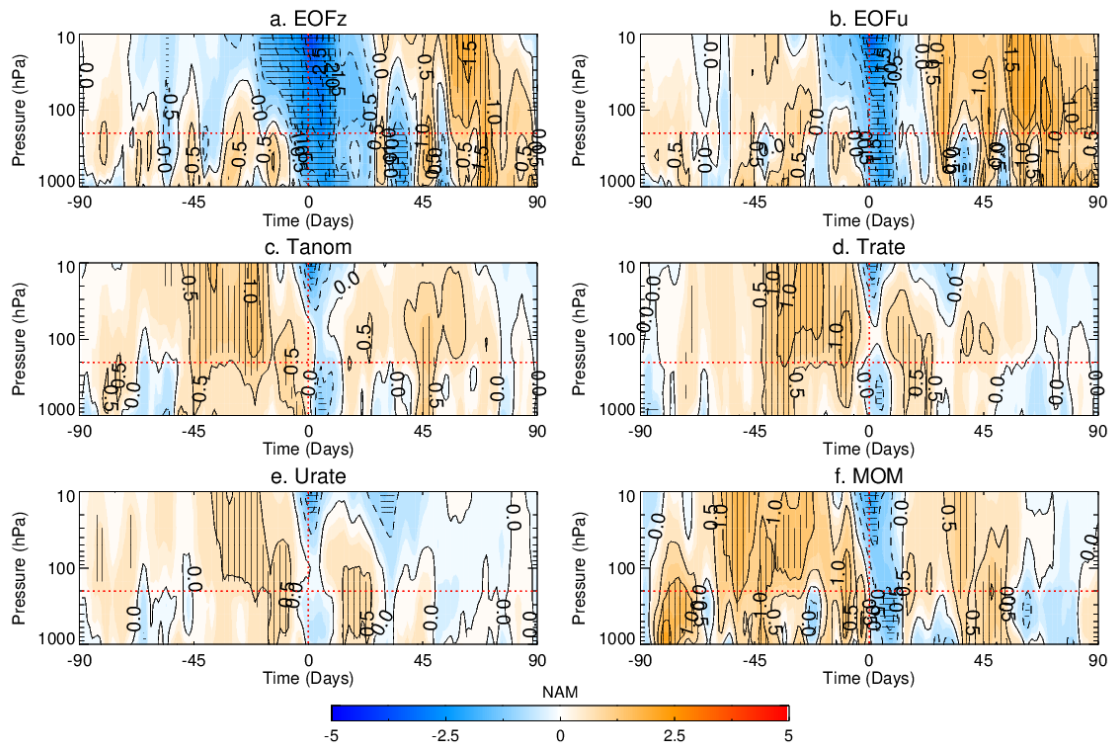


FIG. S2. Same as Fig. 6 but for minor SSWs only. Note that U&T and U60 are not included herein. Results are shown for the readjusted onset dates (See the main text for details).

