

1 **Supplementary material**

2

3 **Global meteorological drought: Part II - Seasonal forecasts**

4

5 **E. Dutra¹, W. Pozzi², F. Wetterhall¹, F. Di Giuseppe¹, L. Magnusson¹, G. Naumann³, P.**
6 **Barbosa³, J. Vogt³, and F. Pappenberger¹**

7 [1]{European Centre for Medium-Range Weather Forecasts, Reading, United Kingdom}

8 [2]{Group on Earth Observations, Geneva, Switzerland}

9 [3]{Joint Research Centre, Institute for Environment and Sustainability, Ispra, Italy}

10

11 Correspondence to: E. Dutra (emanuel.dutra@ecmwf.int)

12

13 **List of figures**

14 Figure S1. Regions used in the analysis adapted from Giorgi and Francisco (2000). 3

15 Figure S2. As Figure 1 but for the Amazon region (AMZ). 4

16 Figure S3. As Figure 1 but for the Australia region (AUS) 5

17 Figure S4. As Figure 1 but for the Central America region (CAM). 6

18 Figure S5. As Figure 1 but for the Central Asia region (CAS). 7

19 Figure S6. As Figure 1 but for the Central North America region (CNA). 8

20 Figure S7. As Figure 1 but for the East Africa region (EAF). 9

21 Figure S8. As Figure 1 but for the East Asia region (EAS). 10

22 Figure S9. As Figure 1 but for the Eastern North America region (ENA). 11

23 Figure S10. As Figure 1 but for the Mediterranean region (MED). 12

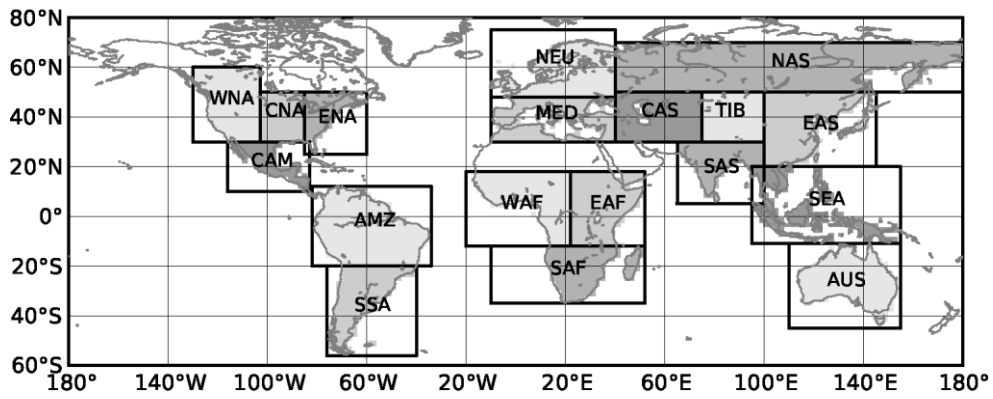
24 Figure S11. As Figure 1 but for the North Asia region (NAS). 13

25 Figure S12. As Figure 1 but for the Northern Europe region (NEU). 14

1	<u>Figure S13. As Figure 1 but for the South Africa region (SAF).</u>	15
2	<u>Figure S14. As Figure 1 but for the South Asia region (SAS).</u>	16
3	<u>Figure S15. As Figure 1 but for the South East Asia region (CNA).</u>	17
4	<u>Figure S16. As Figure 1 but for the South South America region (SSA).</u>	18
5	<u>Figure S17. As Figure 1 but for the Tibet region (TIB).</u>	19
6	<u>Figure S18. As Figure 1 but for the West Africa region (WAF).</u>	20
7	<u>Figure S19. As Figure 1 but for the West North America region (WNA).</u>	21
8	<u>Figure S20. Drought onset frequency distributions of (a) brier score, (b) reliability, (c)</u>	
9	<u>resolution, (d) sharpness and (e) brier skill score for the SPI forecasts produced by GPC</u>	
10	<u>(red0, GPC CLM (black), ERAI S4 (blue) and ERAI CLM (gray). The statistics are based</u>	
11	<u>only on land points (similar to Yuan and Wood (2013)), and the reference forecasts for the</u>	
12	<u>brier skill score was the climatological frequency of the verification dataset (GPC).</u>	22
13	<u>Figure S21. Seasonal forecasts of 6-month SPI in the Horn of Africa region (3S-12N, 40E-</u>	
14	<u>52E) given by GPC S4 (blue) and GPC CLM (black), and the GPC monitoring (red)</u>	
15	<u>issued in September 2011 (top left), October 2011 (top right), February 2012 (bottom left) and</u>	
16	<u>March 2012 (bottom right). . The solid lines represent the ensemble mean forecasts of GPC</u>	
17	<u>S4 (blue) and GPC CLM (black), and the dashed blue line the GPC S4 ensemble mean</u>	
18	<u>rescaled. The shaded areas represent the ensemble distribution between the percentiles 30 to</u>	
19	<u>70 (dark shading) and minimum to maxim (light shading). The horizontal dotted lines denote</u>	
20	<u>the -0.8, 0 and 0.8 SPI values, and the vertical dotted line forecast issue date.</u>	23
21	<u>Figure S22. Seasonal forecasts of SPI-6 given by GPC S4 issued in October 2010 and valid</u>	
22	<u>for March 2011: ensemble mean (top left), ensemble mean rescaled (top right), probability of</u>	
23	<u>SPI> 0.8 (middle left), probability of SPI <-0.8 (middle right). Lower panel: SPI-6 in March</u>	
24	<u>2011 from GPC. In all maps gray denote grid-point where the SPI is not defined.</u>	24
25	<u>Figure S23. As Figure S21 but for the the SPI-6 forecasts issued in March, May, July and</u>	
26	<u>August 2012 for the U.S. Great Plains region (35N-45N, 110W-90W).</u>	25
27	<u>Figure S24. As Figure S22 but for the the SPI-6 forecasts issued in April 2012 and valid for</u>	
28	<u>August 2012 in the U.S. Great Plains region (35N-45N, 110W-90W).</u>	26

