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ERA-CLIM2 Meeting Reading 19-21 Nov 2014

Comparison of ERA-20C and ERA-PreSAT with 20CR and reconstructions

Stefan Brönnimann

Outline

- 1940-1942 El Niño event
- Extreme events
- Early 20th century Arctic warming
- Winds

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Data sets

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- ERA-20C, ERA-PreSAT, 20CR
- AMIP-typ models (ERA-20CM, ECHAM5.4)
- Monthly statistical 3D-reconstructions based on SLP, station temperature, and upper-level data

  BL2004: northern extratropics, 1939-1947, PCA regresion

  REC1: global, 1880-1957, PCA regresion

  REC2: global (incomplete), 1918-1957, only «cone of influence» around locations with upper-air data

The 1940s El Niño

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- El Niño late 1939 to early 1942, contrasted with 1939, 1943/44 (La Niña years).
- Among the largest multiannual signal you can get
- Including the stratosphere
- Following: Jan.-Apr. (1940-1942) minus (1939, 1943, 1944)

300 hPa GPH

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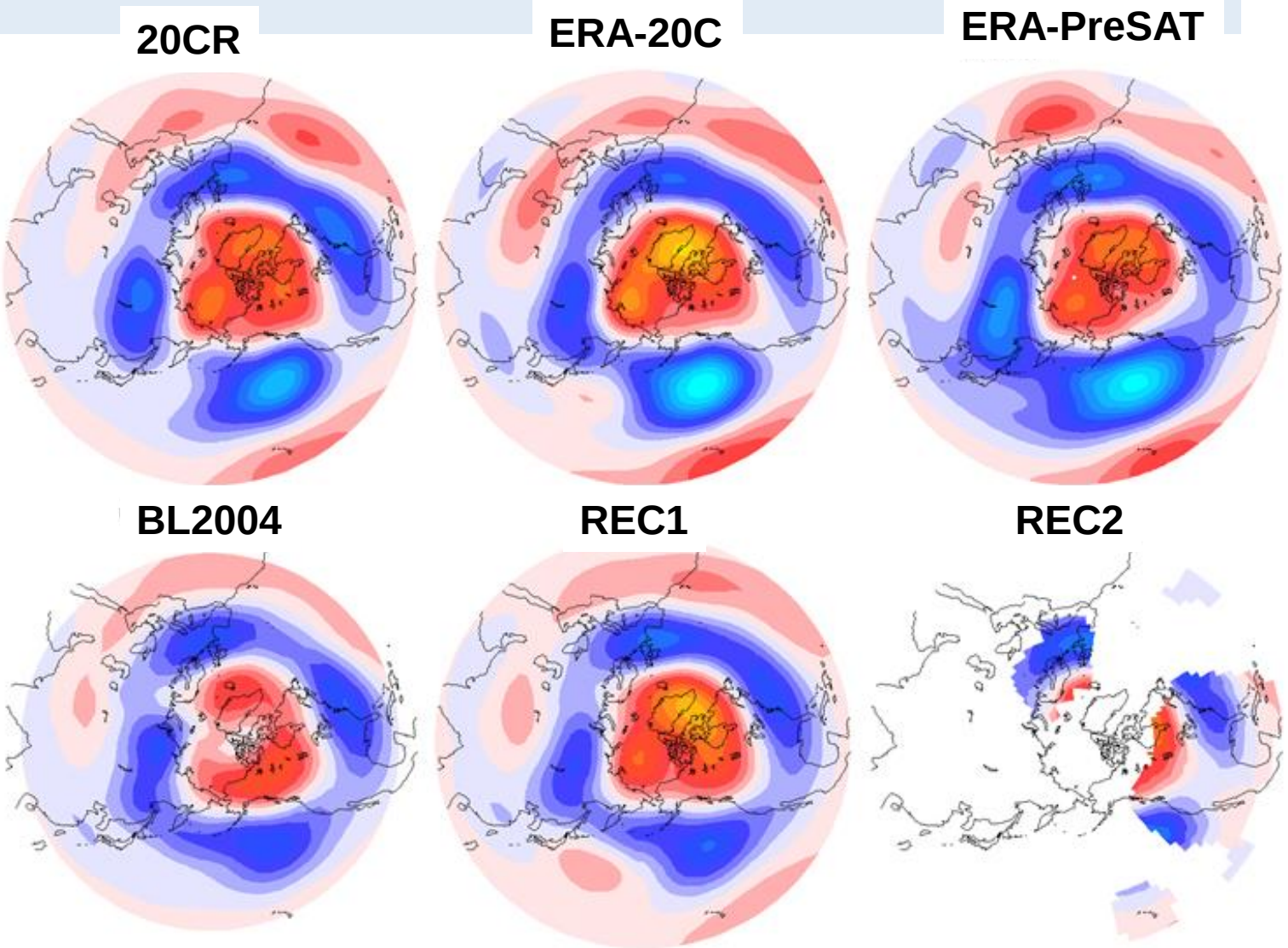

