

1 **Supplementary Materials for**

2 “Evolution of Arctic Sea Ice Concentration Trends and the Role of Atmospheric

3 Circulation Forcing, 1979-2007” by Clara Deser and Haiyan Teng

4 Submitted to *Geophysical Research Letters*, Sep 13 2007; Revised Nov 16 2007

5  
6 **Empirical orthogonal function analysis of sea ice concentration anomalies**

7 Are the Sea Ice Concentration (SIC) trend patterns shown in Fig. 1 of the  
8 manuscript preferred structures of variability, or are they simply a result of dividing the  
9 record in half? To address this question, we have applied Empirical Orthogonal Function  
10 (EOF) analysis to the covariance matrix of SIC anomalies over the full period of record,  
11 using a separate EOF analysis for winter and for summer. The two leading EOFs in each  
12 season and their associated principal component (PC) time series are shown in Fig. S1. In  
13 each season, the first and second EOFs account for approximately 30% and 17% of the  
14 variance, respectively, and are well separated according to the criterion of North et al.  
15 (1982).

16 In winter, the leading EOF exhibits out-of-phase variations between the eastern  
17 and western Atlantic and between the eastern and western Pacific, strongly reminiscent of  
18 the trend pattern during the first half of the record (see Fig. 1 in the manuscript). This  
19 EOF is nearly identical to that in Ukita et al. (2007) based on February-March averages  
20 over the period 1979-2003, and consistent with results obtained using data sets beginning  
21 in the early 1950s (Walsh and Johnson, 1979; Fang and Wallace, 1994; Deser et al.,  
22 2000). The associated PC time series exhibits an upward trend from 1979 to 1995, near  
23 zero values from 1996 through 2004, and positive values from 2005 through 2007. EOF2

24 of winter SIC is characterized by uniform polarity throughout the Arctic marginal ice  
25 zones, with largest amplitudes in the Labrador Sea. This EOF resembles the trend pattern  
26 during the second half of the record (see Fig. 1 in the manuscript). Its PC time series  
27 exhibits generally negative values before 1995 and positive values thereafter, indicative  
28 of a decreasing trend of winter SIC in the peripheral seas. To our knowledge, such an  
29 EOF pattern has not been reported previously for winter SIC. It is notable that the first  
30 and second EOFs of winter SIC anomalies during 1979-2007 correspond to the winter  
31 SIC trend patterns in the first and second halves of the record, respectively, indicating  
32 that these two trend patterns dominate the variability over the period of study.

33 The leading EOF of summer SIC anomalies during 1979-2006 exhibits uniform  
34 polarity throughout most of the Arctic marginal ice zone, with largest amplitudes from  
35 the Laptev Sea eastward to the Beaufort Sea. This EOF resembles closely the patterns of  
36 summer SIC trends during 1979-2006 and 1993-2006, and projects substantially onto the  
37 trend pattern for 1979-1993 (see Fig. 1 in the manuscript). This similarity is consistent  
38 with the fact that the leading PC time series exhibits an upward trend over the period of  
39 record. The second EOF of summer SIC anomalies consists of out-of-phase variations  
40 between the Barents/Kara Seas and the East Siberian/Beaufort Seas, with no discernible  
41 trend in its PC time series. This EOF does not correspond closely to any of the summer  
42 SIC trend patterns shown in Fig. 1 in the manuscript, although it captures some of the  
43 out-of-phase behavior evident in the early period.

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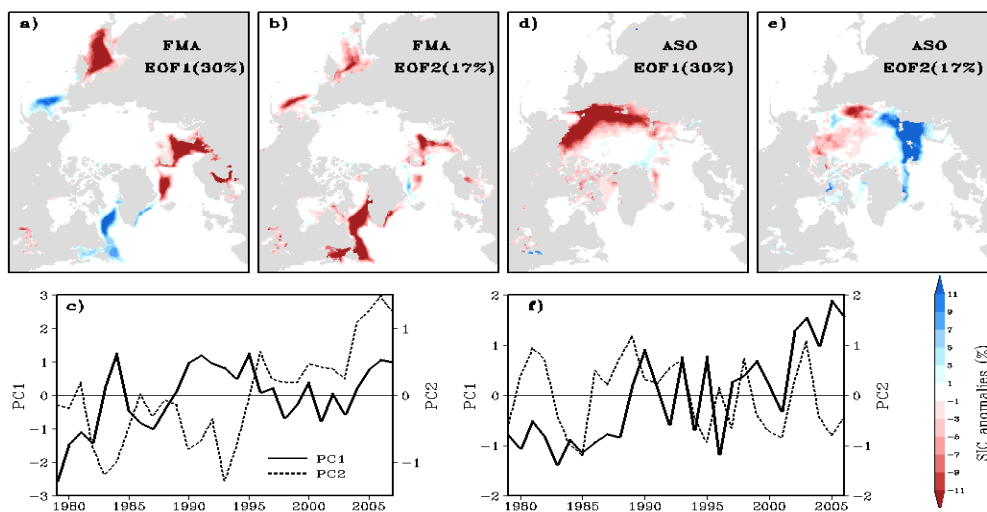
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## 58 **Figure Caption**

59 Figure S1. Sea ice concentration EOFs 1 and 2 and their associated PC time series based  
60 on the period 1979-2007 for winter (panels a – c) and 1979-2006 for summer (panels d –  
61 f). EOF 1 (2) accounts for 30% (17%) of the variance in each season

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## 63 **Figures**



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65 **Figure S1.** Sea ice concentration EOFs 1 and 2 and their associated PC time series based  
66 on the period 1979-2007 for winter (panels a – c) and 1979-2006 for summer (panels d –  
67 f). EOF 1 (2) accounts for 30% (17%) of the variance in each season