29
30

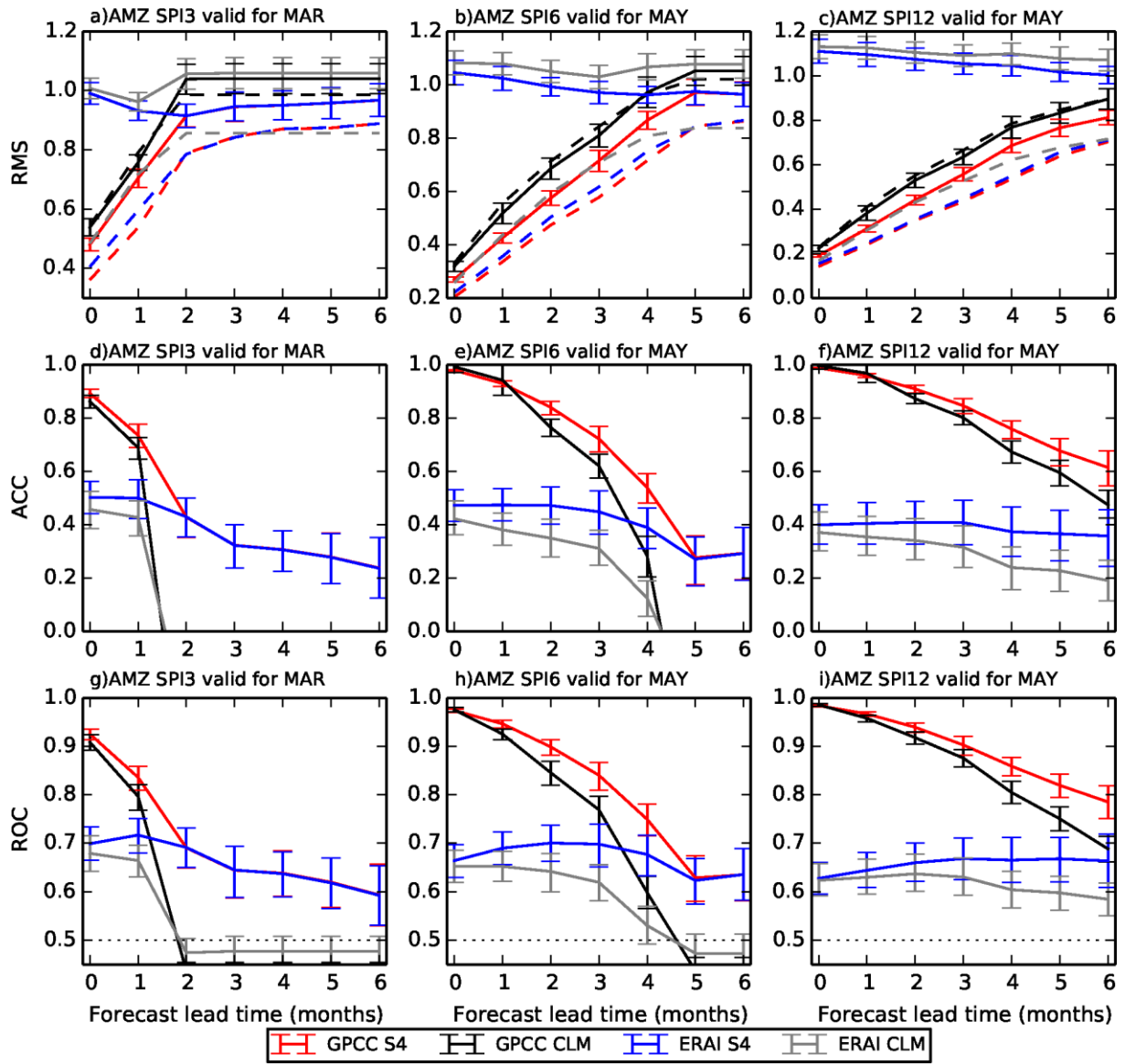
1 **Figures**



2

3 Figure S1. Regions used in the analysis adapted from Giorgi and Francisco (2000).

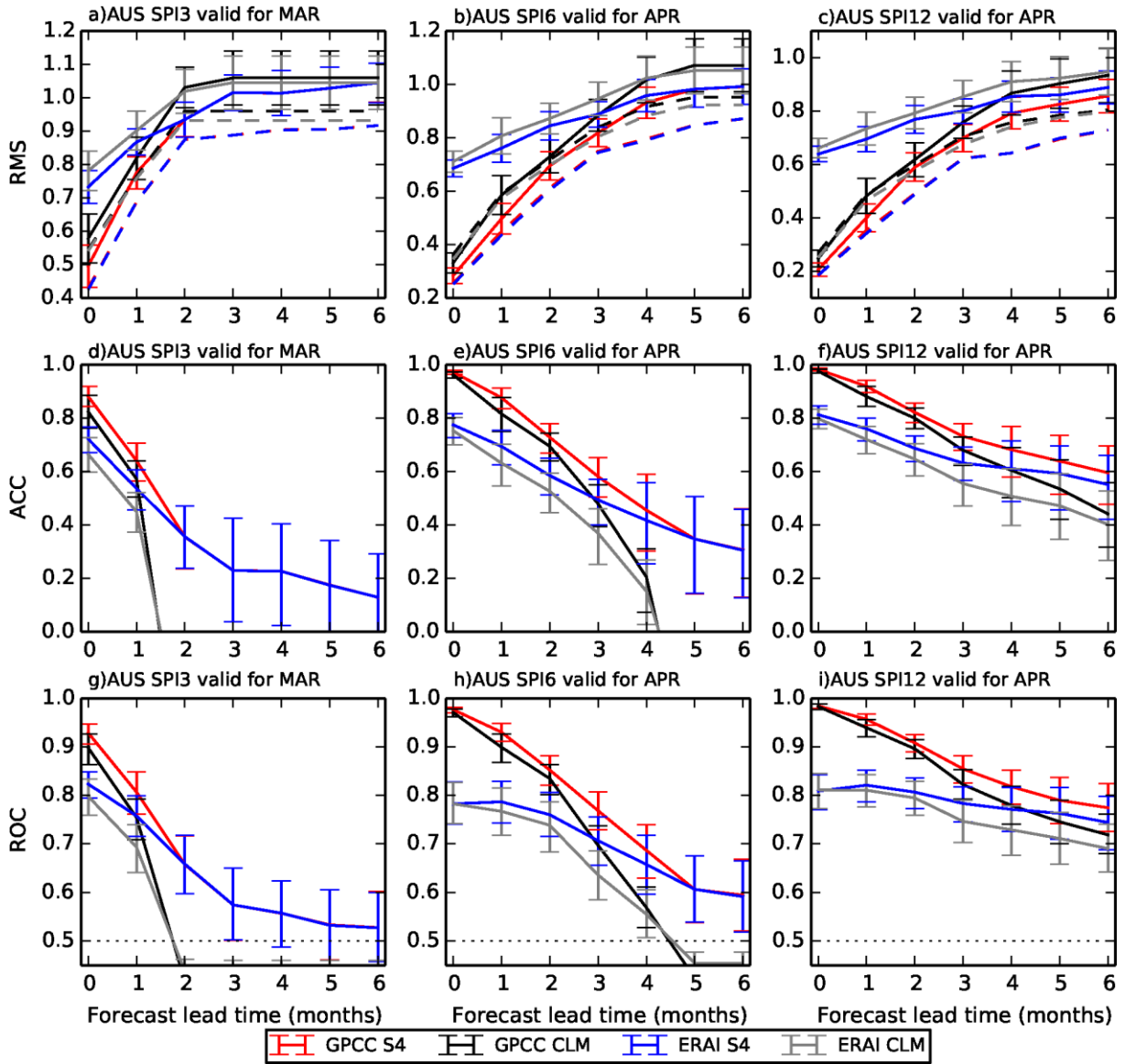
4



1

2 Figure S2. As Figure 1 but for the Amazon region (AMZ).

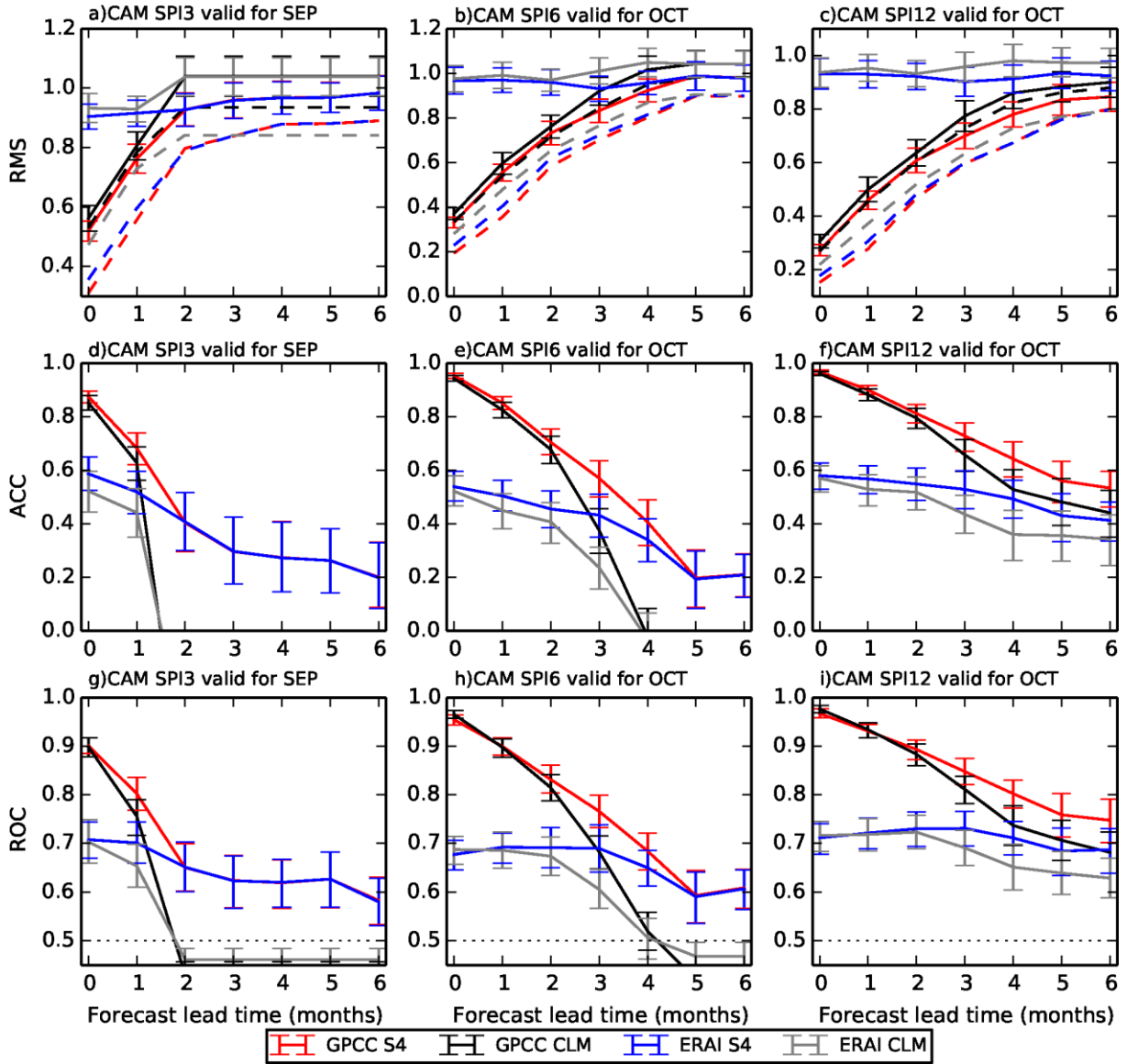
1



2

3 Figure S3. As Figure 1 but for the Australia region (AUS)

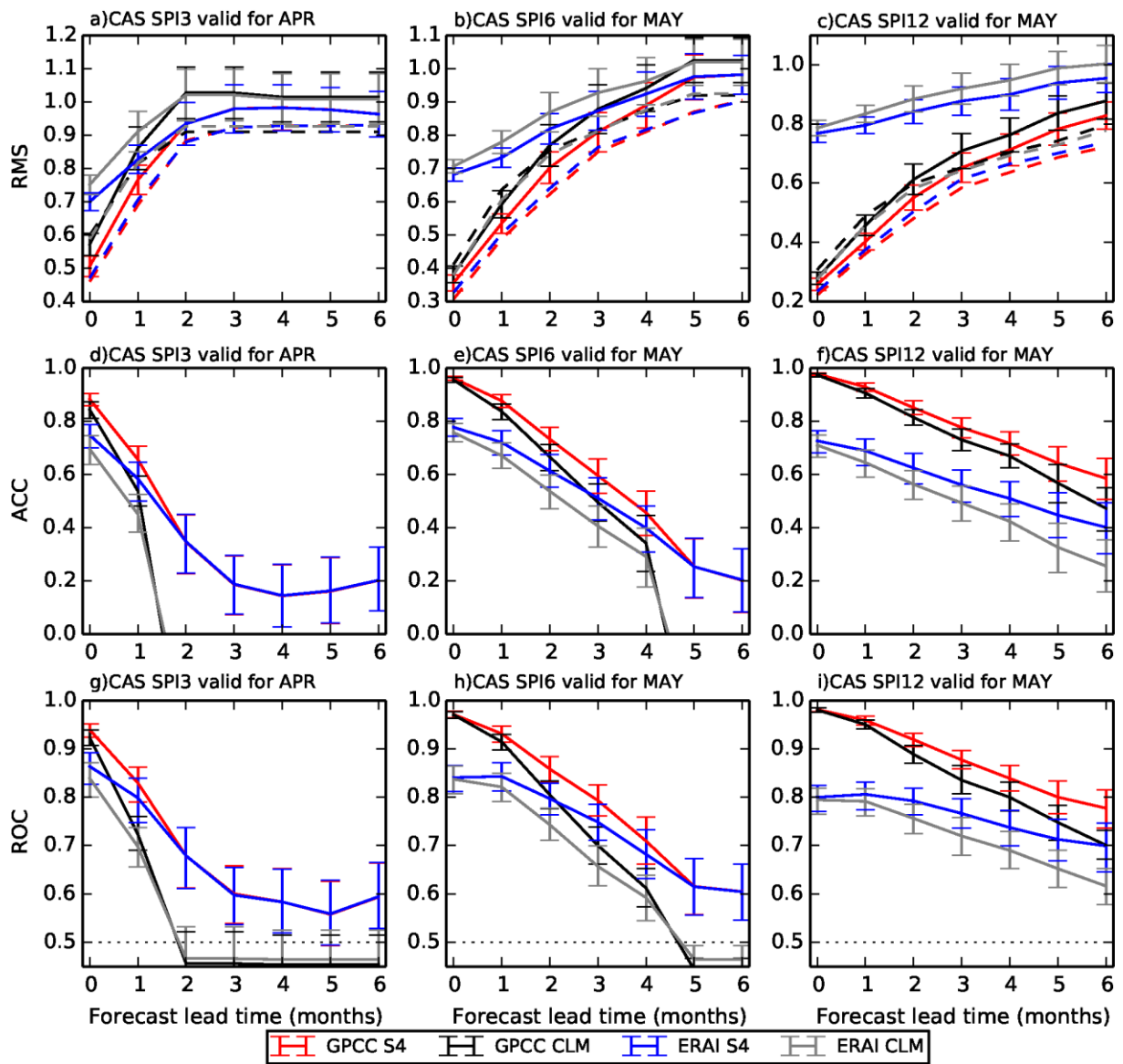