100 hPa GPH

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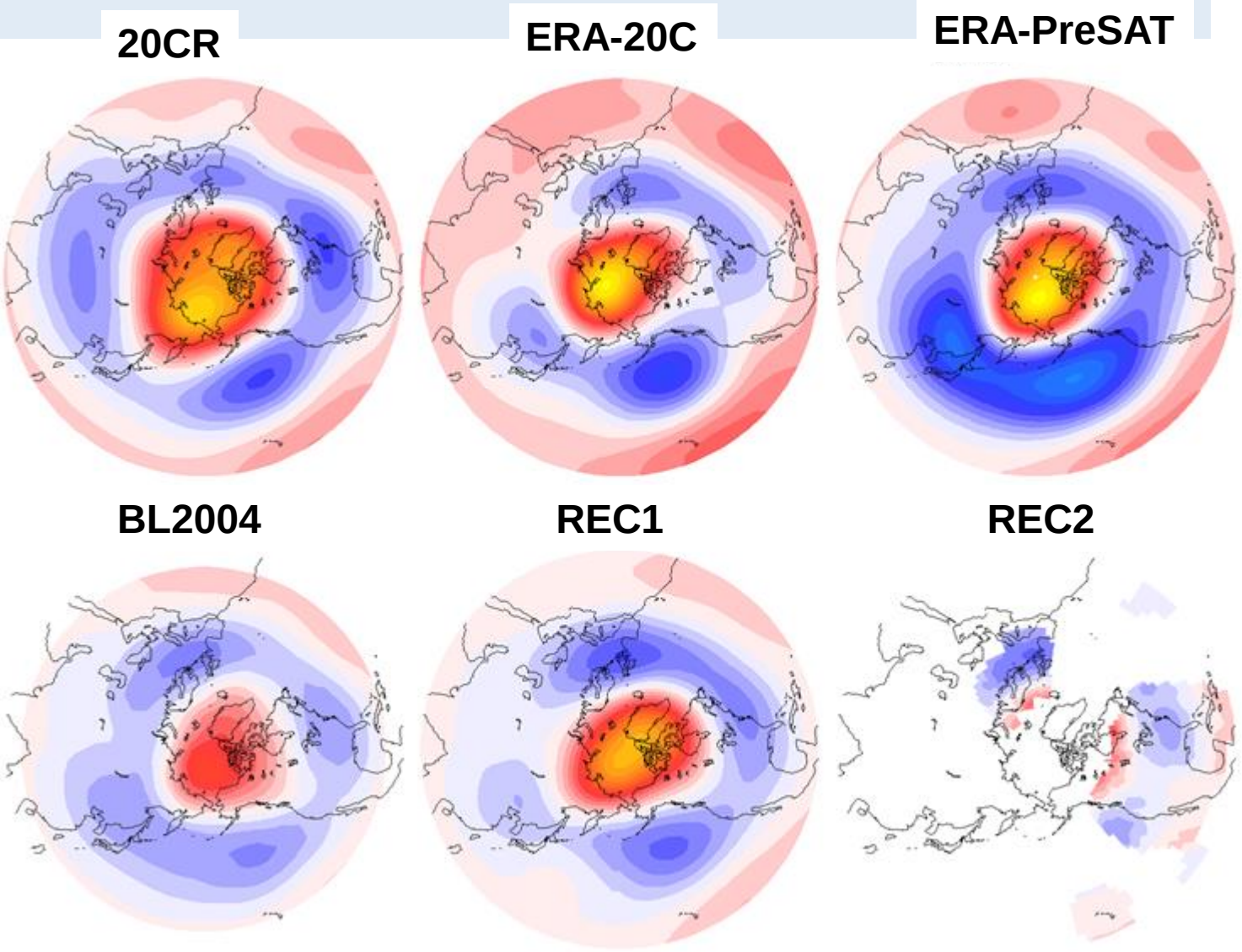
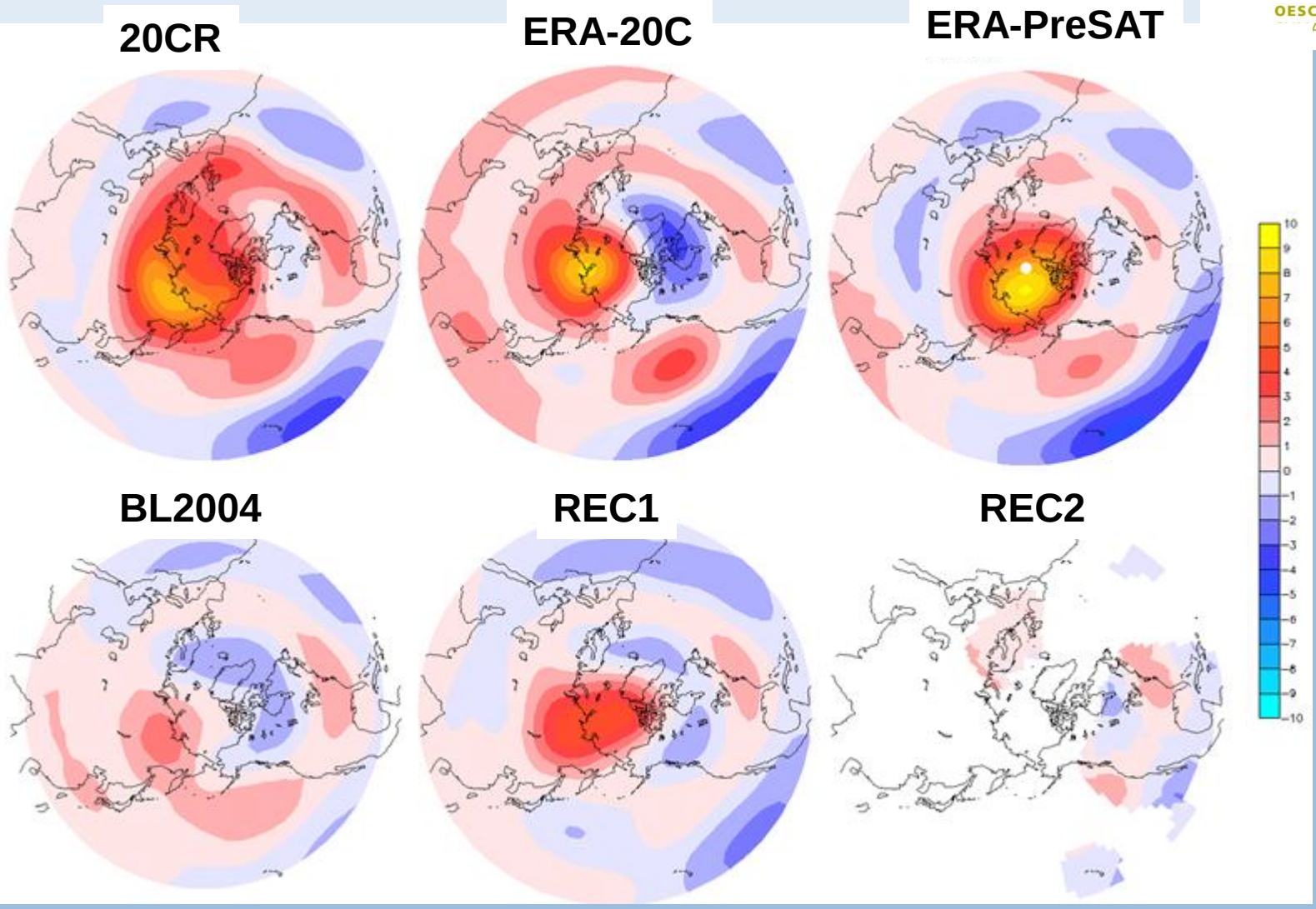
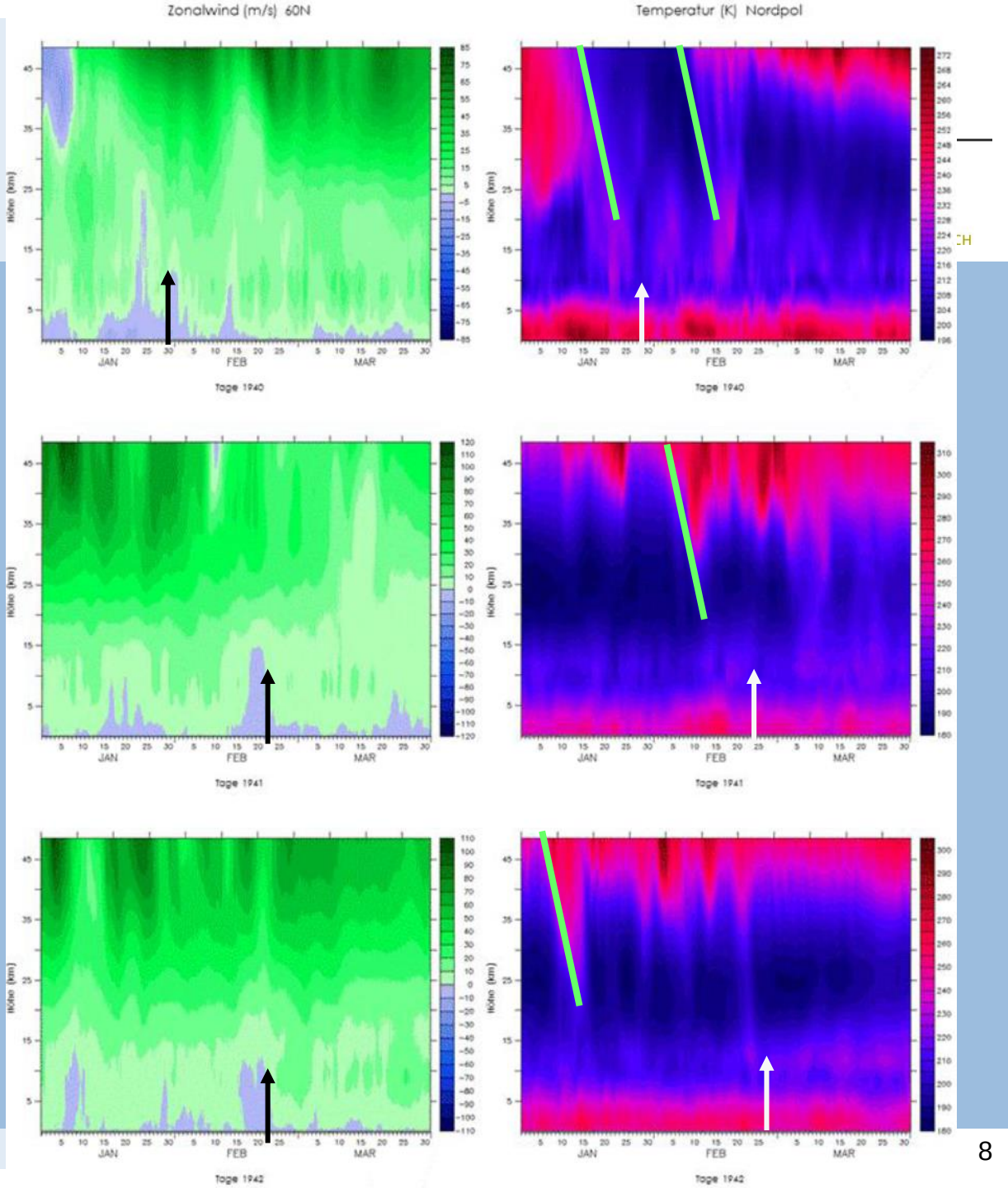


100 hPa Temperature



Sudden Stratospheric Warmings ERA-PreSAT

Downward propagation timing not right



Analyses of Extremes

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- 20CR (ensemble mean), ERA-20C (deterministic), ERA-PreSAT
- All work done by students of the «Seminar in Climatology and Climate Risks», FS 2014

Typhoon Cobra 1944

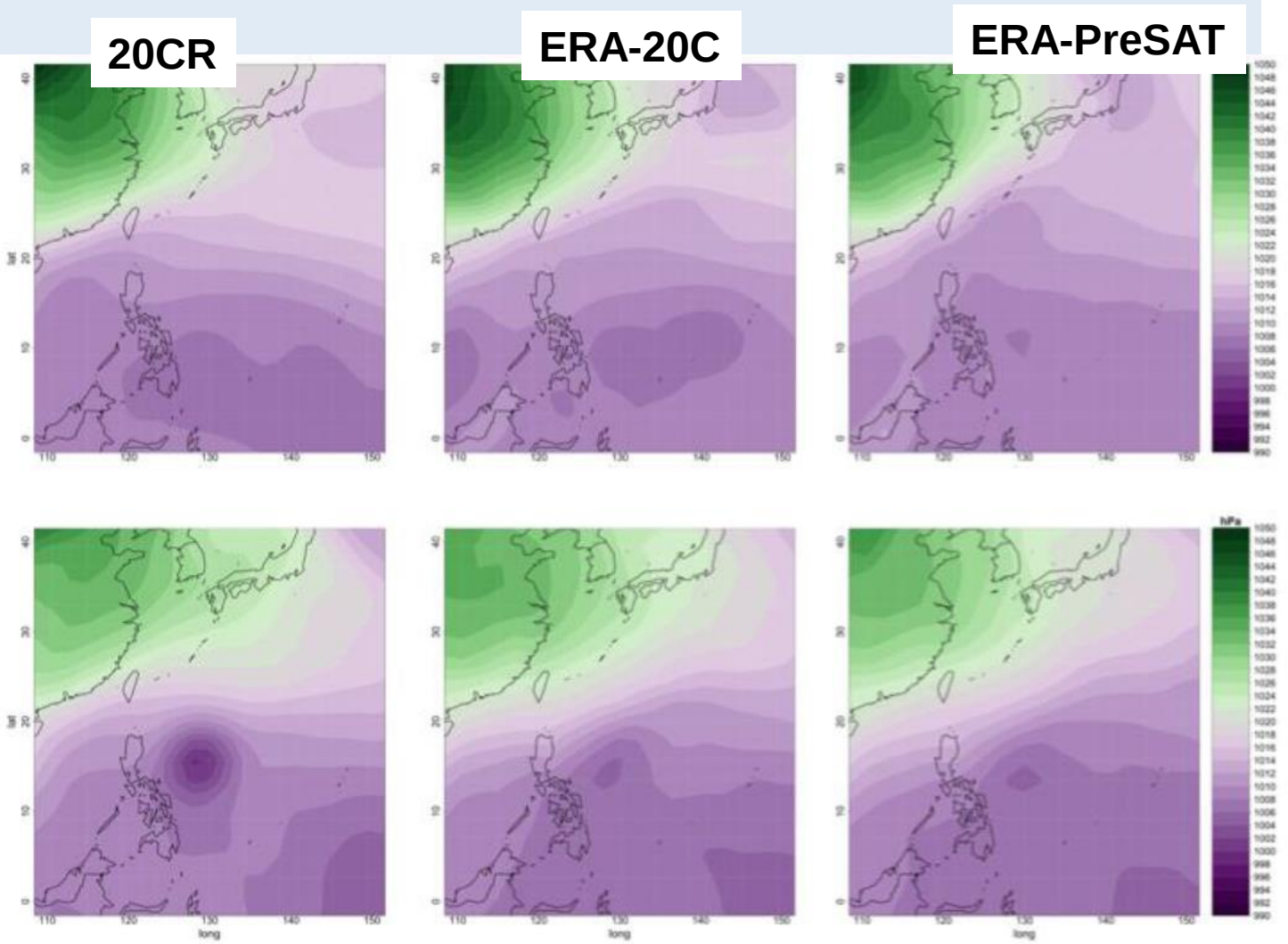

Figure 3. Contours indicate isobars of 6 hourly mean SLP in [hPa] on 15 December 1944 12 UTC (top) and 18 December 1944 06 UTC (bottom) from 20CR (left), ERA-20C (middle) and ERA-PreSAT (right).