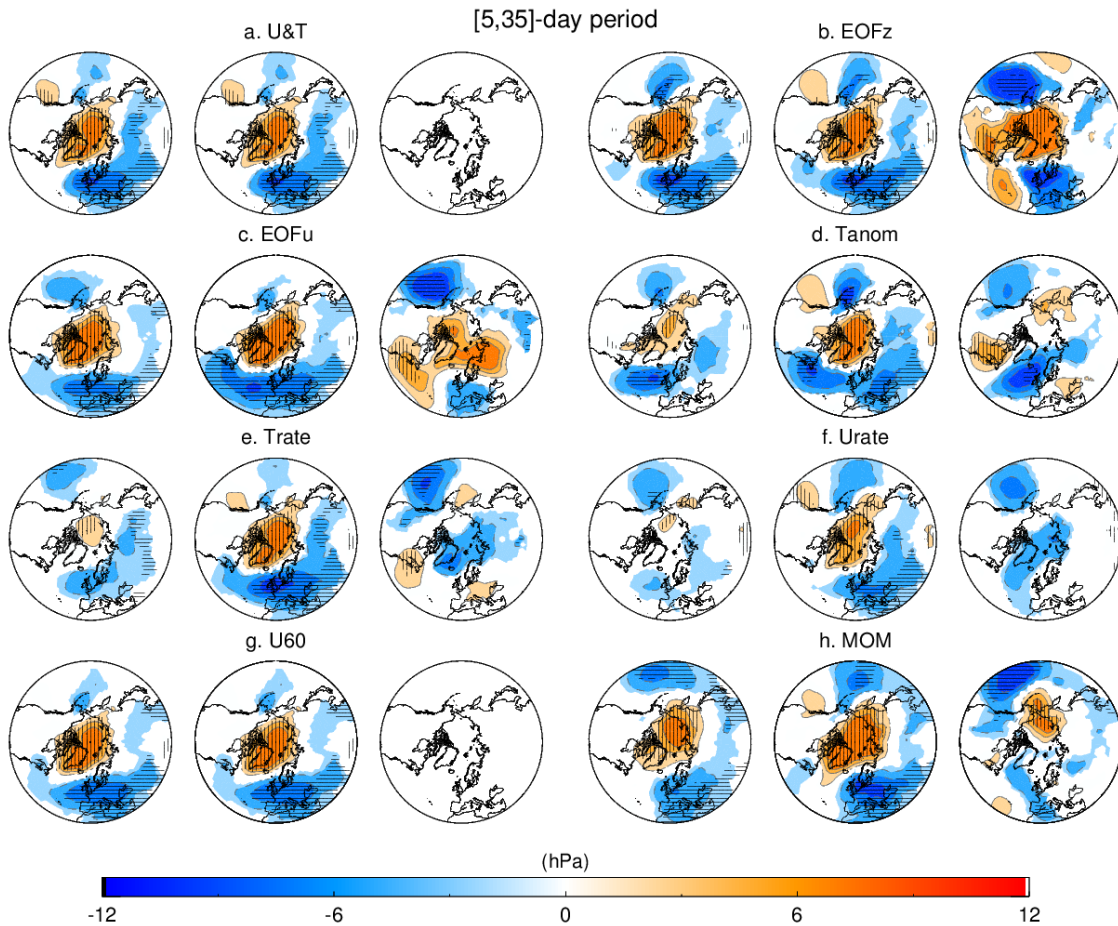


FIG. S3. SSW-based composites of the mean sea-level pressure (MSLP) anomalies (in hPa) in the [5,35]-day period after events for: (a) U&T; (b) EOFz; (c) EOFu; (d) Tanom; (e) Urate; (f) Trate; (g) U60; and (h) MOM. The three panels of each method show the corresponding composites for: (left) all; (middle) major and; (right) minor SSWs. Horizontal (vertical) hatched areas indicate negative (positive) anomalies that are statistically significant at the 95% confidence level according to a 1000-trial Monte Carlo test. Results are shown for the readjusted onset days (See the main text for details). Note that U&T and U60 do not include minor SSWs.