1



2

3 Figure S4. As Figure 1 but for the Central America region (CAM).

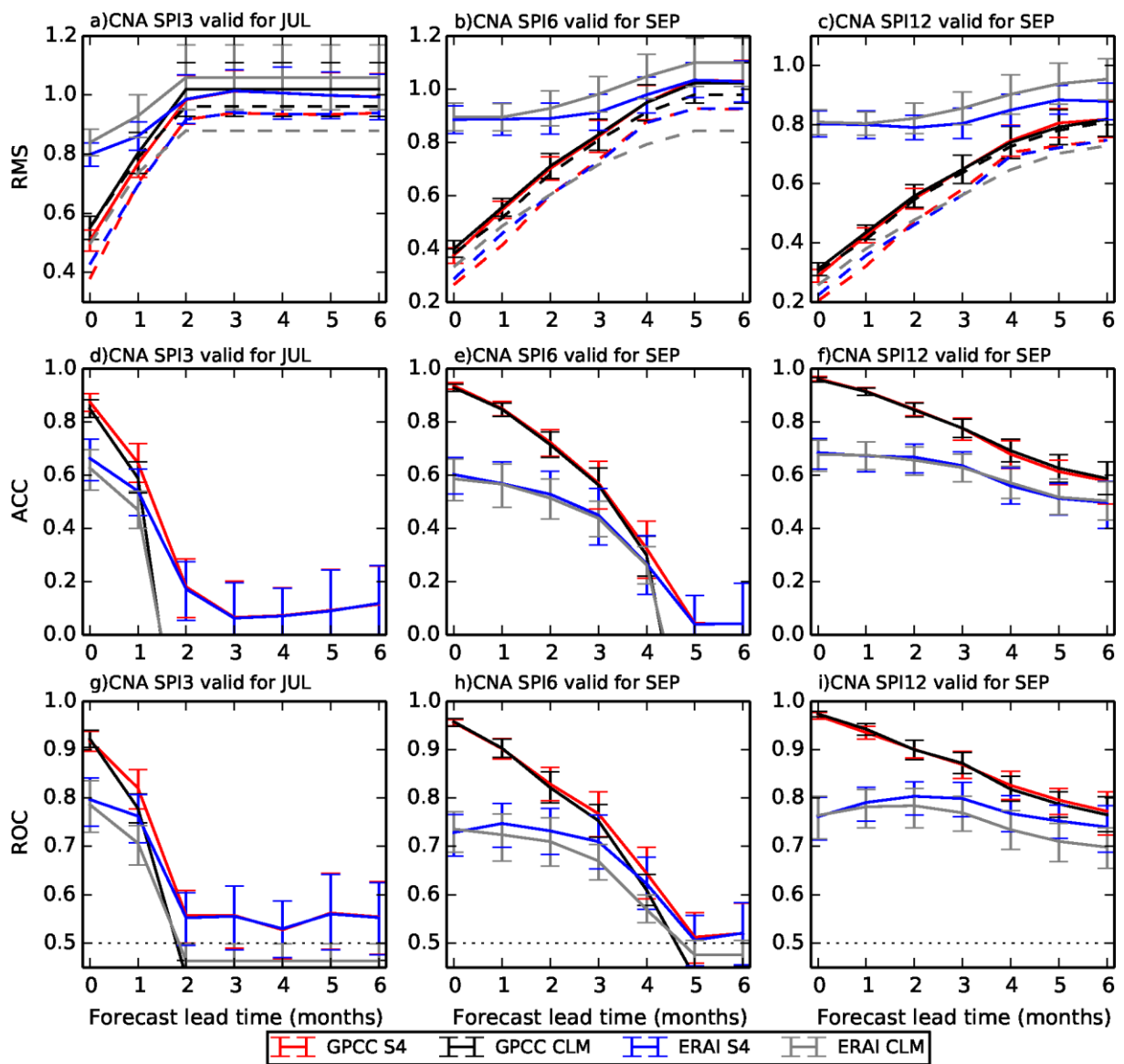
4



1

2 Figure S5. As Figure 1 but for the Central Asia region (CAS).

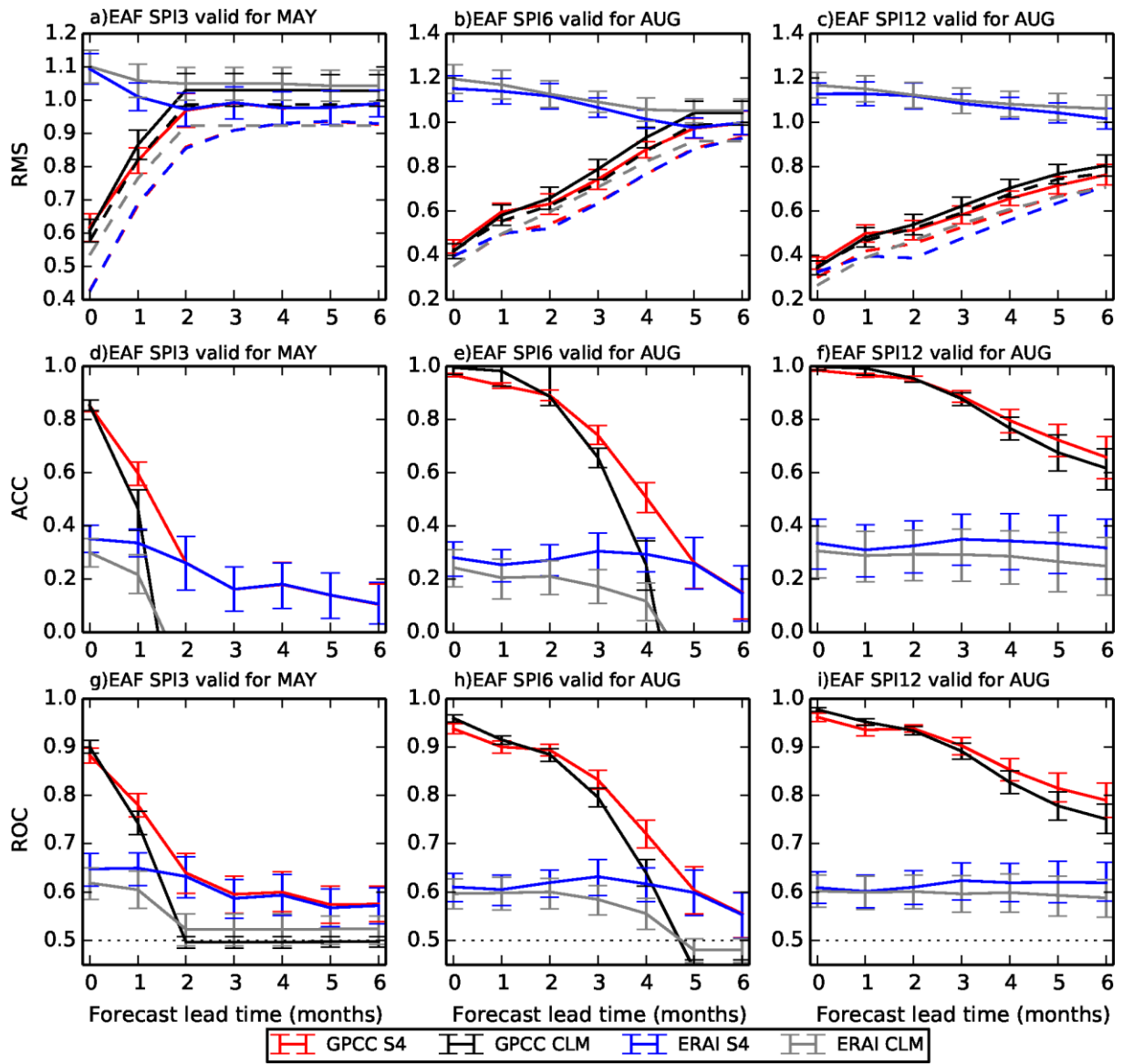
3



1

2 Figure S6. As Figure 1 but for the Central North America region (CNA).

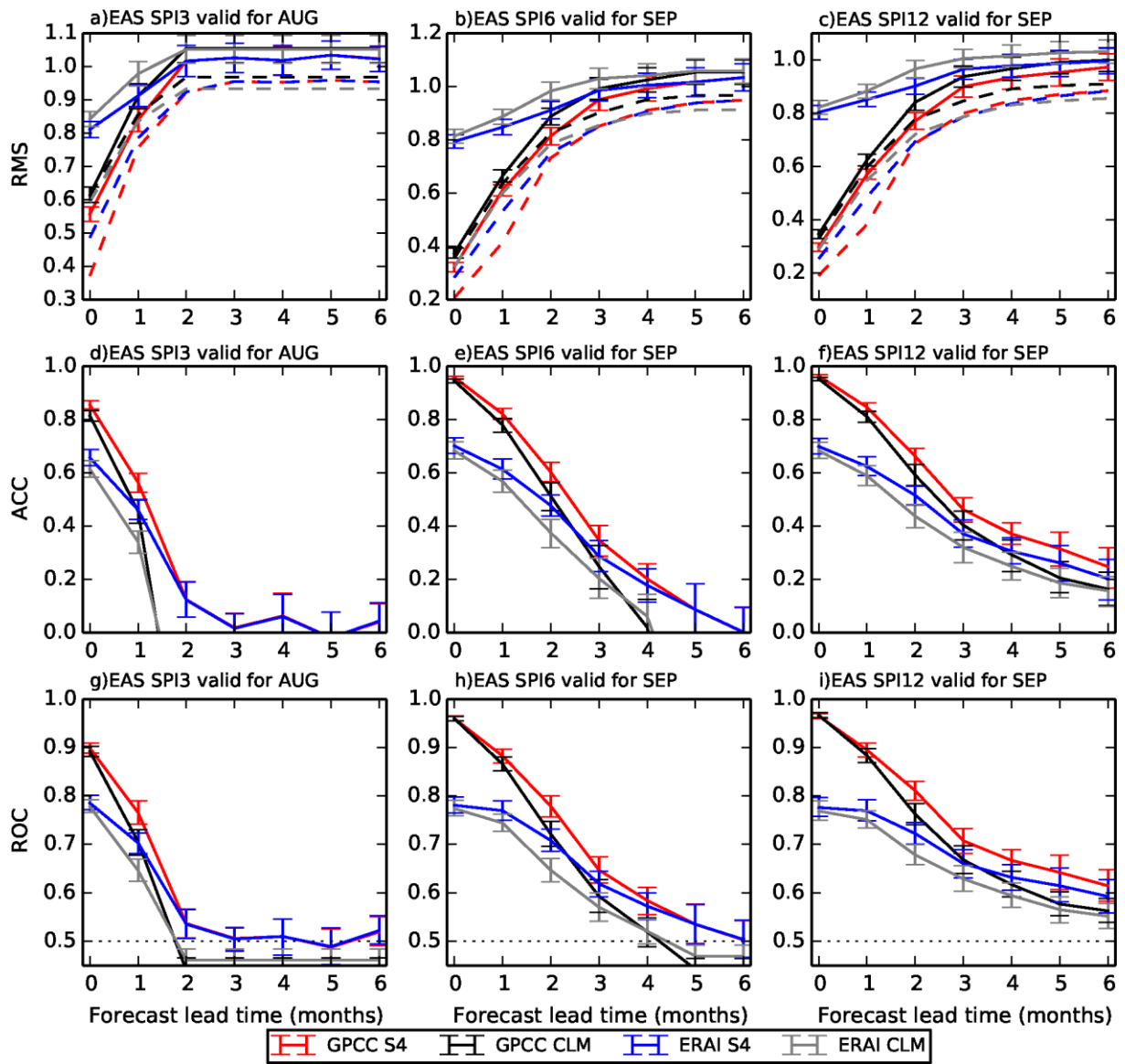
3



1