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Dennis Feuchter, Markus Mosimann, Marco Tscherrig

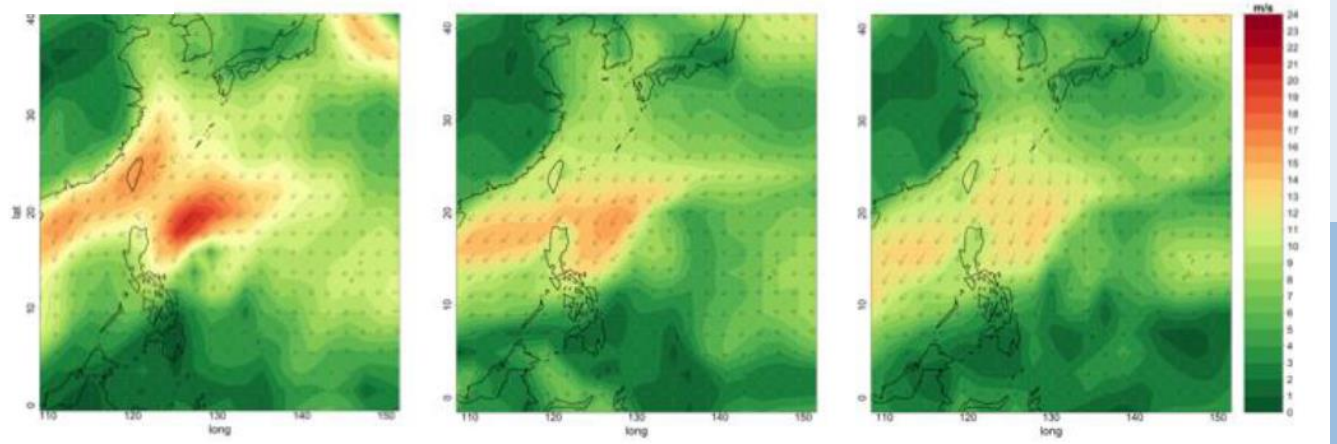

Figure 4. Wind vector fields at 10 m in [m/s] on 18 December 1944 12 UTC in 20CR (left), ERA-20C (middle) and ERA-PreSAT (right). The values are 3 (6) hourly means in 20CR (ERA-20C and ERA-PreSAT). The arrows indicate the wind direction; the colour contours indicate the wind speed in [m/s].

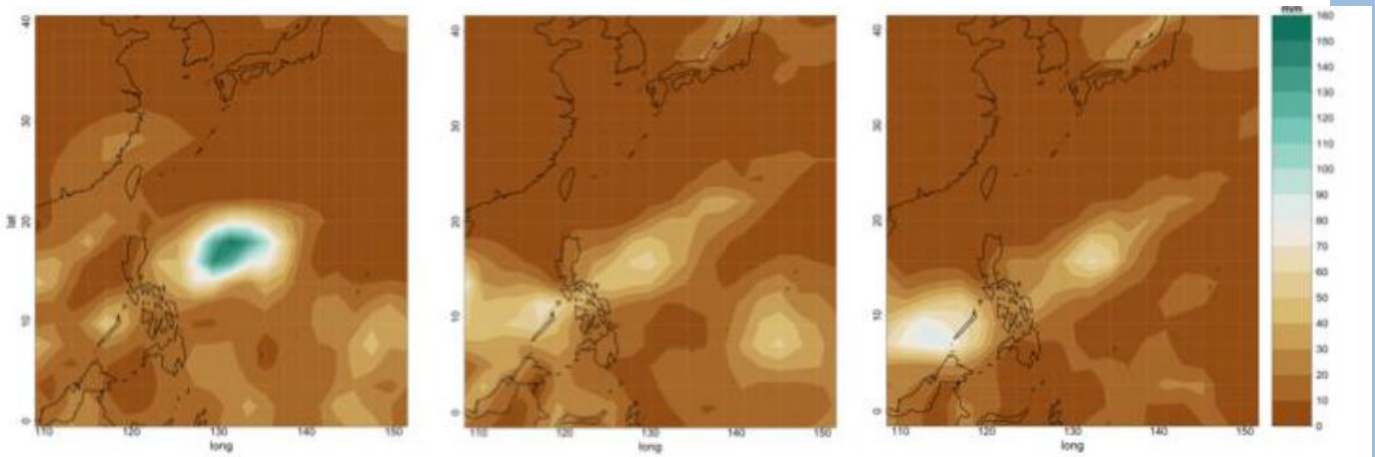

Figure 5. Contours show the 2-day-precipitation accumulation in [mm] for 17 and 18 December 1944 in 20CR (left), ERA-20C (middle) and ERA-PreSAT (right).

20CR has typhoon better than ERA20C and ERA-PreSAT

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Typhoon Hongkong 1906

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ERA-20C

20CR

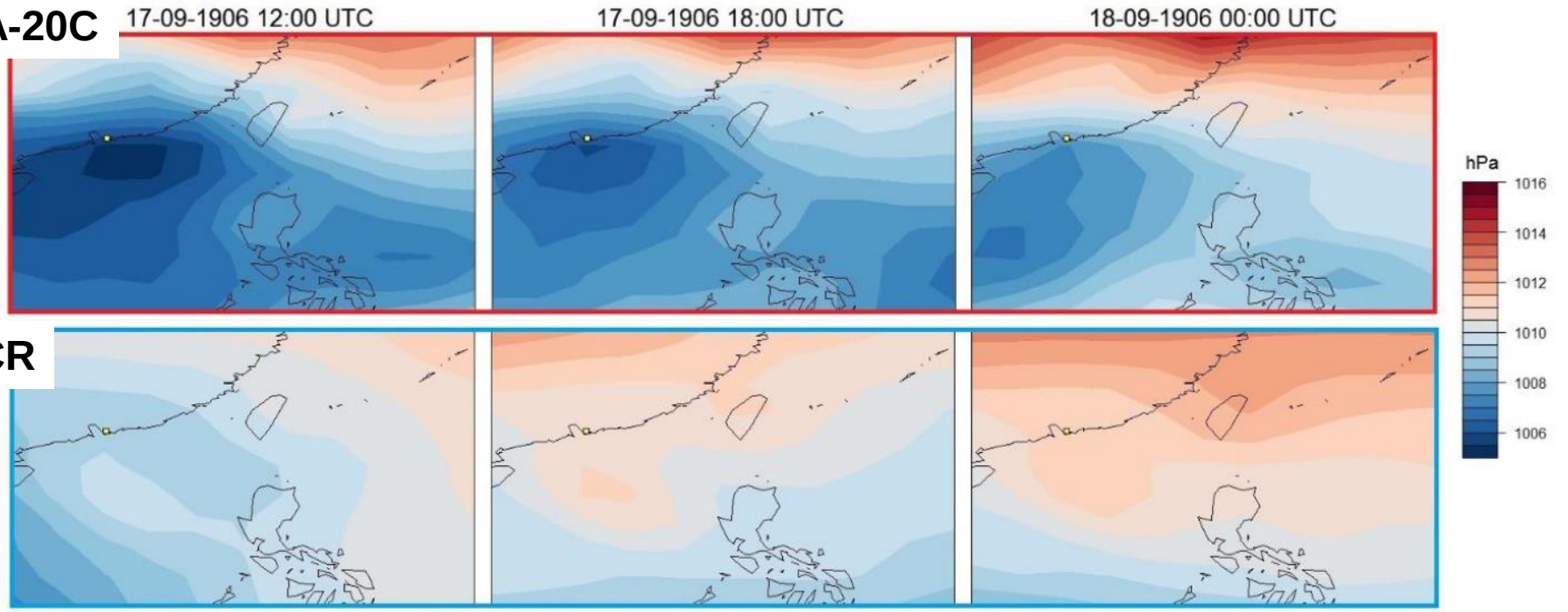

Figure 2: Sea-level pressure of ERA-20C (top) and 20CR (bottom) from 17.09.1906 12:00 UTC to 18.09.1906 00:00 UTC in the area 110°E -130°E / 10°N - 30°N.

ERA20C has typhoon better than 20CR

Dominique Lüthi, Regula Mülchi

Hurricane Janet 1955

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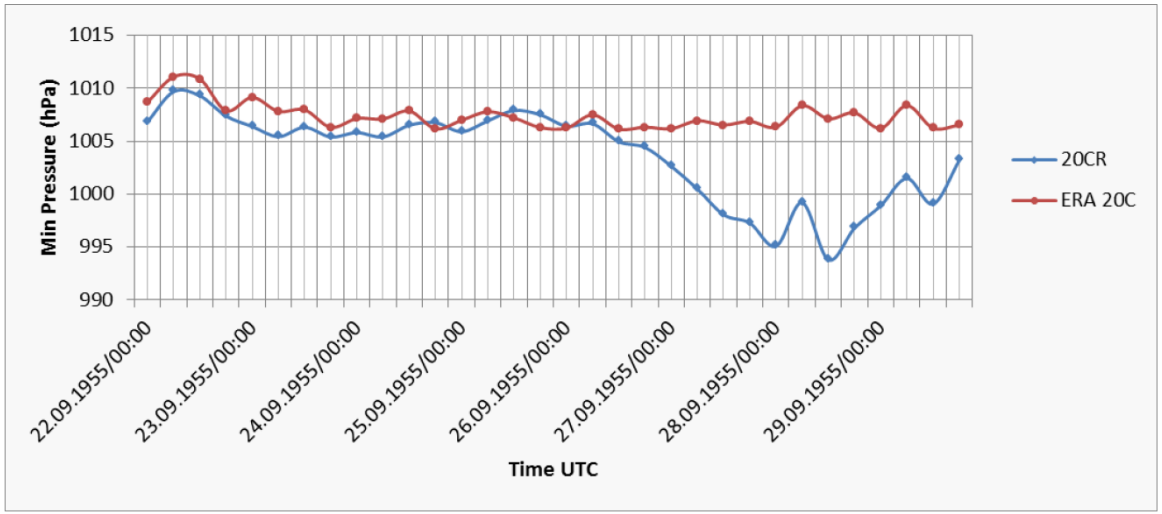

Figure 4: Minimum sea level pressure (SLP) development over time for Hurricane Janet with data from the 20CR and ERA-20C reanalysis datasets.