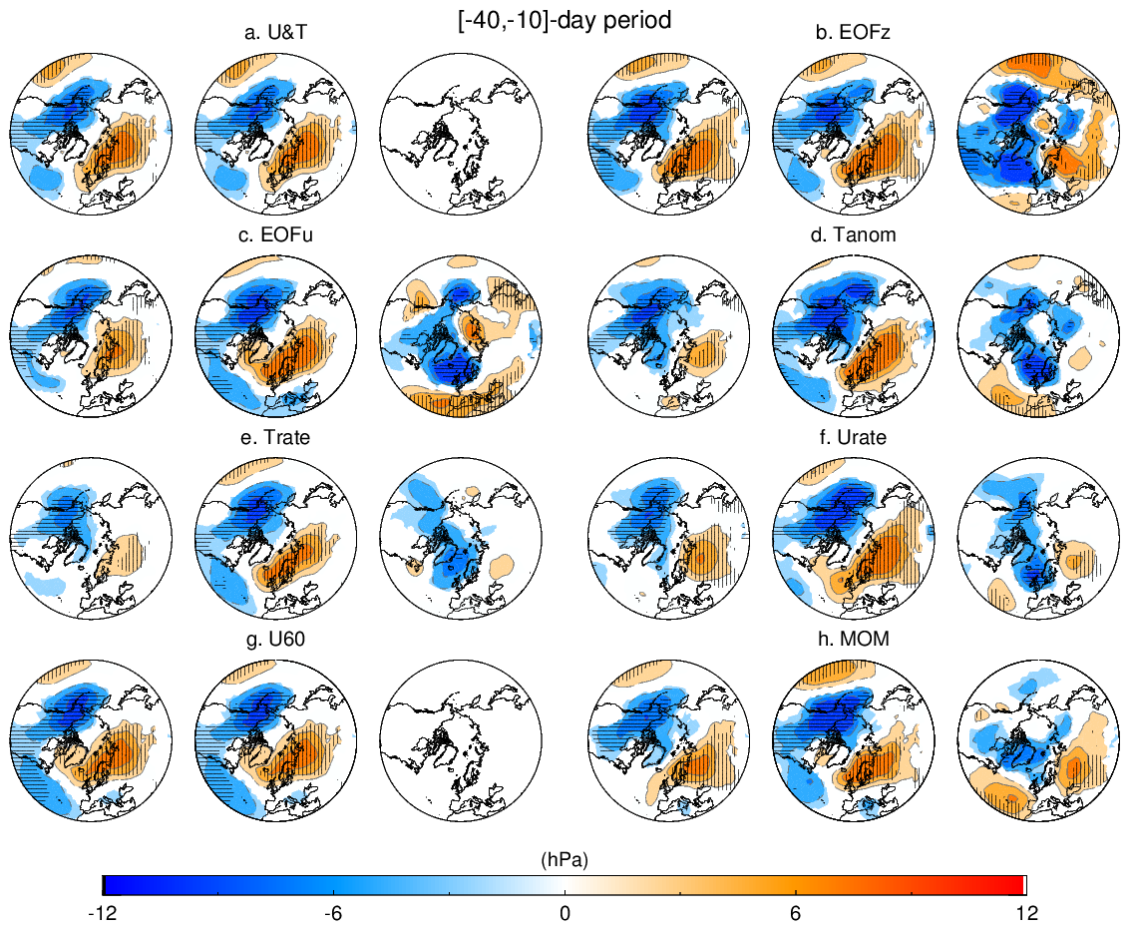


FIG. S4. Same as Fig. S3 but for the [-40,-10]-day period prior to events.

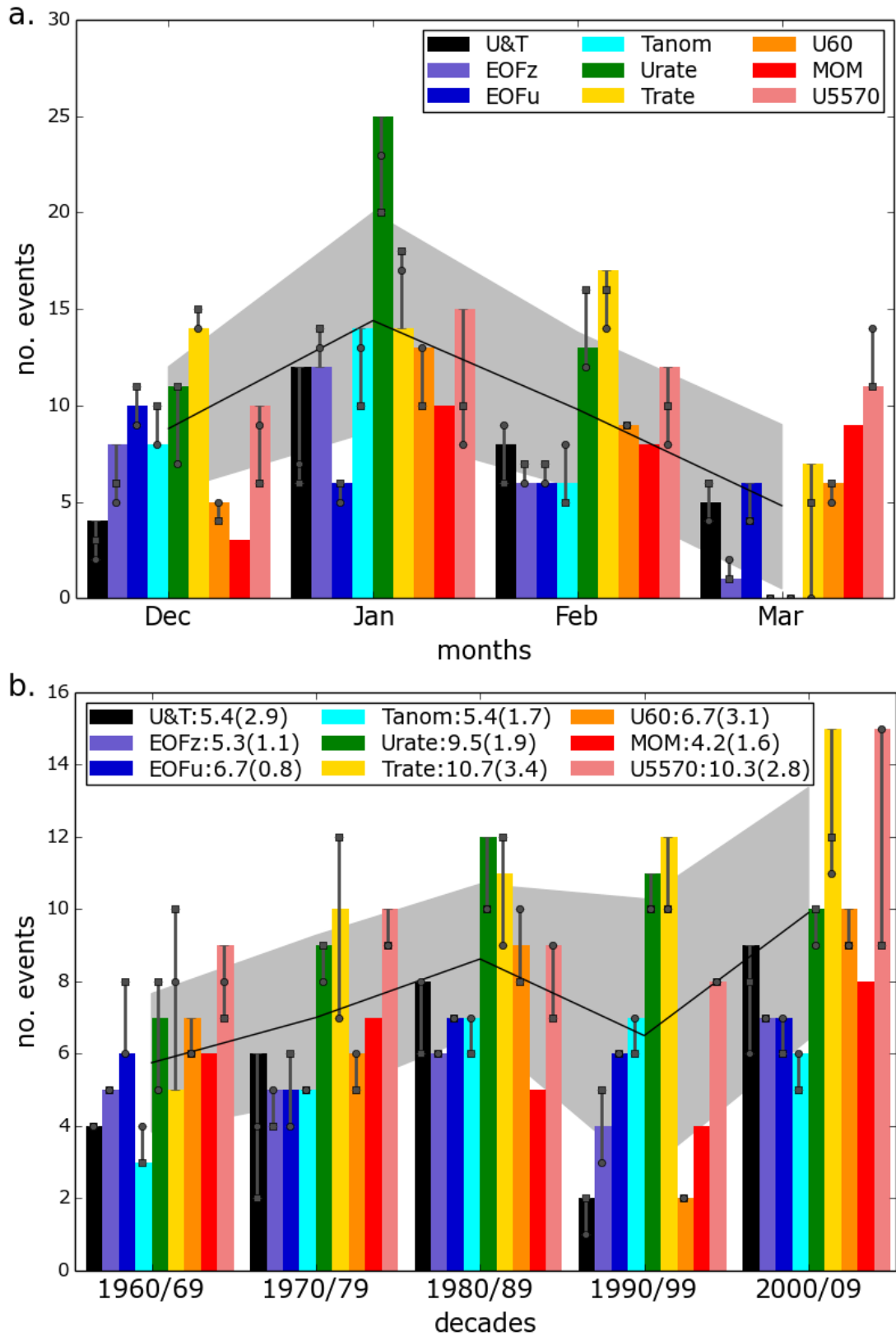


FIG. S5. (a) As Fig. 2 and (b) as in Fig. 3 but adding the U5570 method (See the main text for details).