2 Figure S7. As Figure 1 but for the East Africa region (EAF).

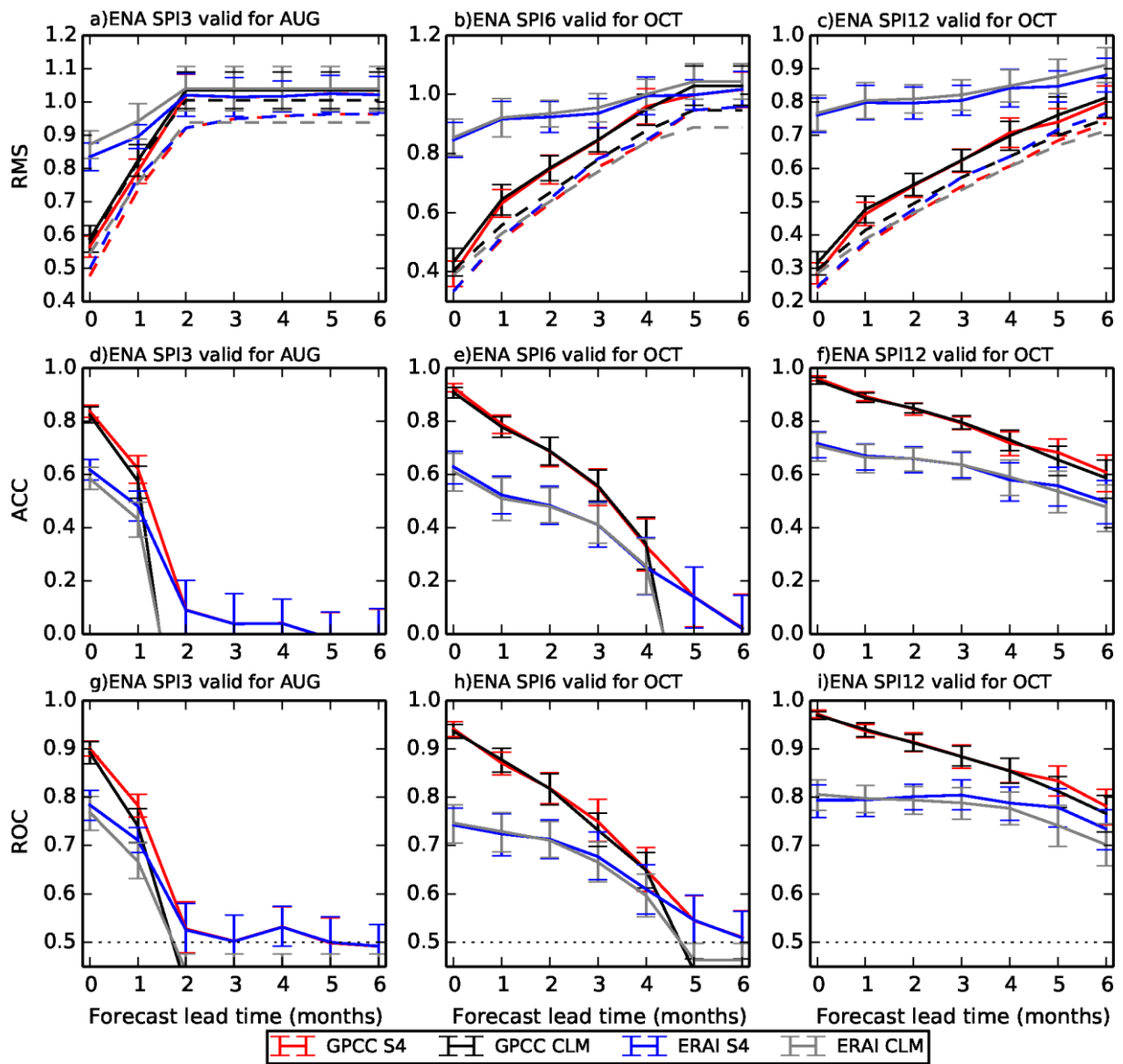
3



1

2 Figure S8. As Figure 1 but for the East Asia region (EAS).

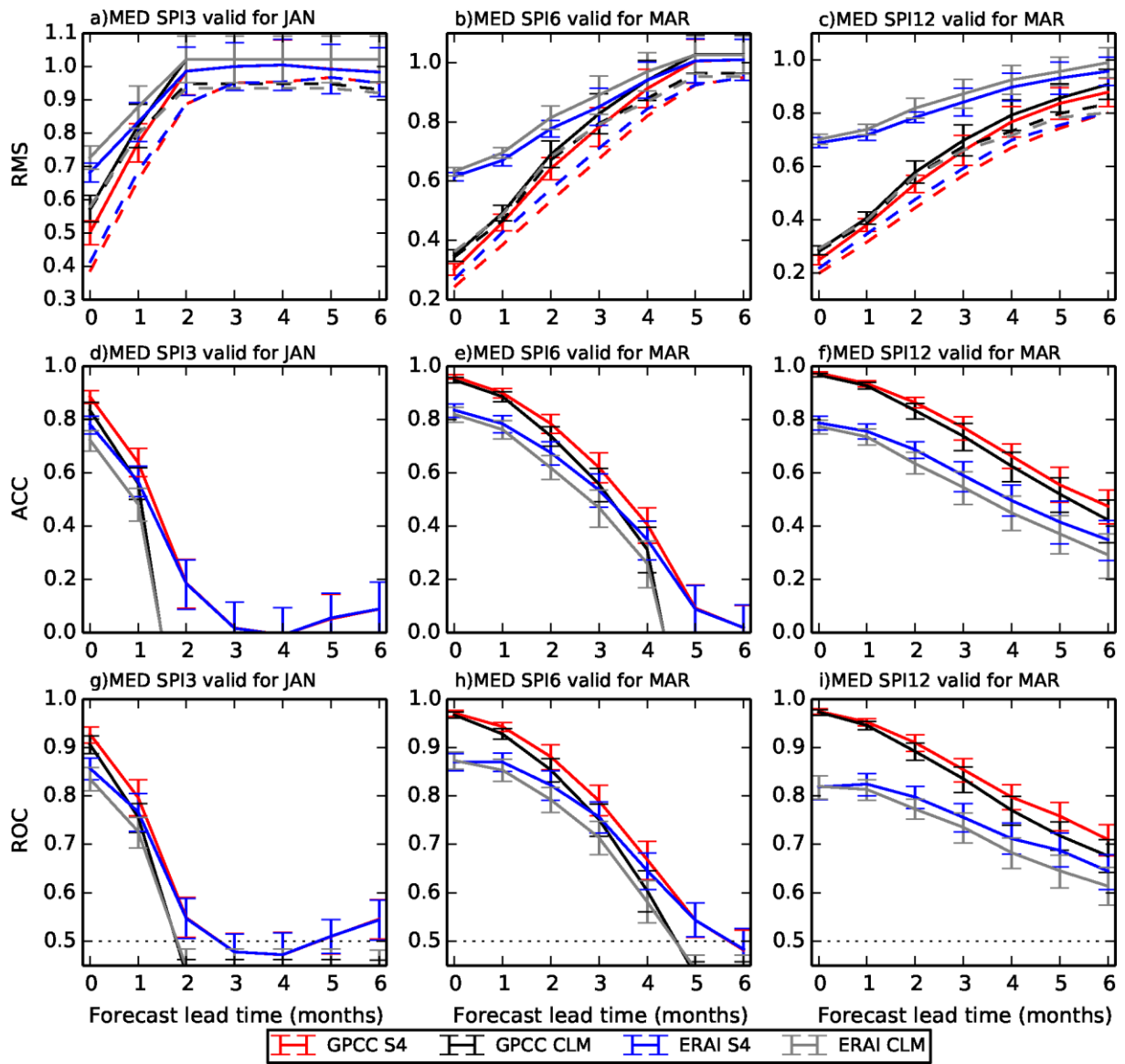
3



1

2 Figure S9. As Figure 1 but for the Eastern North America region (ENA).

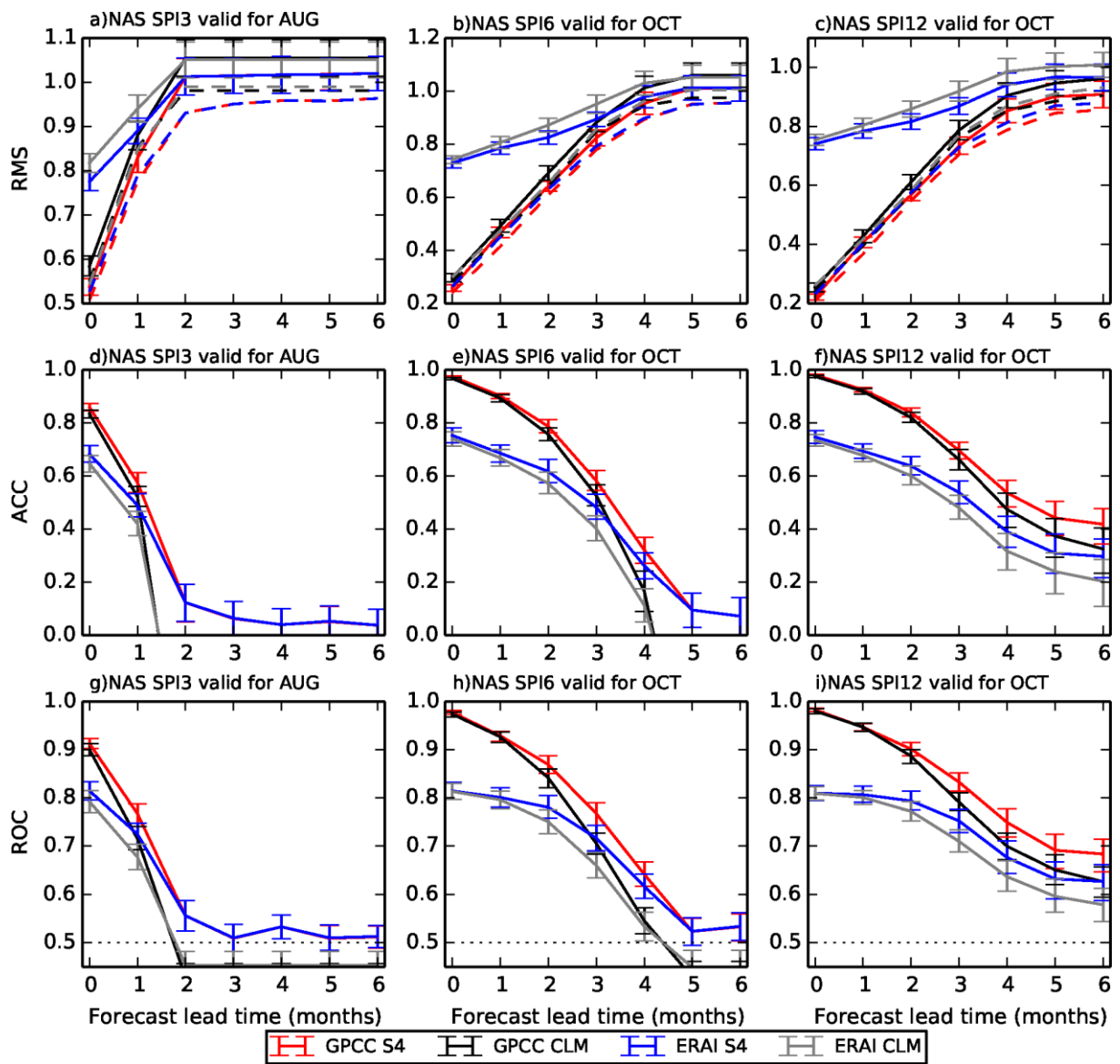
3



1

2 Figure S10. As Figure 1 but for the Mediterranean region (MED).