ERA20C misses the hurricane

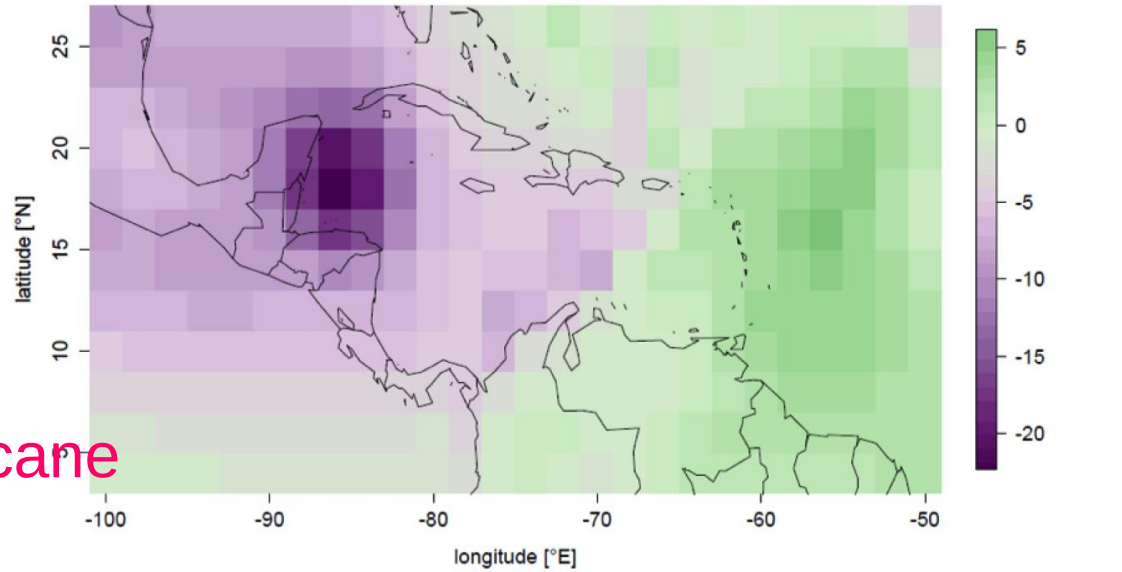

Figure 8: Difference map of SLP with data from ERA-20C and 20CR on 28 September 1955 at 00 UTC. (Negative values (violet) mean that 20CR represents a lower SLP than ERA-20C.)

Christoph Bertschi, Jan Stohler, Selina Studer

Typhoon Bart 1999

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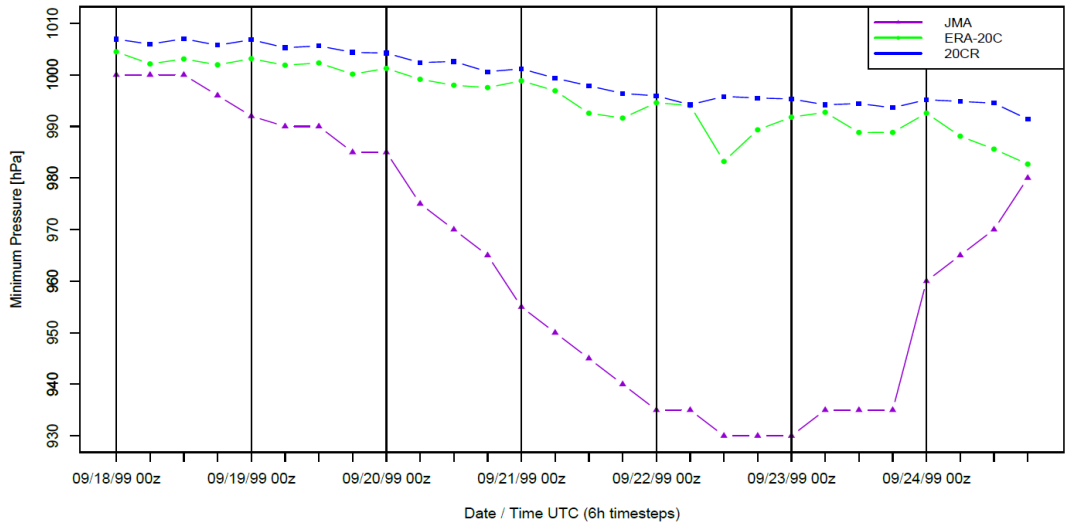

Figure 3: The minimum SLP time series of Typhoon Bart from the 18 September 00UTC to the 24 September

Underestimated in both,
Slightly better in ERA20C

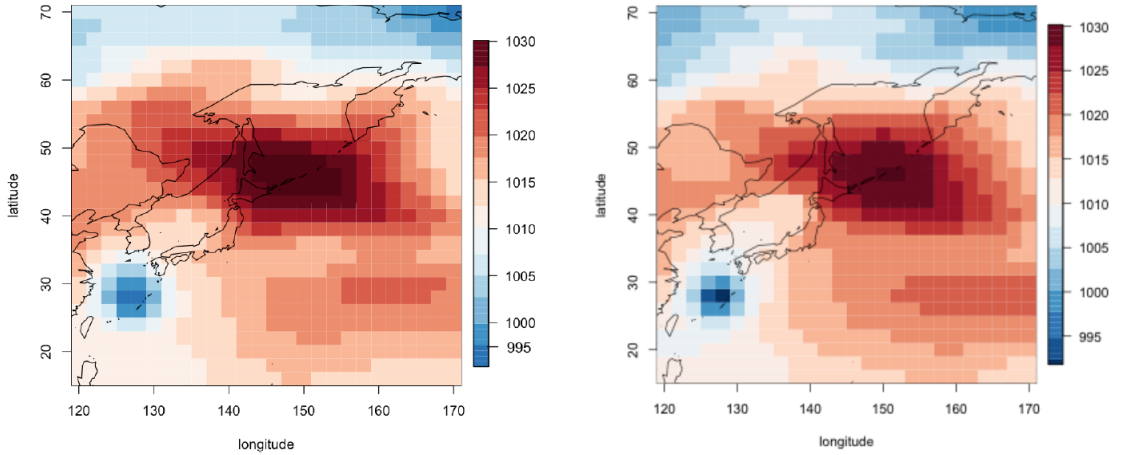

Figure 2: Sea Level Pressure (SLP) fields in hectopascal (hPa) on the 23 September 00UTC in **a)** 20CR and **b)** ERA-20C. Low SLP values in blue close to the southern coast of Japan represent Typhoon Bart.

Regina Daus, Nadine Schorpp, Matthias Worni

1930s Arctic warming comparisons

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Data compared:

Observation.based data:

- ERA-20C (one member)
- 20CR (ensemble mean)
- EREC = REC1: Monthly statistical reconstructions based on surface and upper-air data using hemispheric principal components across all variables and levels (Griesser et al. 2010)

Model simulations:

- ERA-20CM (ensemble mean)
- CCC400 (ensemble mean): ECHAM5.4, T63, AMIP-type, 30 members

700 hPa GPH DJF
Differences w/r to 1900-19

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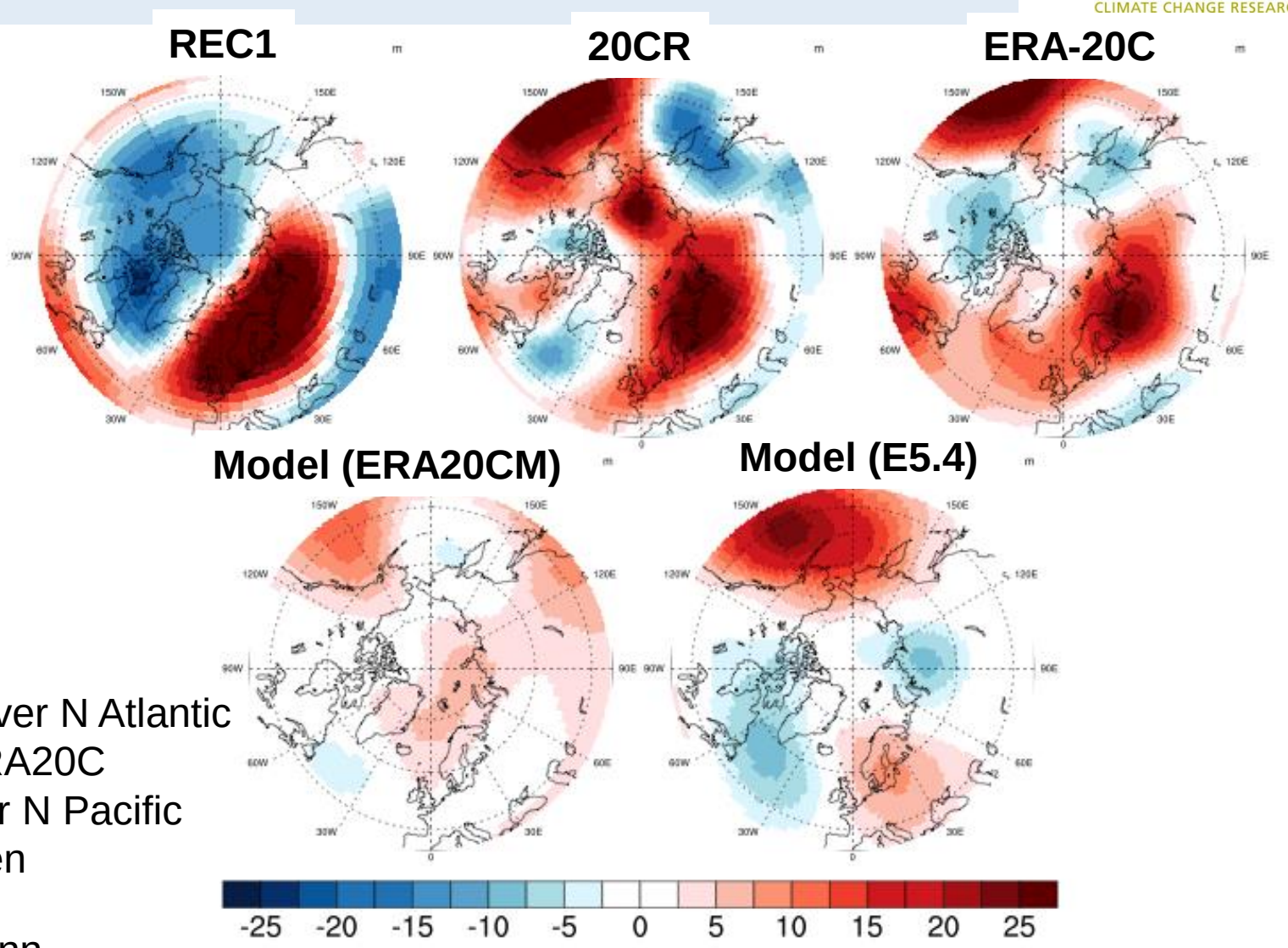