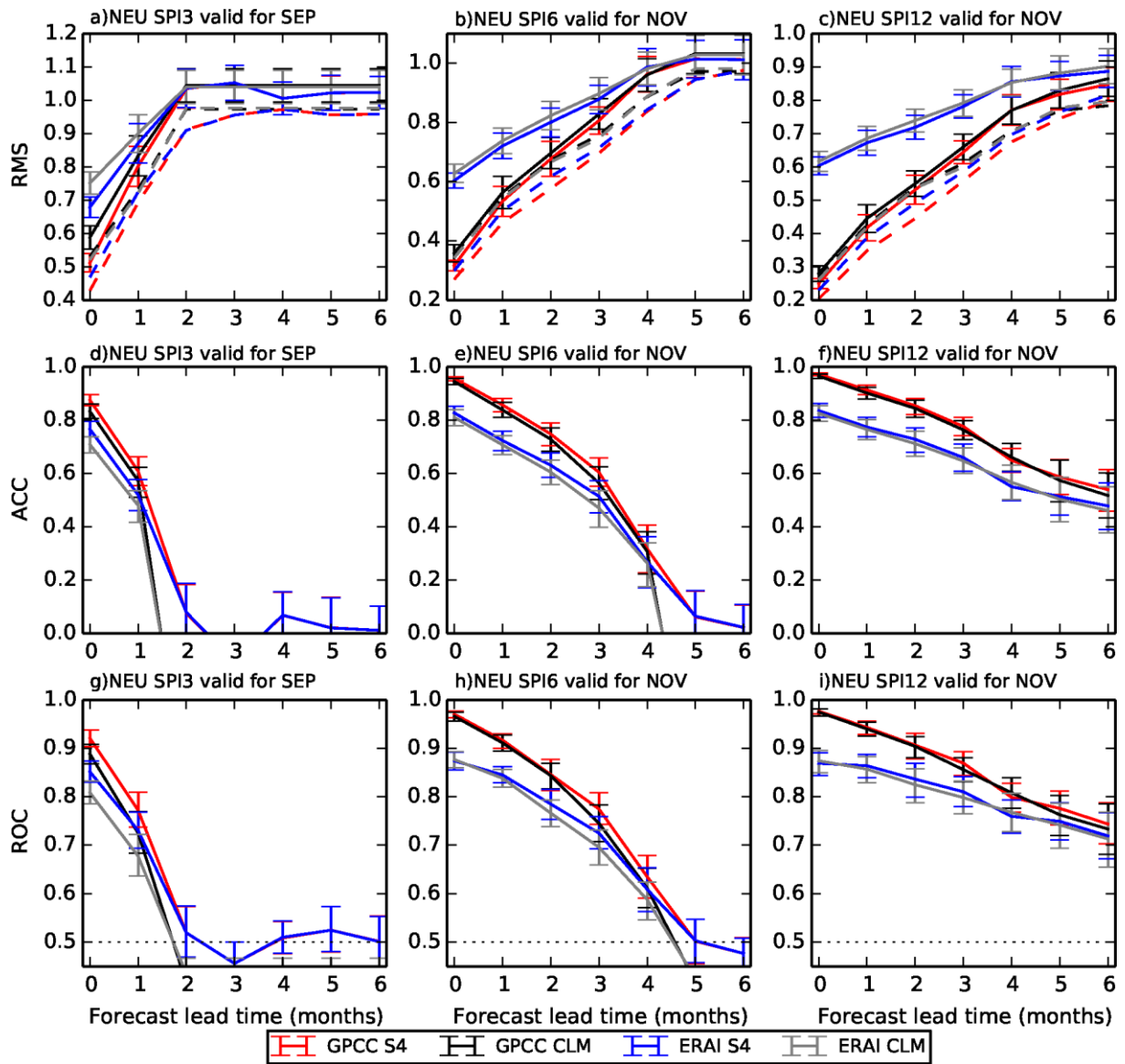
3



1

2 Figure S11. As Figure 1 but for the North Asia region (NAS).

3



1

2 Figure S12. As Figure 1 but for the Northern Europe region (NEU).

3

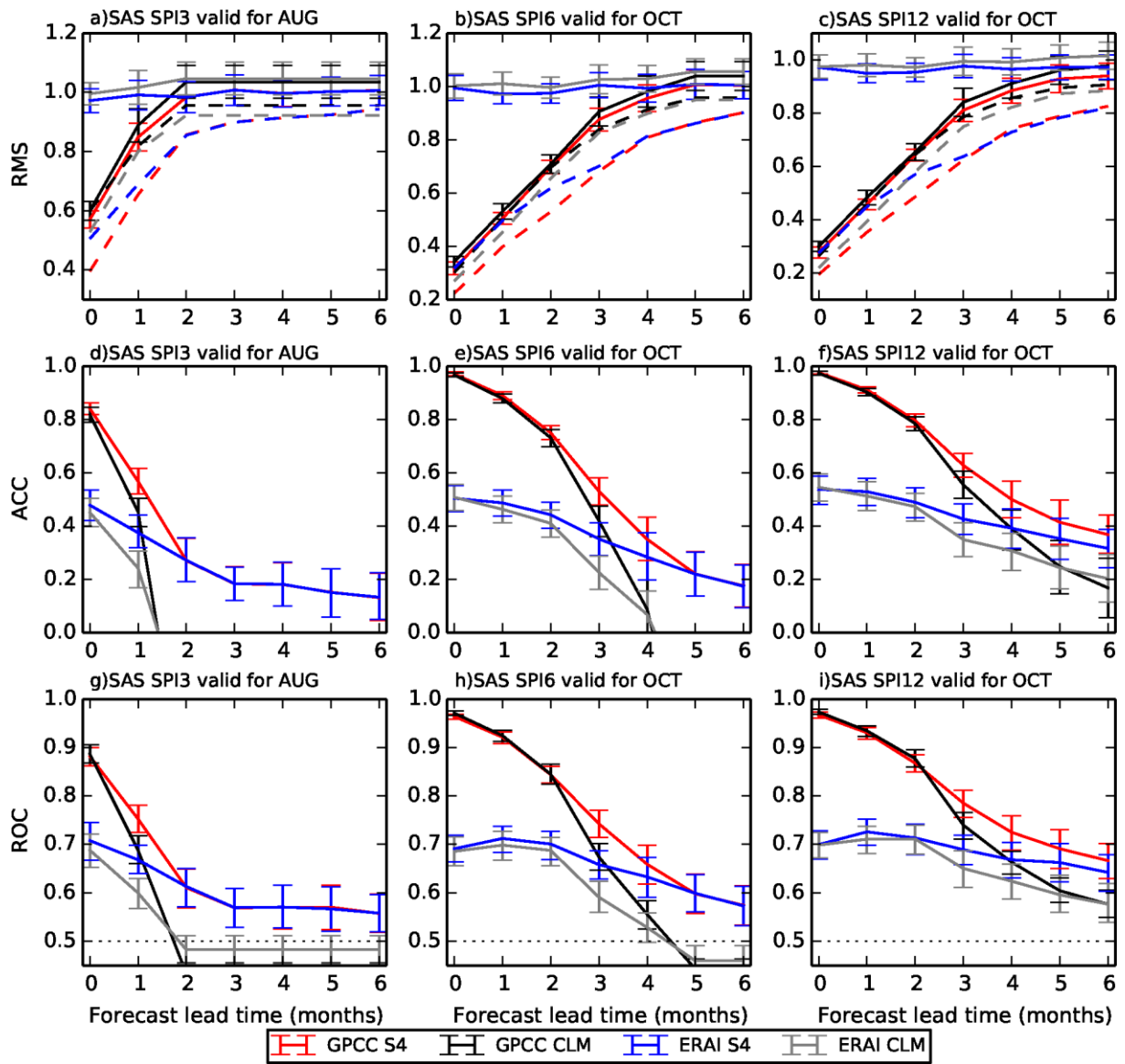
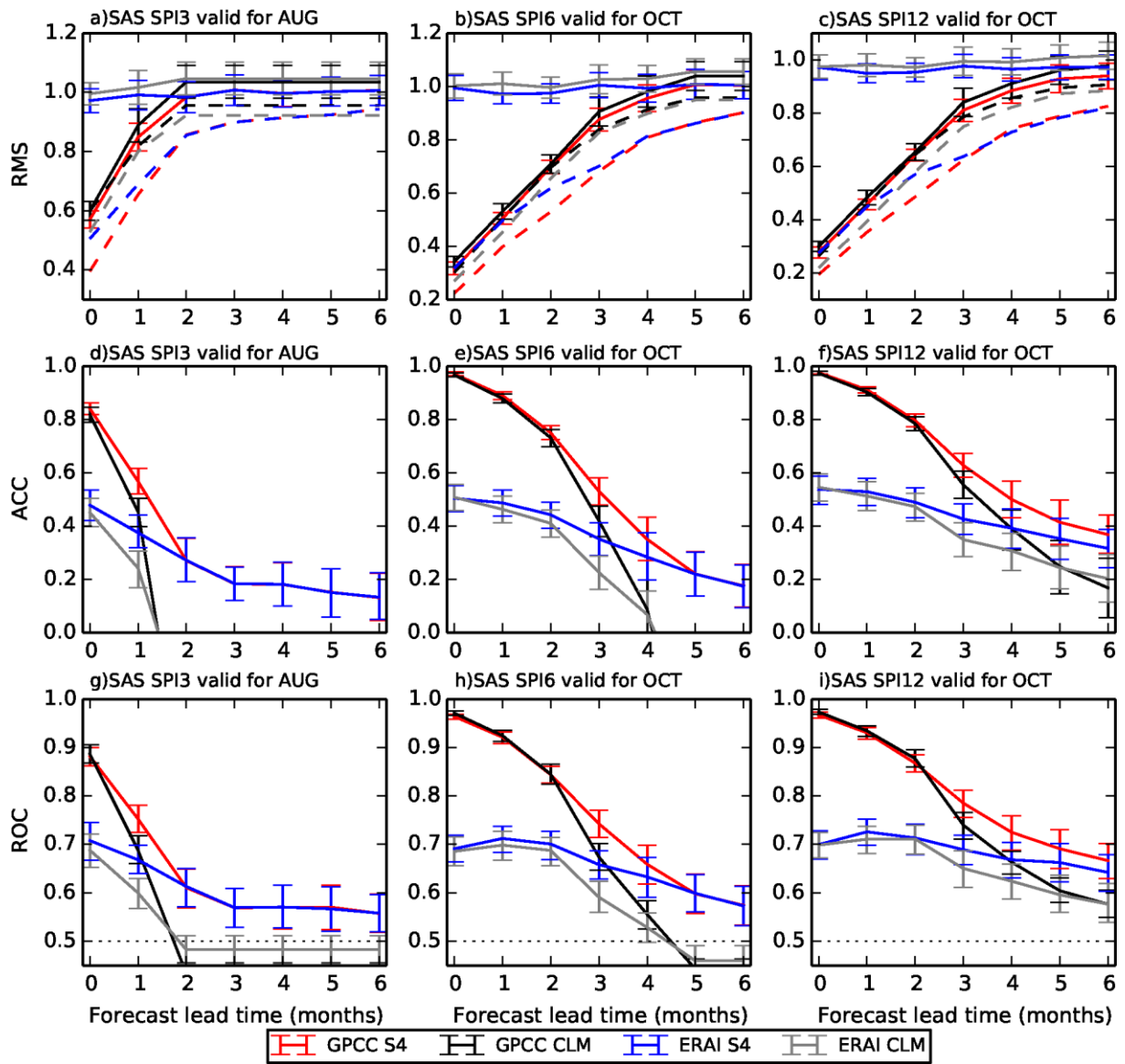


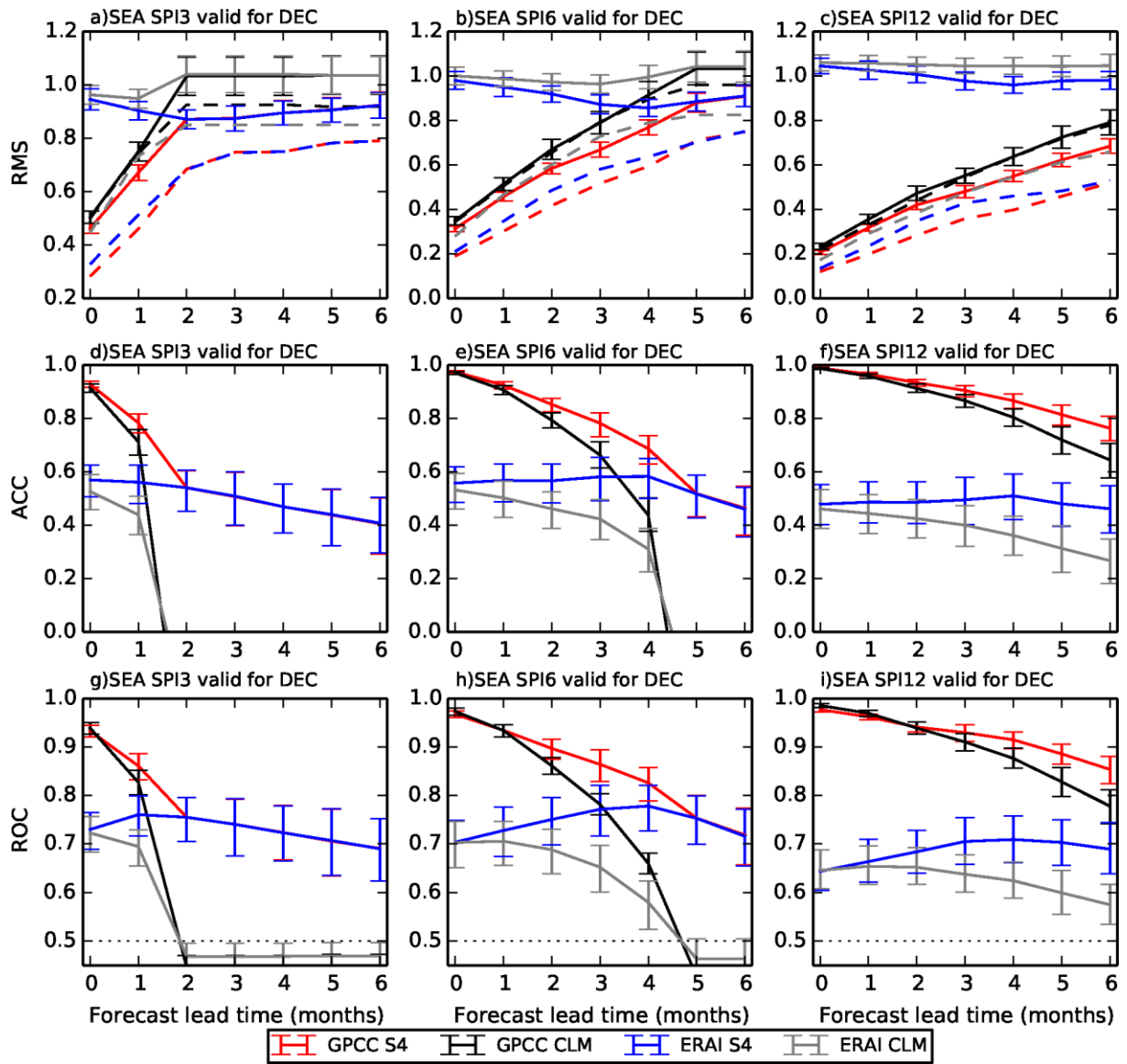
Figure S13. As Figure 1 but for the South Africa region (SAF).