Differences over N Atlantic
20CR and ERA20C
signature over N Pacific
is model driven

Martin Wegmann

Same for 700 hPa temperature

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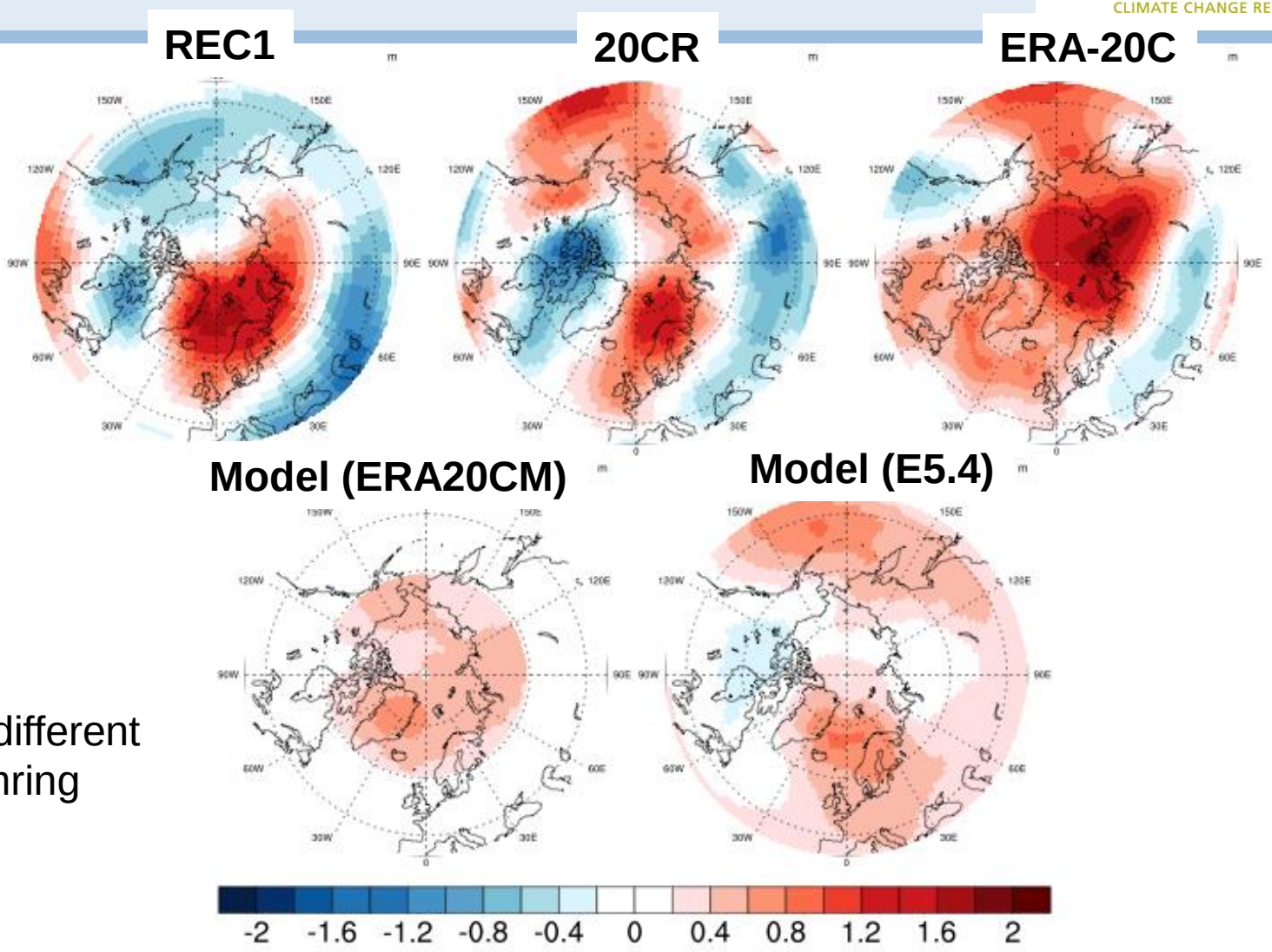

ERA20C has different shape of warmring

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Same but w/r to 1971-2000 (GPH)

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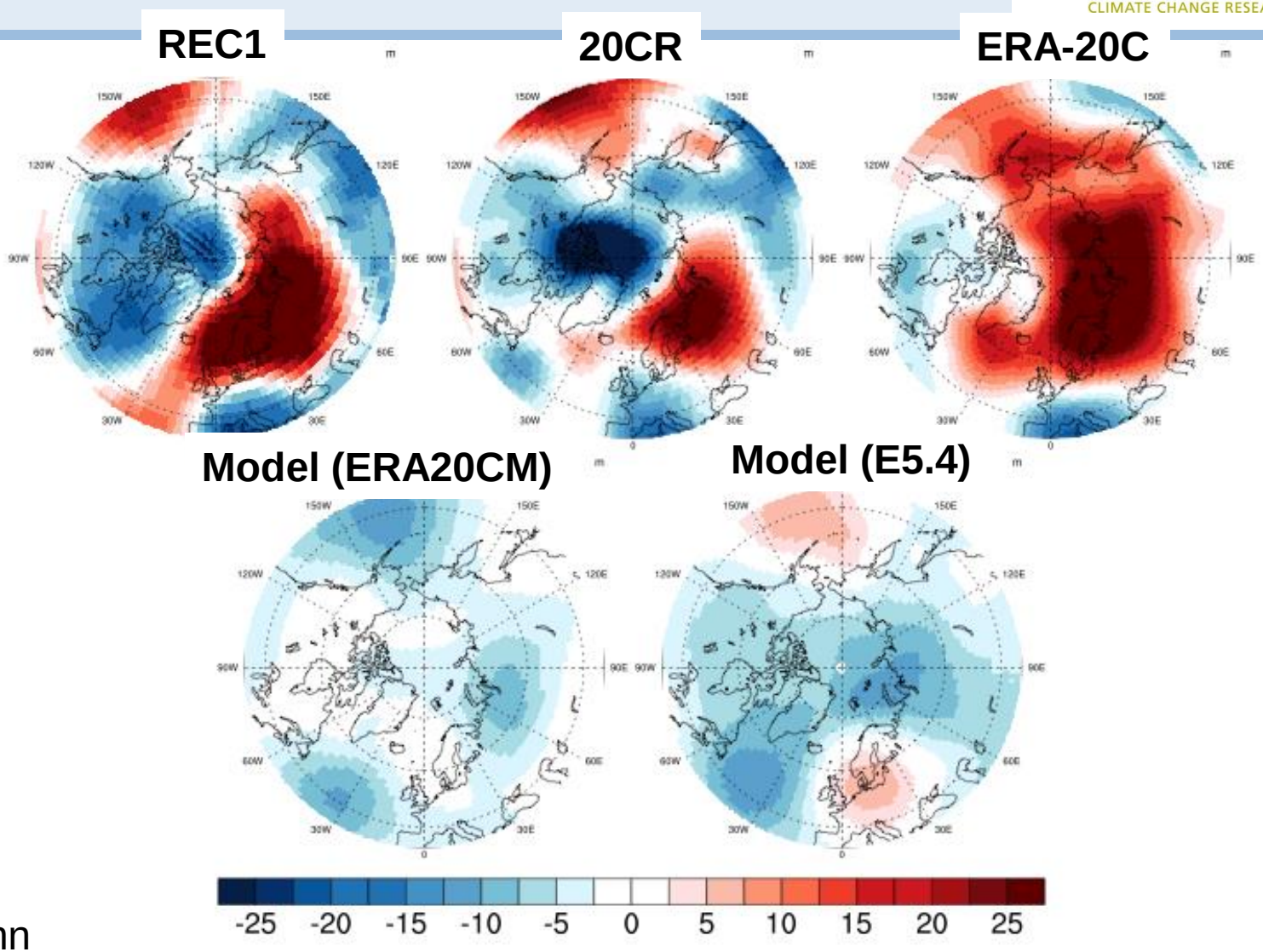

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Same but w/r to 1971-2000 (Temp)

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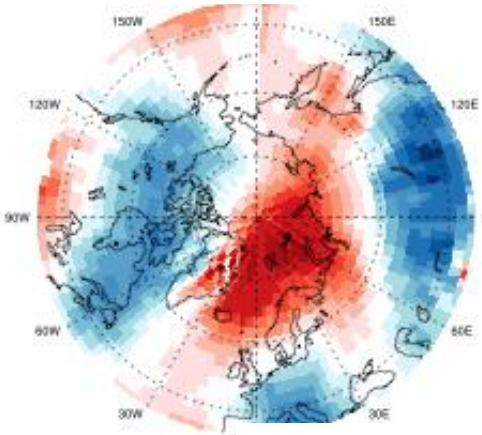
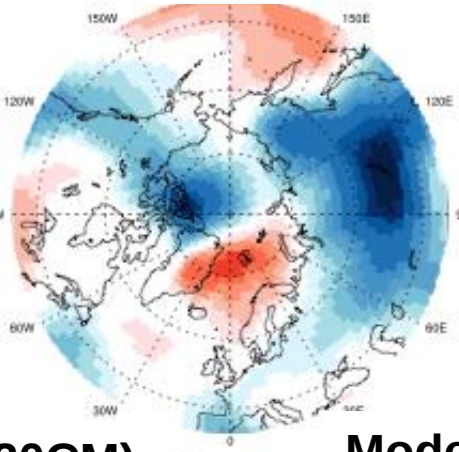
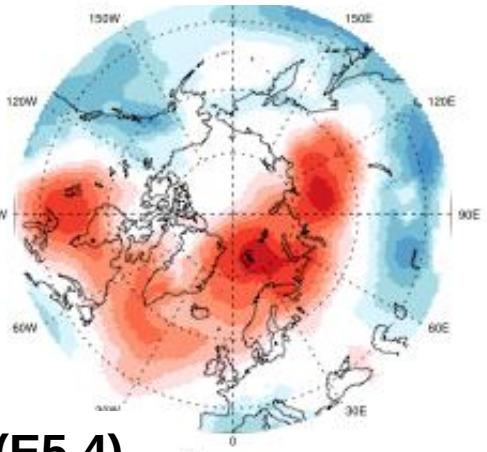
REC1



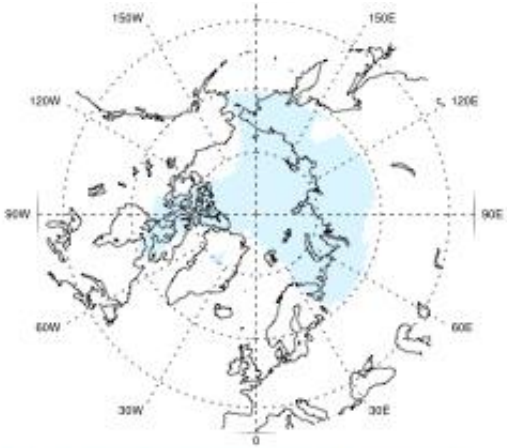
20CR



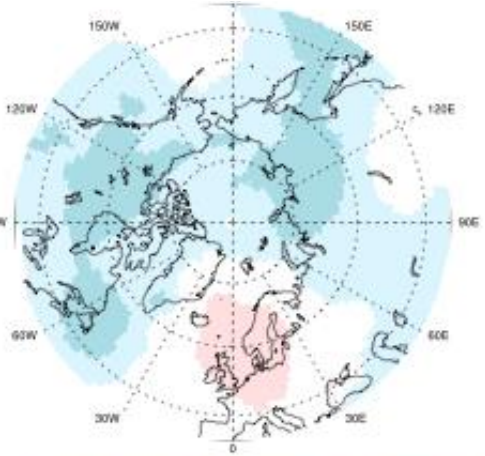
ERA-20C

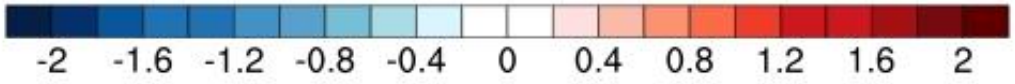


Model (ERA20CM)



Model (E5.4)





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Arctic temperature

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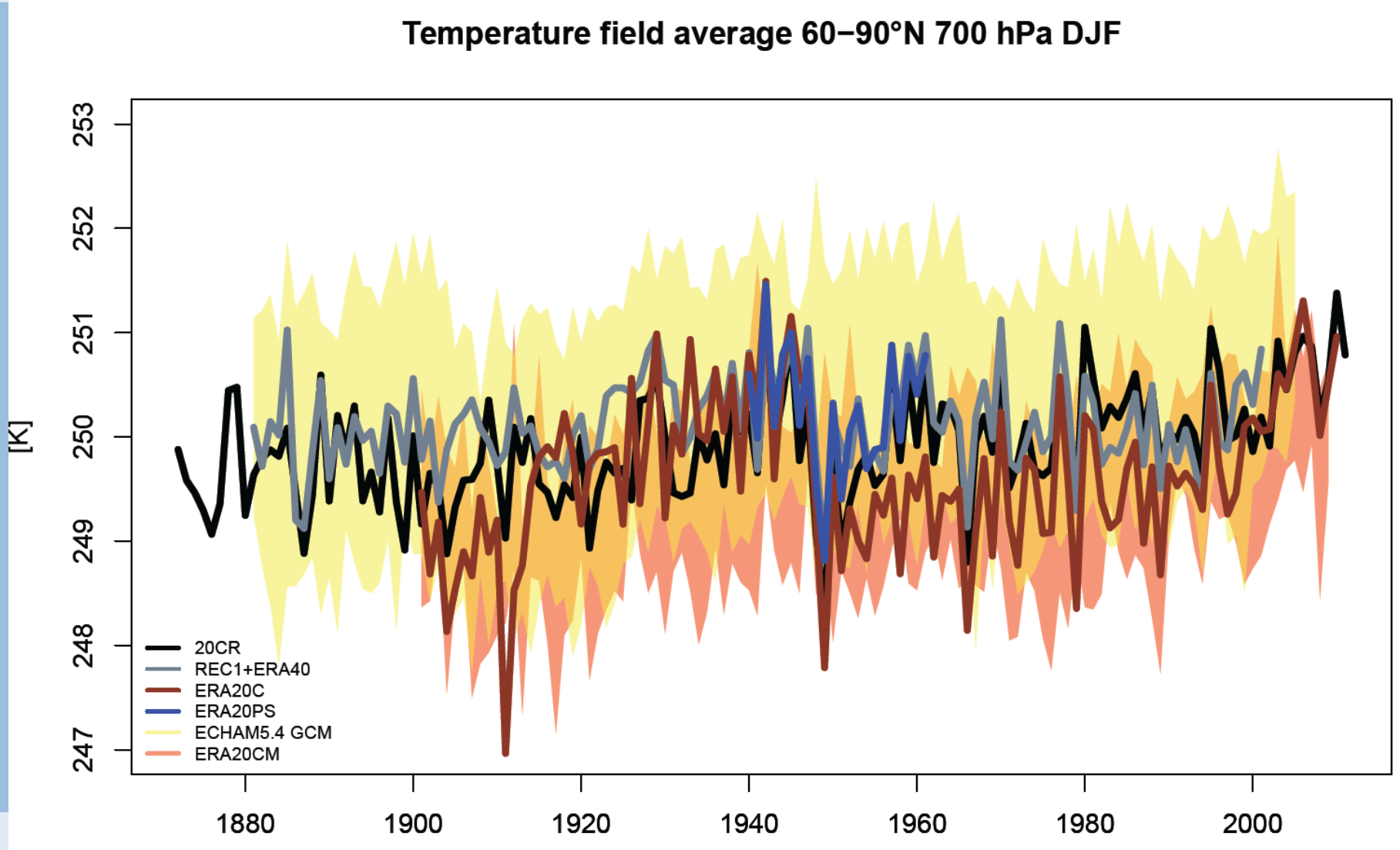
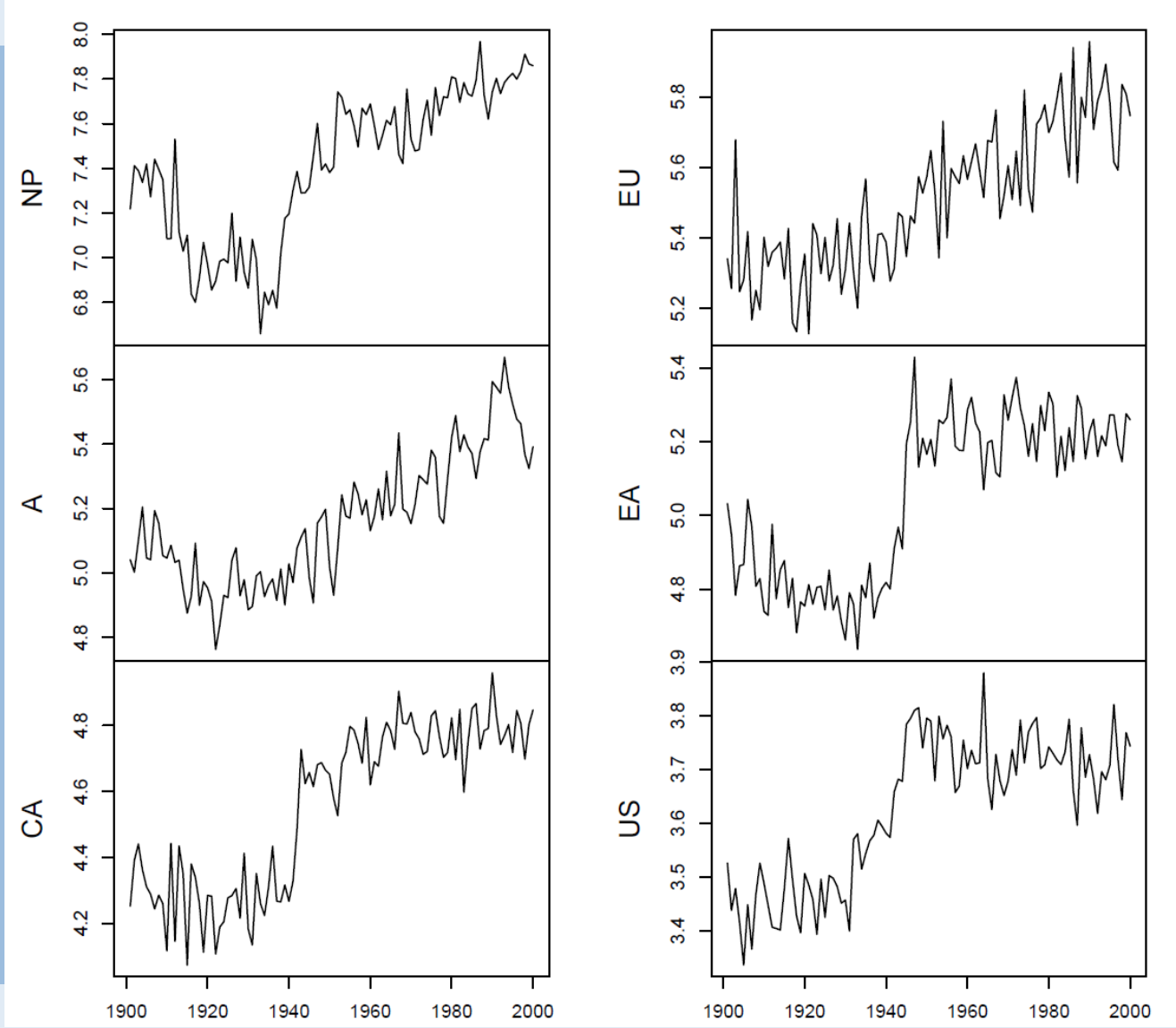