1

2 Figure S14. As Figure 1 but for the South Asia region (SAS).

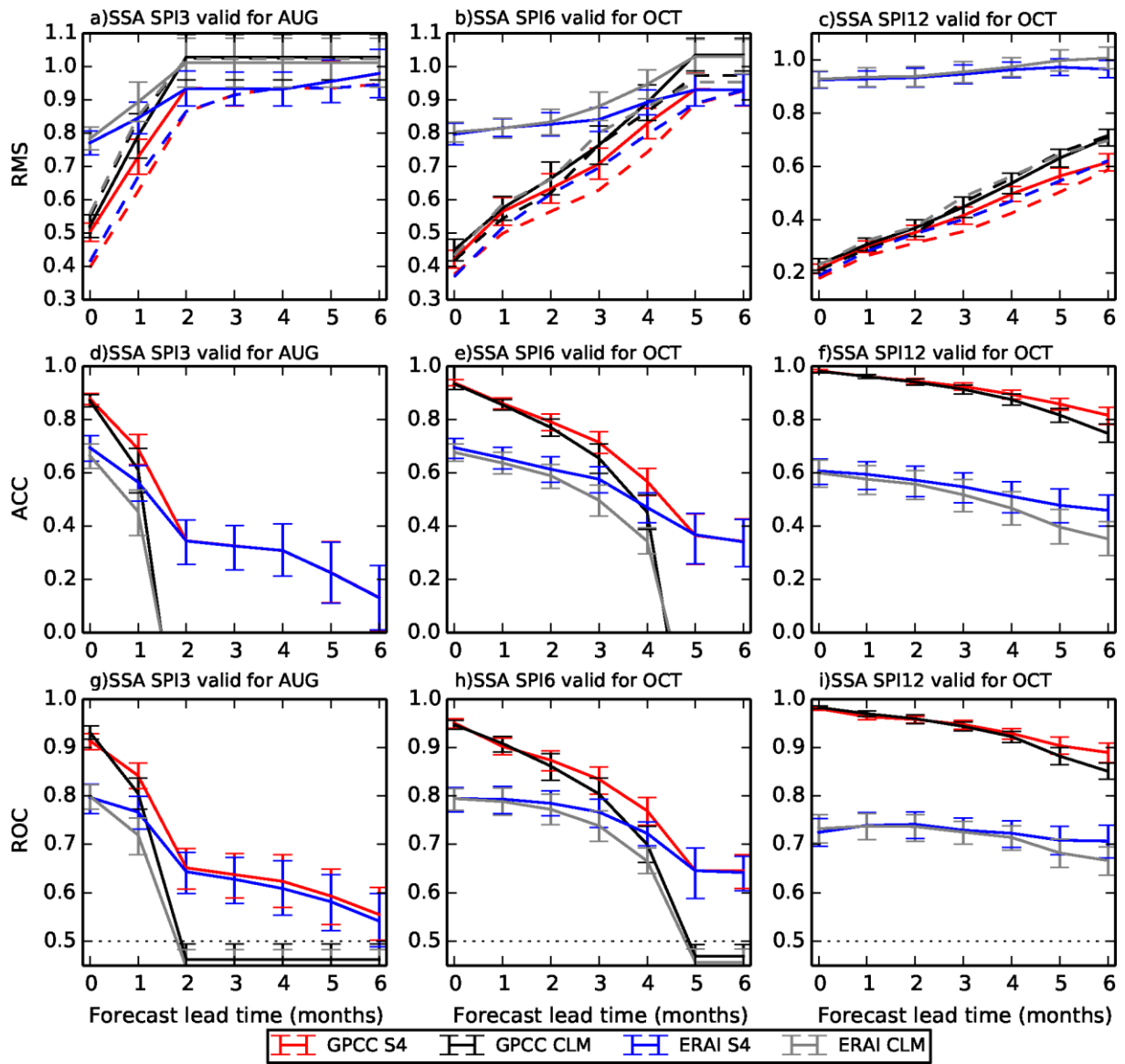
3



1

2 Figure S15. As Figure 1 but for the South East Asia region (CNA).

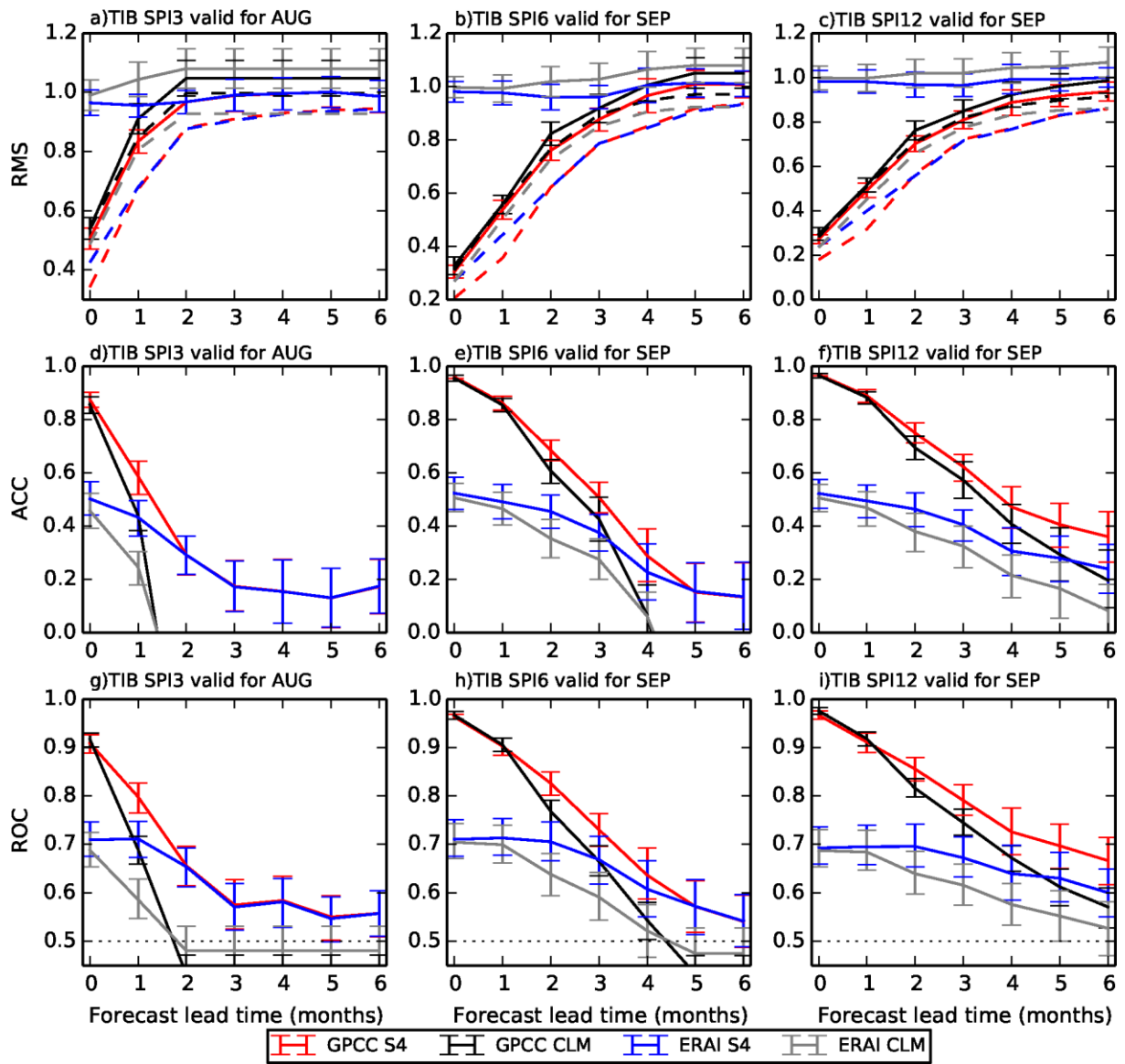
3



1

2 Figure S16. As Figure 1 but for the South South America region (SSA).

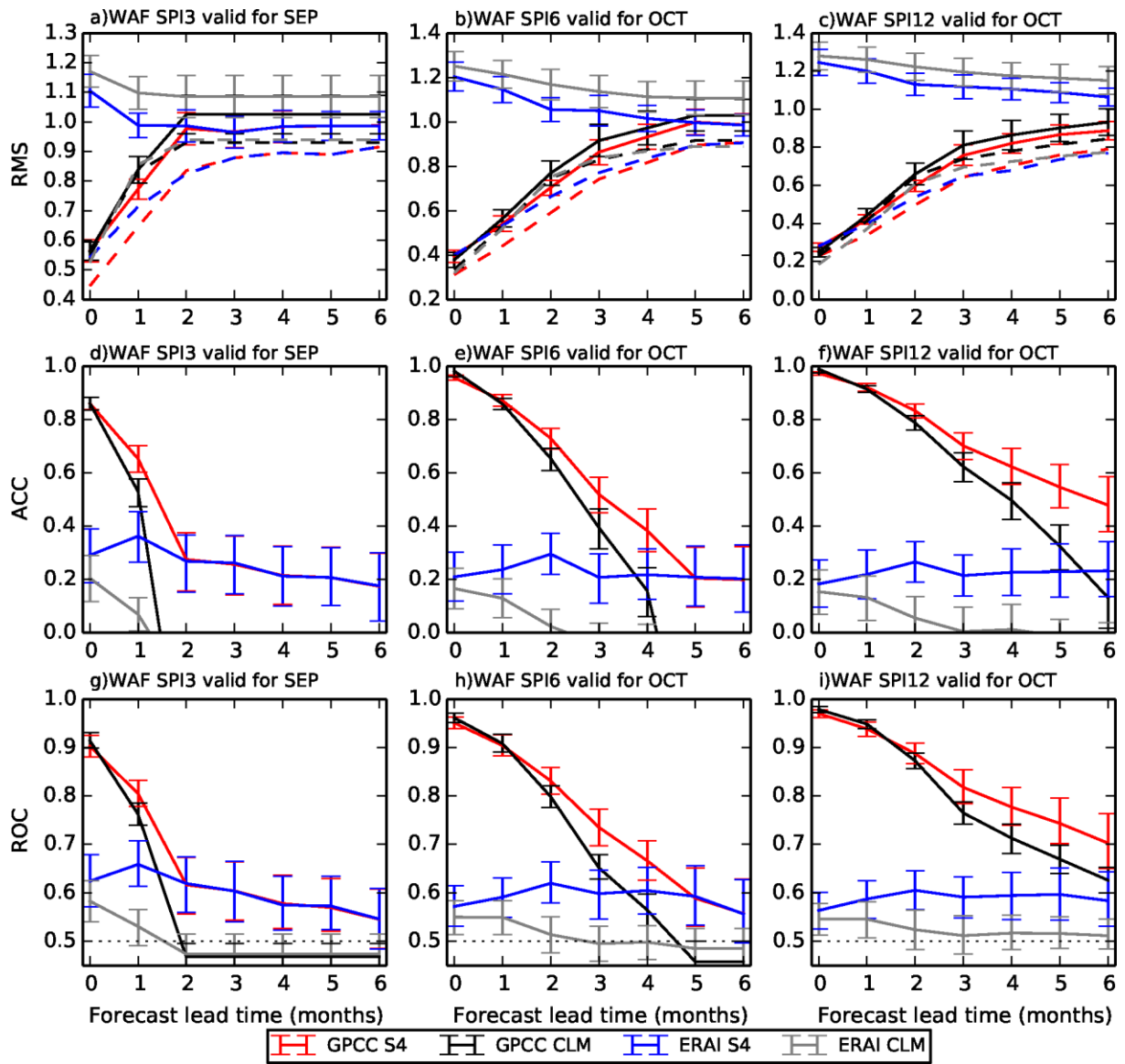
3



1

2 Figure S17. As Figure 1 but for the Tibet region (TIB).

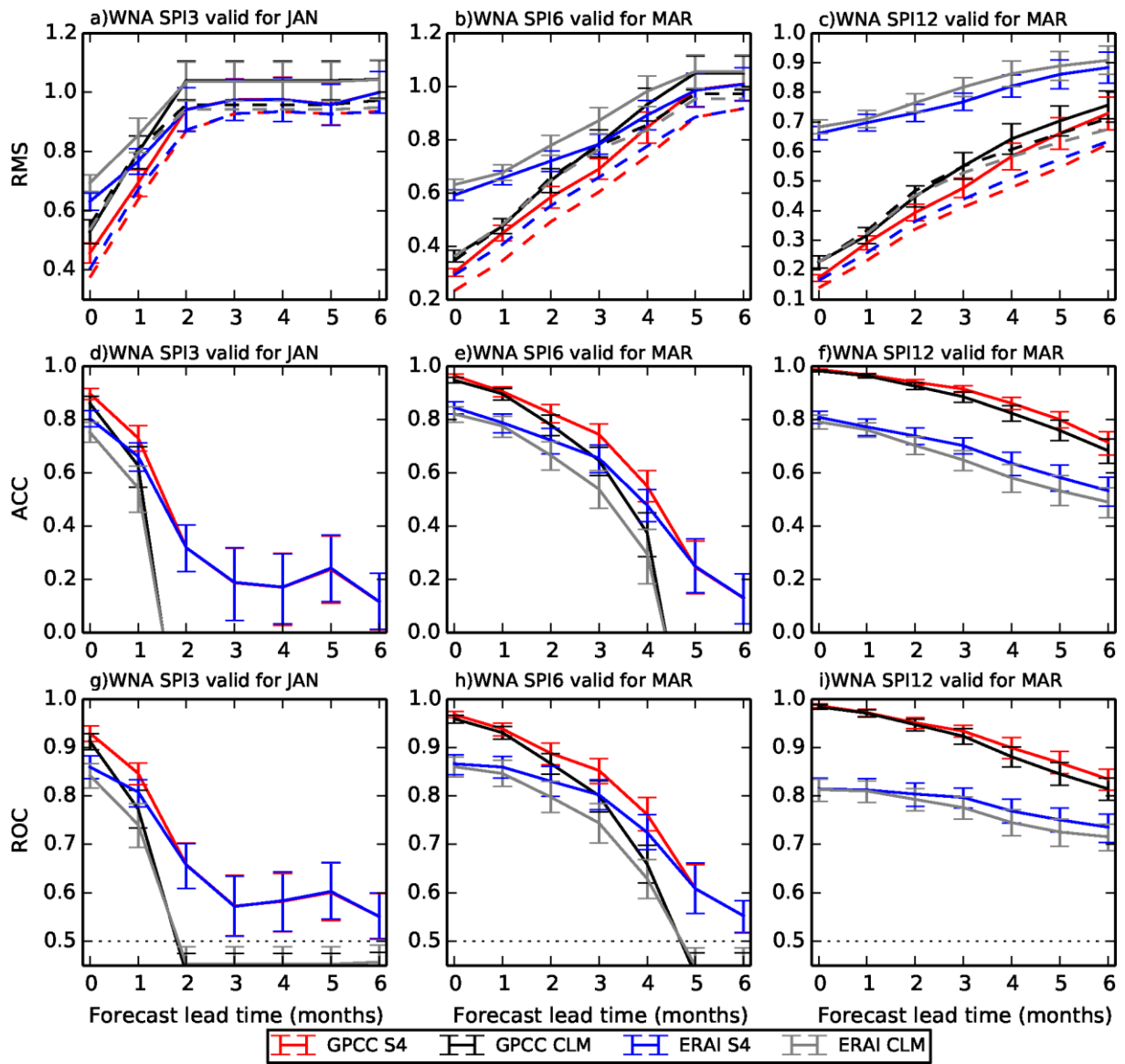
3



1

2 Figure S18. As Figure 1 but for the West Africa region (WAF).

3

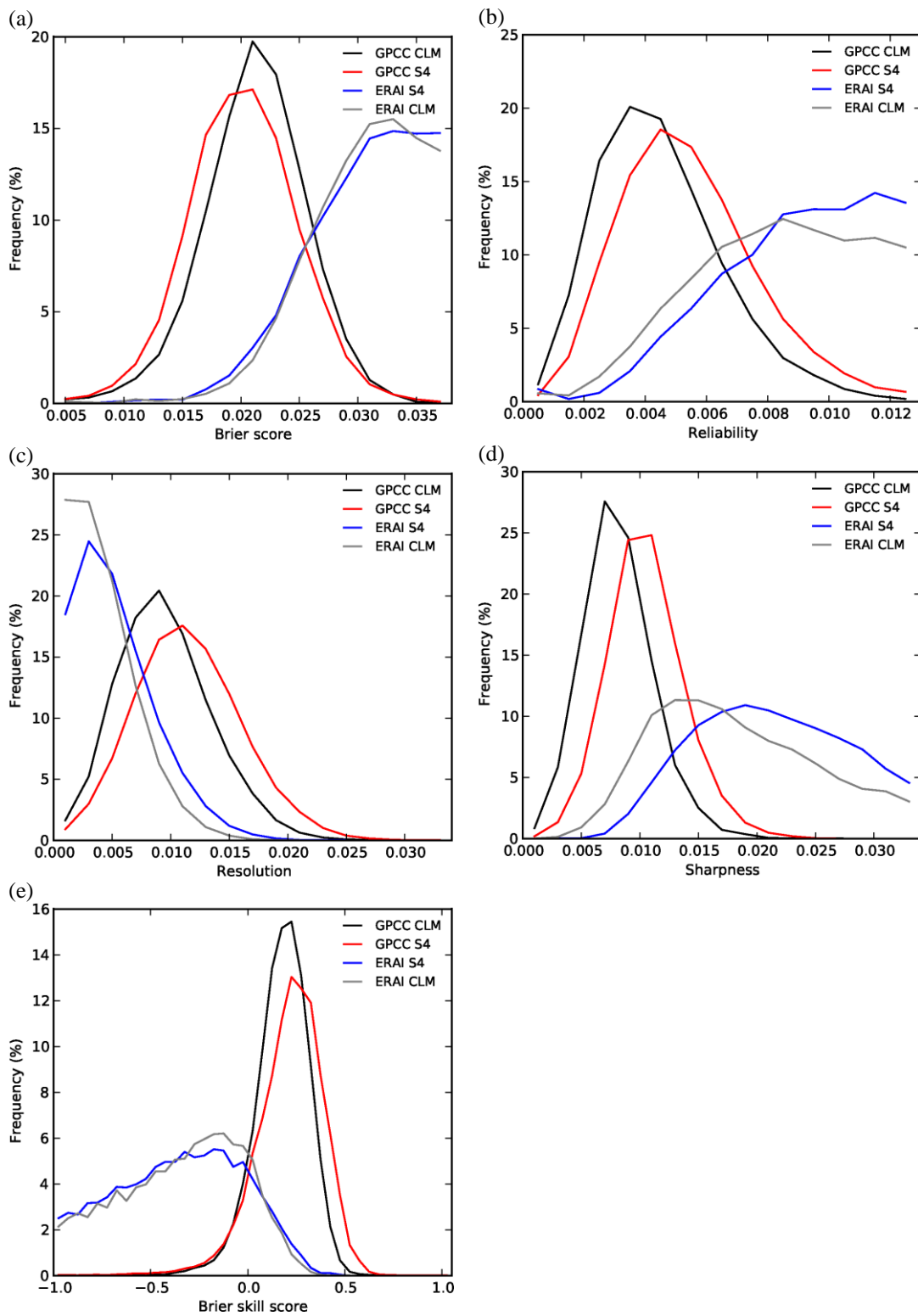


1