ERA-20C 10 m wind speed, area averages



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Wind speed, 10 m or 0.995 sigma, 20-yr moving averages

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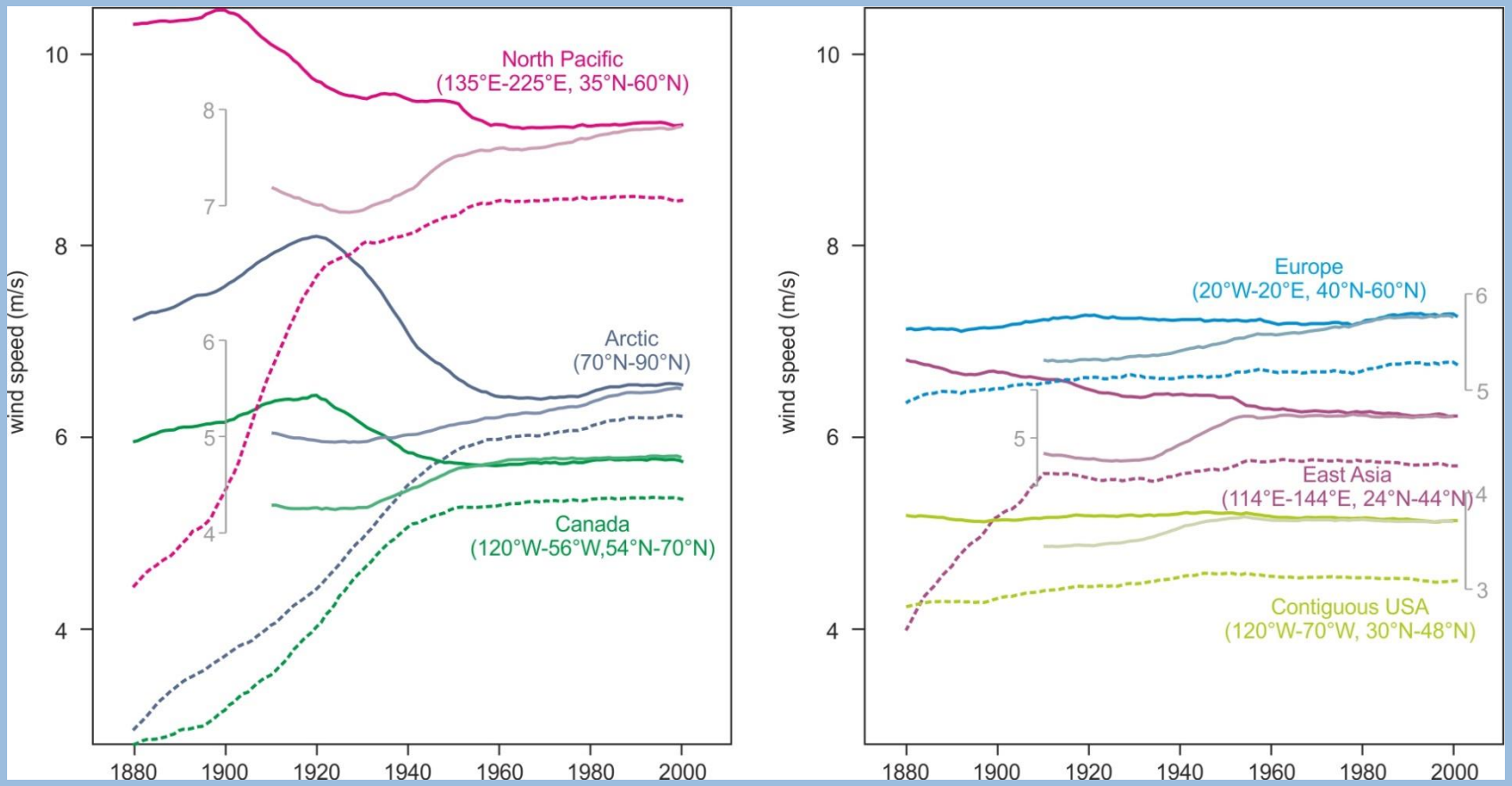
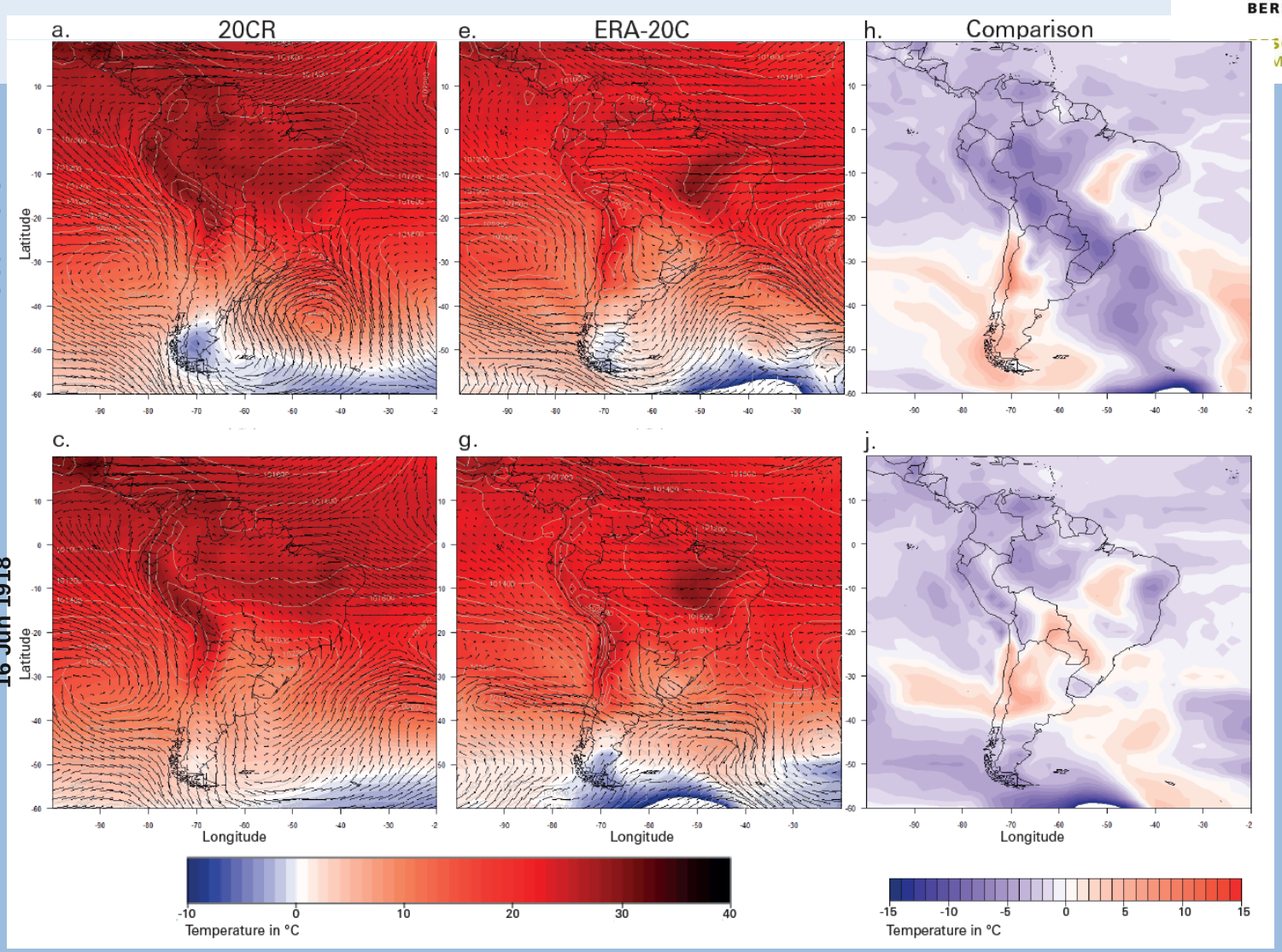


Cold Spell Argentina 1918



Both have signs of a cold spell although only 3 station in ISPD

Carla Laub, Andrea Omlin, Sébastien Rapaz

Australian Heatwave 1939

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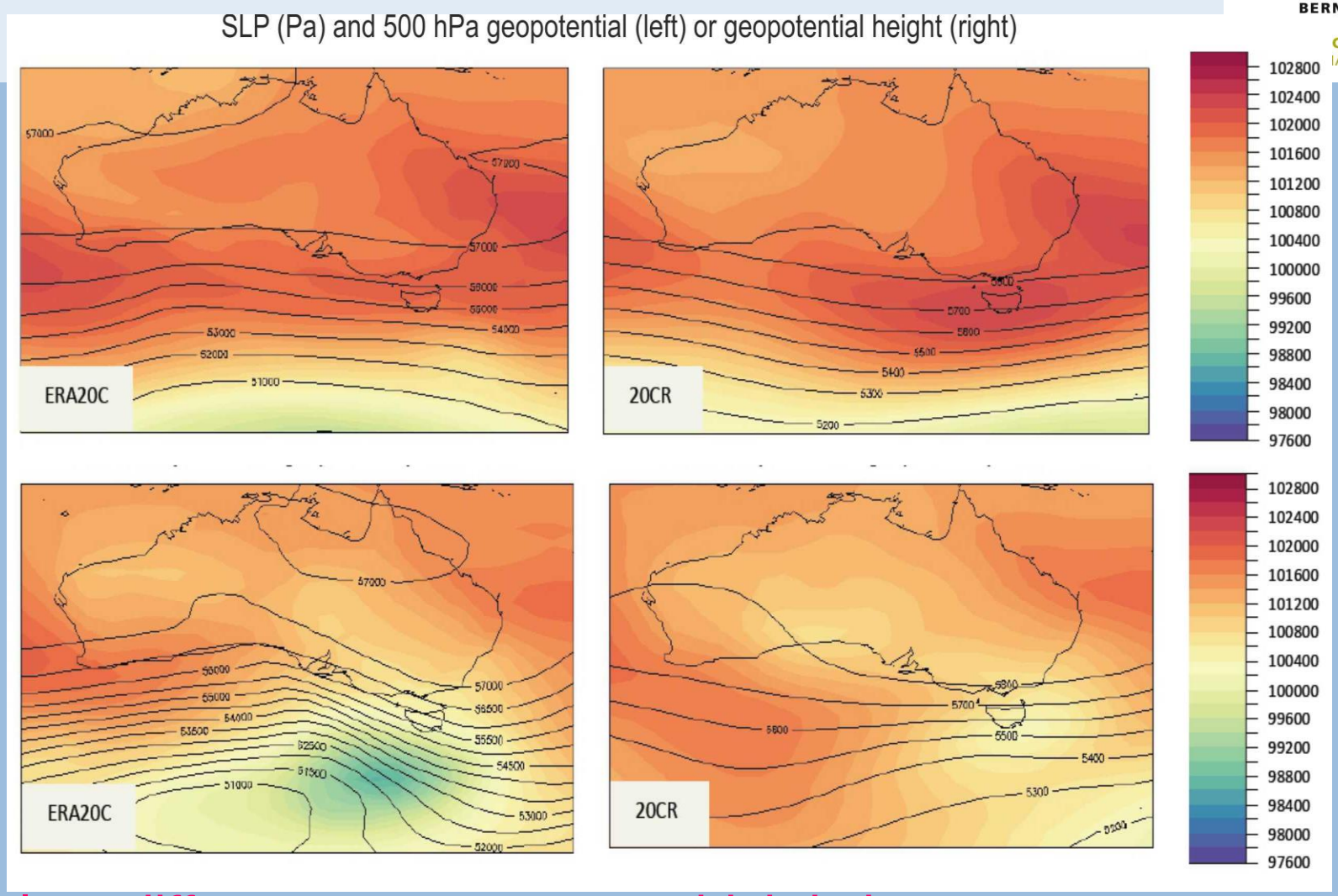

Clear differences – not sure which is better

Alden Ackerman, Jacqueline Fenwick, Mridula George

Flood event Japan 1938

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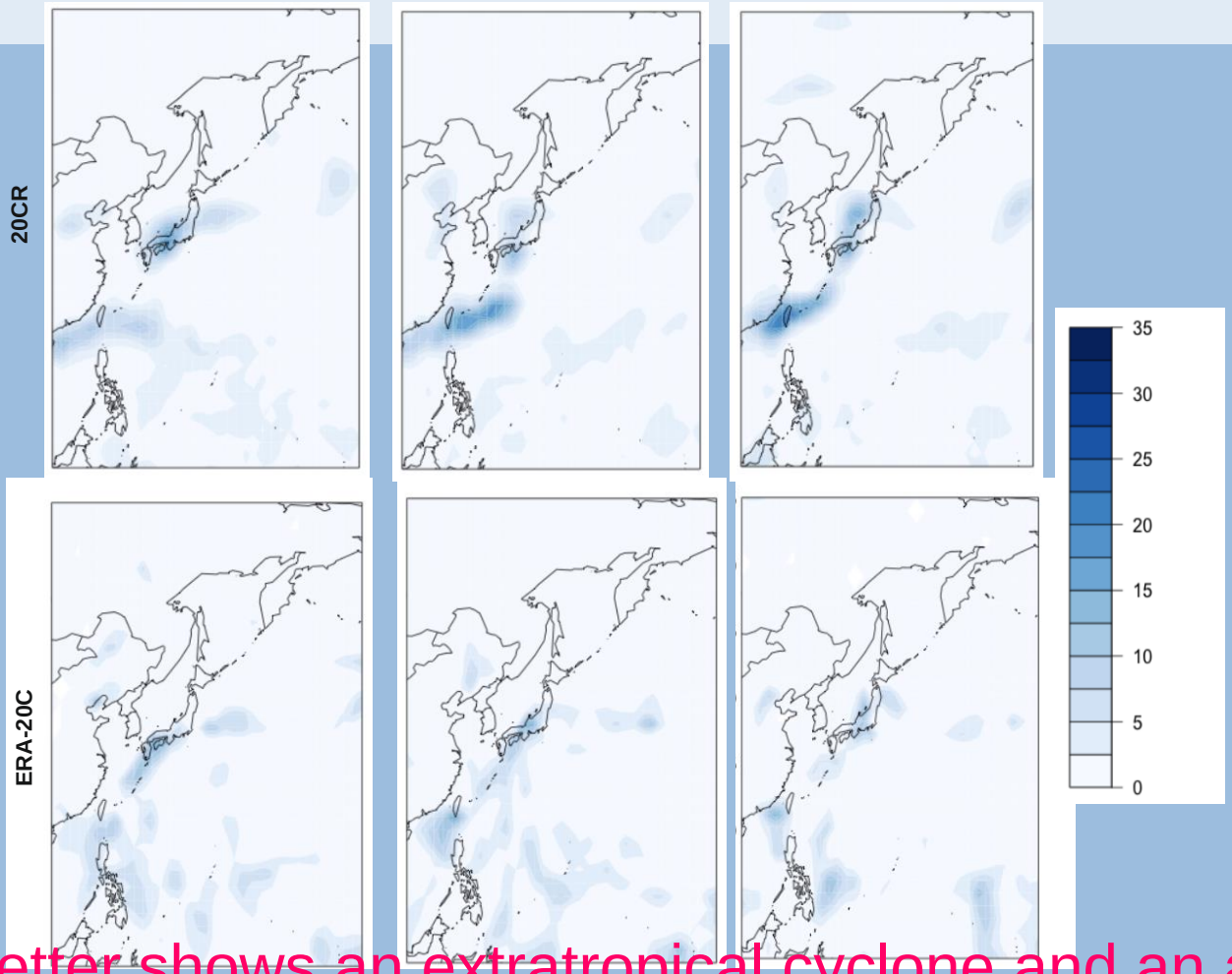
Precipitation (mm/6hrs) on 2 (left), 3 (middle) and 4 (right July 1939



20CR better shows an extratropical cyclone and an approaching tropical cyclone undergoing extratropical transition

Jessica Russell, Marlon Fochler, Oliver Kumar

Cold Spells 1912

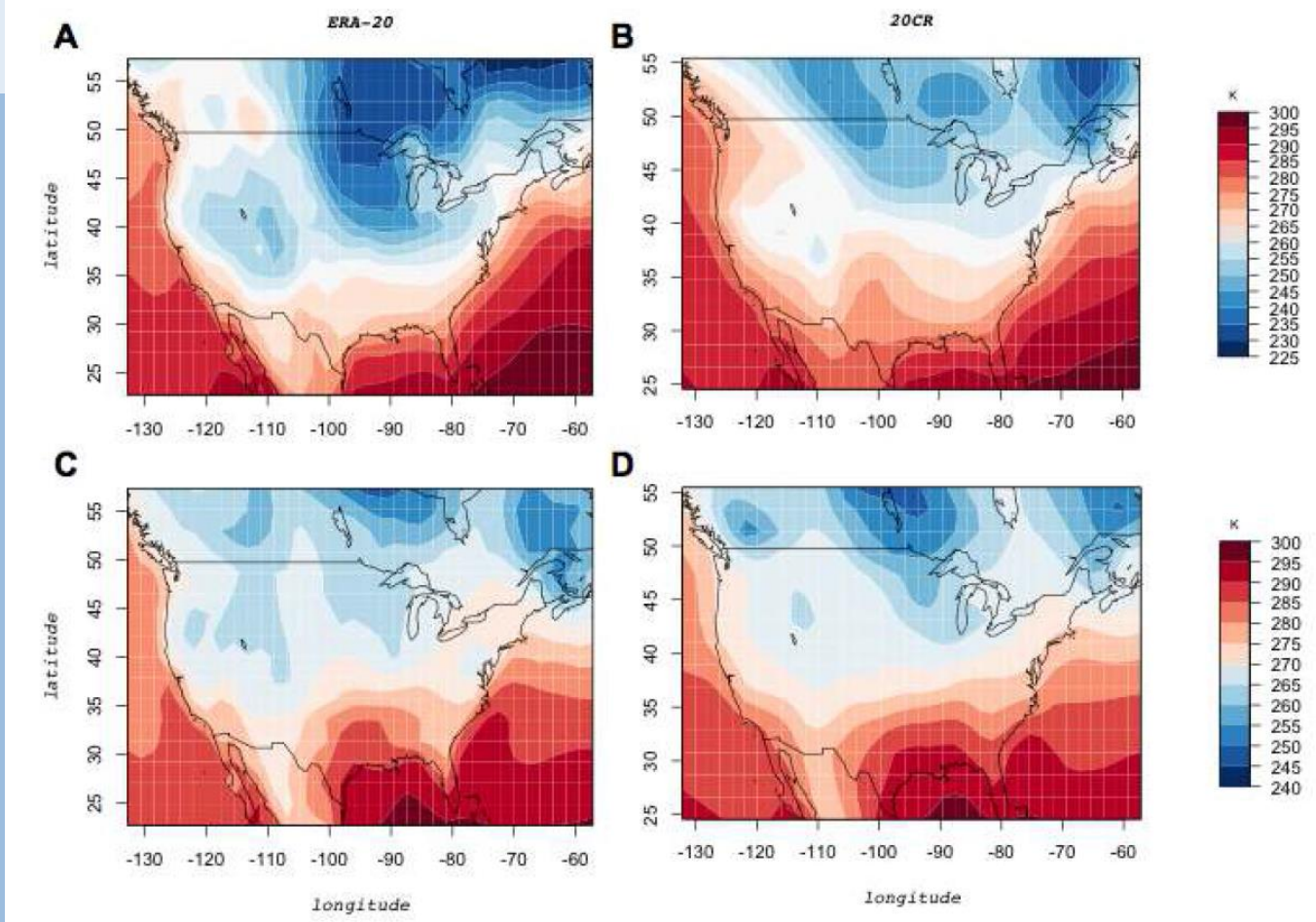


Figure 1: Spatial distribution of 2 m air temperature on January 5th (A, B) and February 20th (C, D). The reanalysis dataset ERA-20C (A, C) and 20CR (B, D) are shown over North America. Temperature values are in Kelvin.

ERA20C has cold spell better than 20CR

Roger Nussbaumer, Fabian Schelbert, Malin Michelle Ziehmer

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