2 Figure S19. As Figure 1 but for the West North America region (WNA).

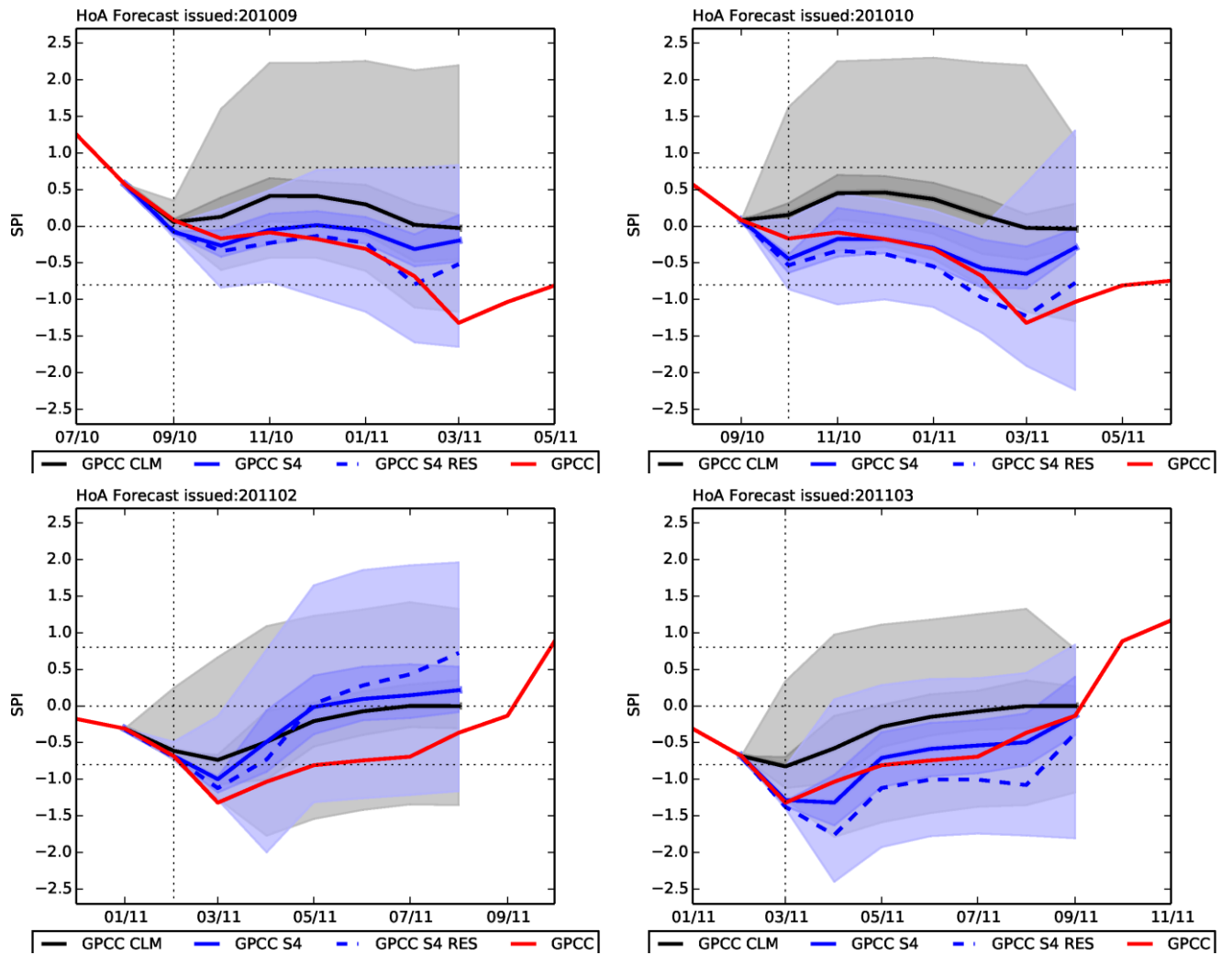
3

4



1 Figure S20. Drought onset frequency distributions of (a) brier score, (b) reliability, (c)
 2 resolution, (d) sharpness and (e) brier skill score for the SPI forecasts produced by GPCC S4
 3 (red0, GPCC CLM (black), ERAI S4 (blue) and ERAI CLM (gray). The statistics are based
 4 only on land points (similar to Yuan and Wood (2013)), and the reference forecasts for the
 5 brier skill score was the climatological frequency of the verification dataset (GPCC).

1
2

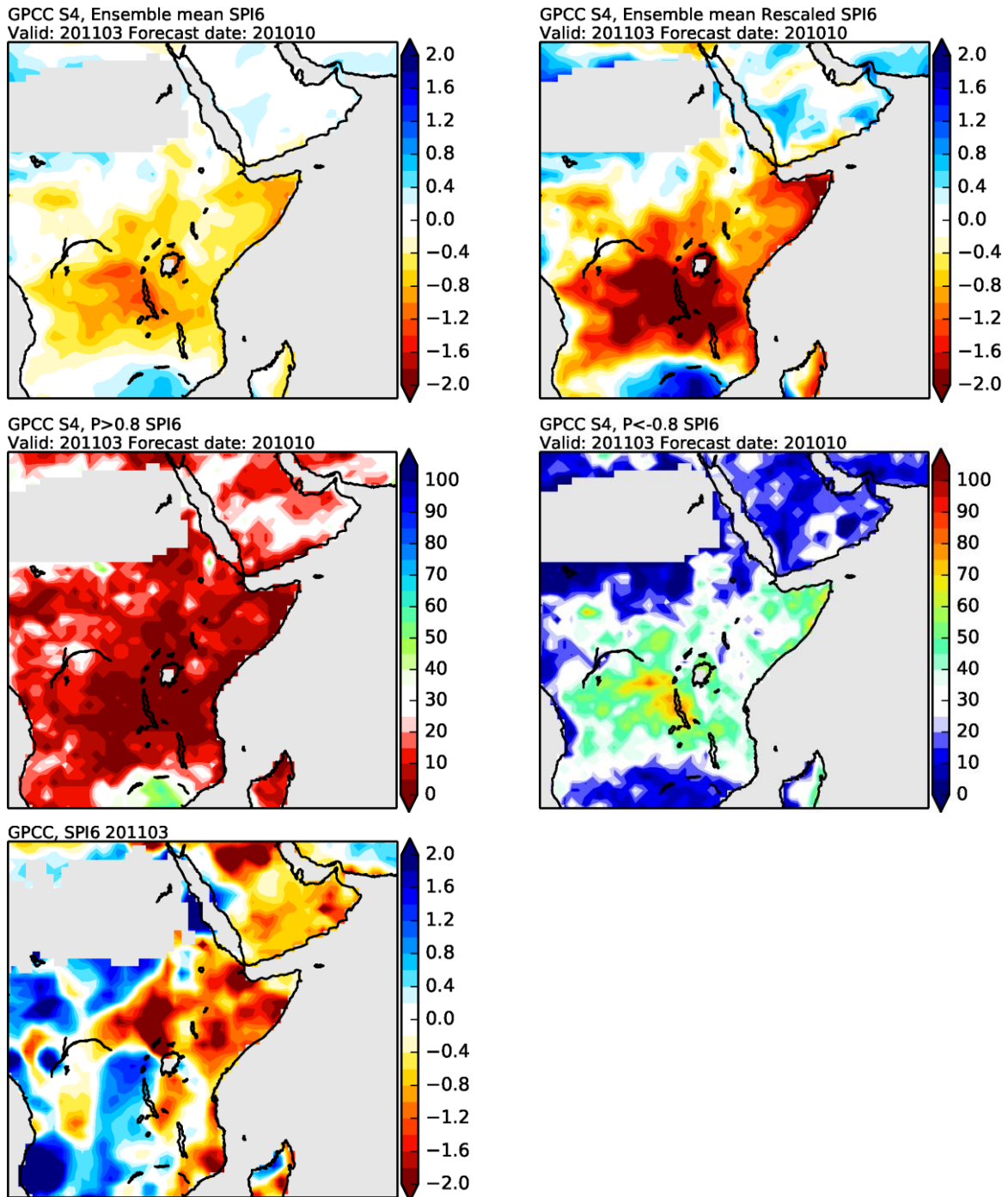


3

4 Figure S21. Seasonal forecasts of 6-month SPI in the Horn of Africa region (3S-12N, 40E-
5 52E) given by GPCC S4 (blue) and GPCC CLM (black), and the GPCC monitoring (red)
6 issued in September 2011 (top left), October 2011 (top right), February 2012 (bottom left) and
7 March 2012 (bottom right). . The solid lines represent the ensemble mean forecasts of GPCC
8 S4 (blue) and GPCC CLM (black), and the dashed blue line the GPCC S4 ensemble mean
9 rescaled. The shaded areas represent the ensemble distribution between the percentiles 30 to
10 70 (dark shading) and minimum to maxim (light shading). The horizontal dotted lines denote
11 the -0.8, 0 and 0.8 SPI values, and the vertical dotted line forecast issue date.

12

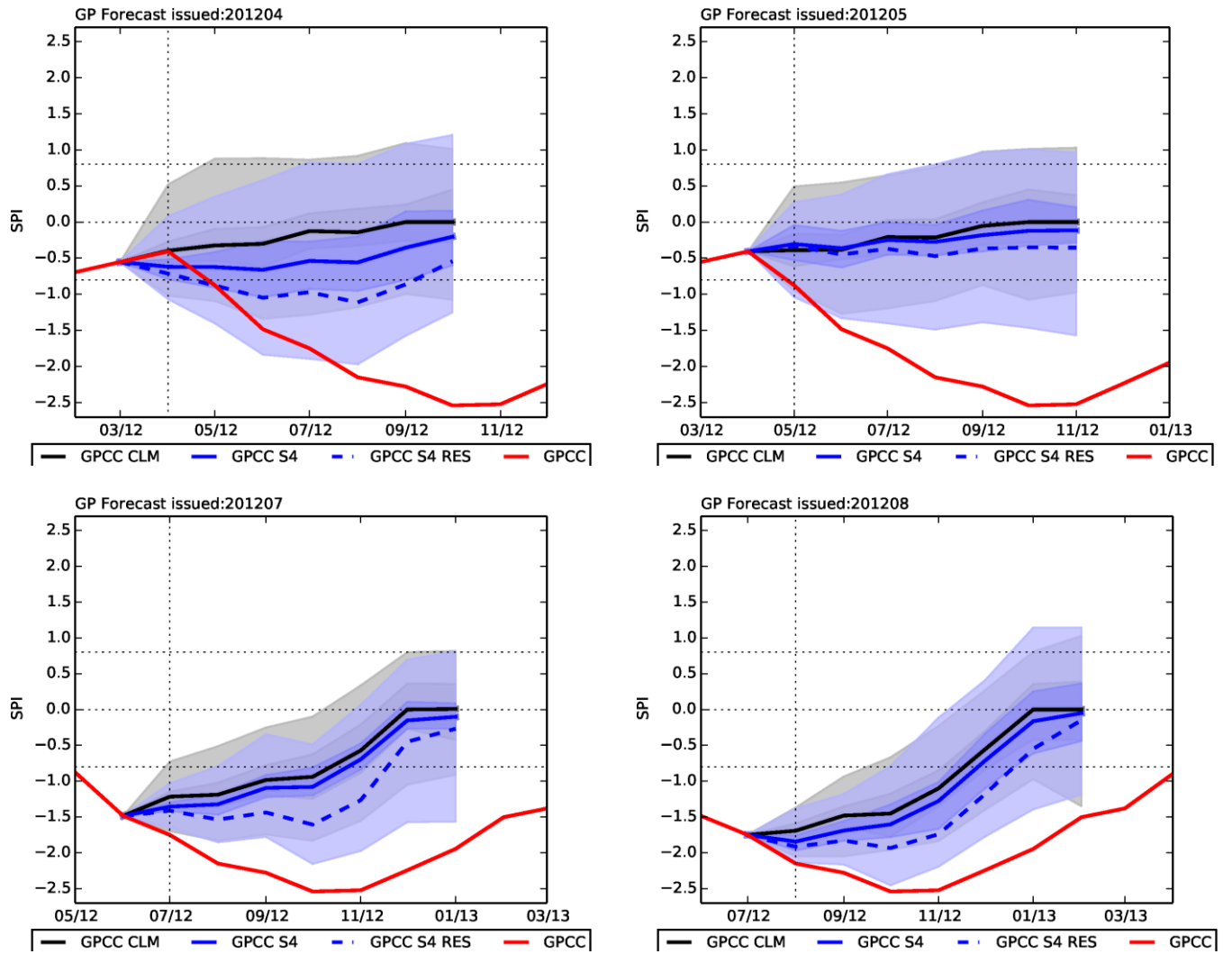
13



1
2
3
4
5
6

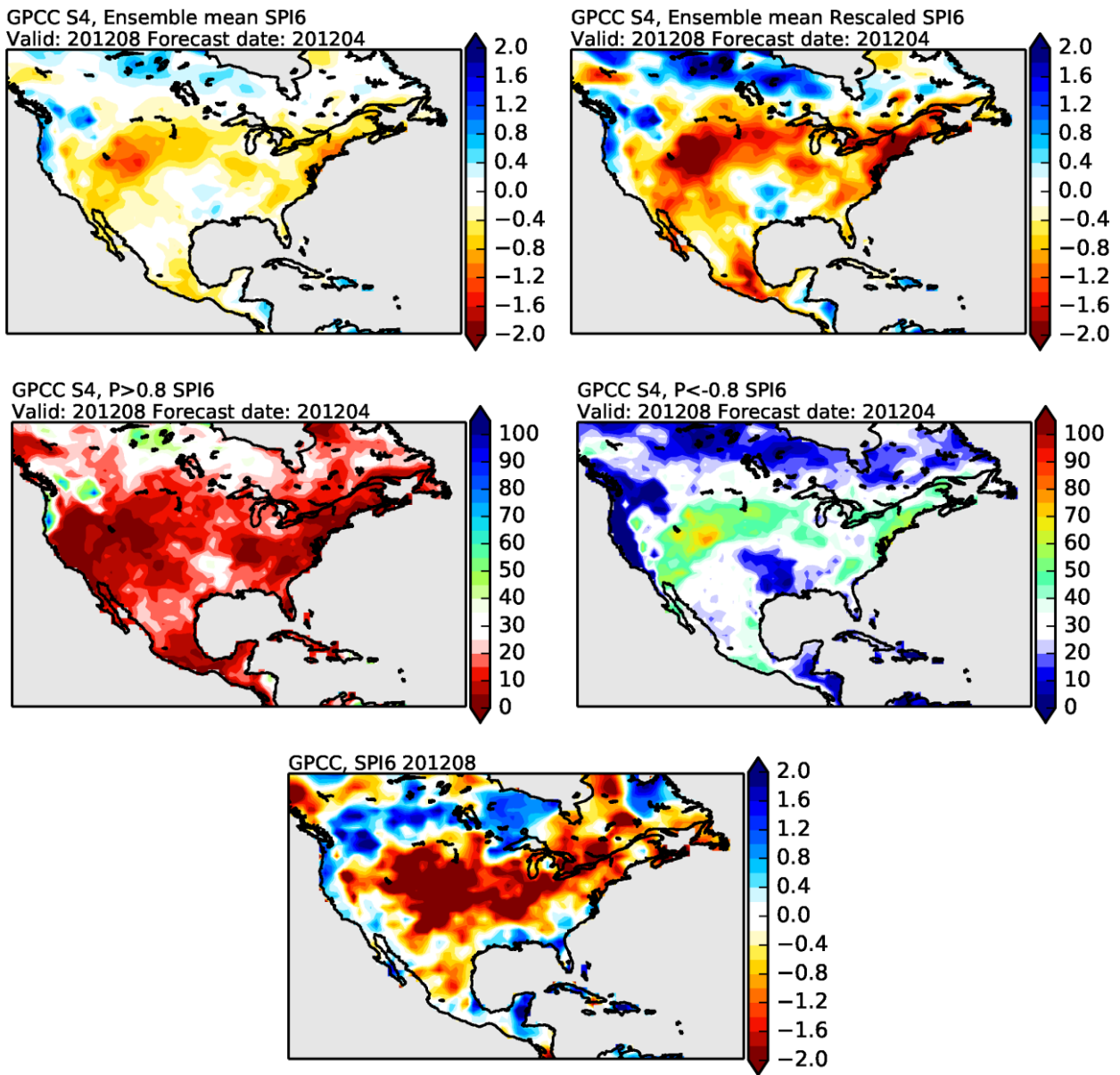
Figure S22. Seasonal forecasts of SPI-6 given by GPCC S4 issued in October 2010 and valid for March 2011: ensemble mean (top left), ensemble mean rescaled (top right), probability of SPI > 0.8 (middle left), probability of SPI < -0.8 (middle right). Lower panel: SPI-6 in March 2011 from GPCC. In all maps gray denote grid-point where the SPI is not defined.

1



2 Figure S23. As Figure S21 but for the the SPI-6 forecasts issued in March, May, and
3 August 2012 for the U.S. Great Plains region (35N-45N, 110W-90W).
4

1



2 Figure S24. As Figure S22 but for the the SPI-6 forecasts issued in April 2012 and valid for
3 August 2012 in the U.S. Great Plains region (35N-45N, 110W-90W).