Supplement to the article

Dynamical downscaling and data assimilation for a cold-air outbreak in the European Alps during the Year Without Summer 1816

Peter Stucki[1,2] and Lucas Pfister[1,2], Yuri Brugnara[1,2,*], Renate Varga[1,2,**], Chantal Hari[1,3,4], Stefan Brönnimann[1,2]

[1] Oeschger Centre for Climate Change Research, University of Bern, Bern, 3012, Switzerland
[2] Institute of Geography, University of Bern, Bern, 3012, Switzerland
[3] Physics Institute, University of Bern, Bern, 3012, Switzerland
[4] Wyss Academy for Nature, University of Bern, Bern, 3011, Switzerland
[*] now at EMPA, Dübendorf, 8600, Switzerland
[**] now at REWE International AG, Wiener Neudorf, 2355, Austria
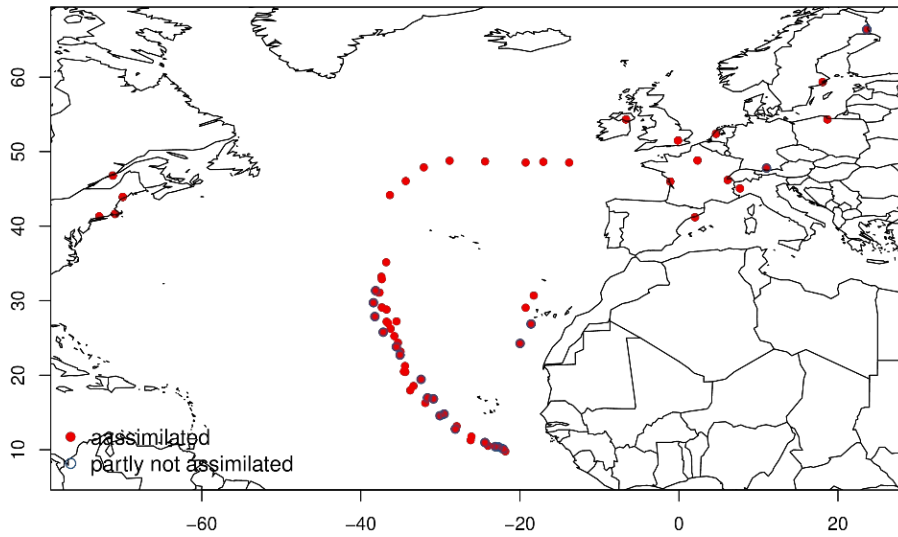
Figures

Figure S1: Locations of surface pressure observations (red dots) from ISPDv4.7 that are assimilated into 20CR for the period 5 June 1816 12:00 to 12 June 1816 11:00. Blue circles mark locations with some instances of observations that are not assimilated.
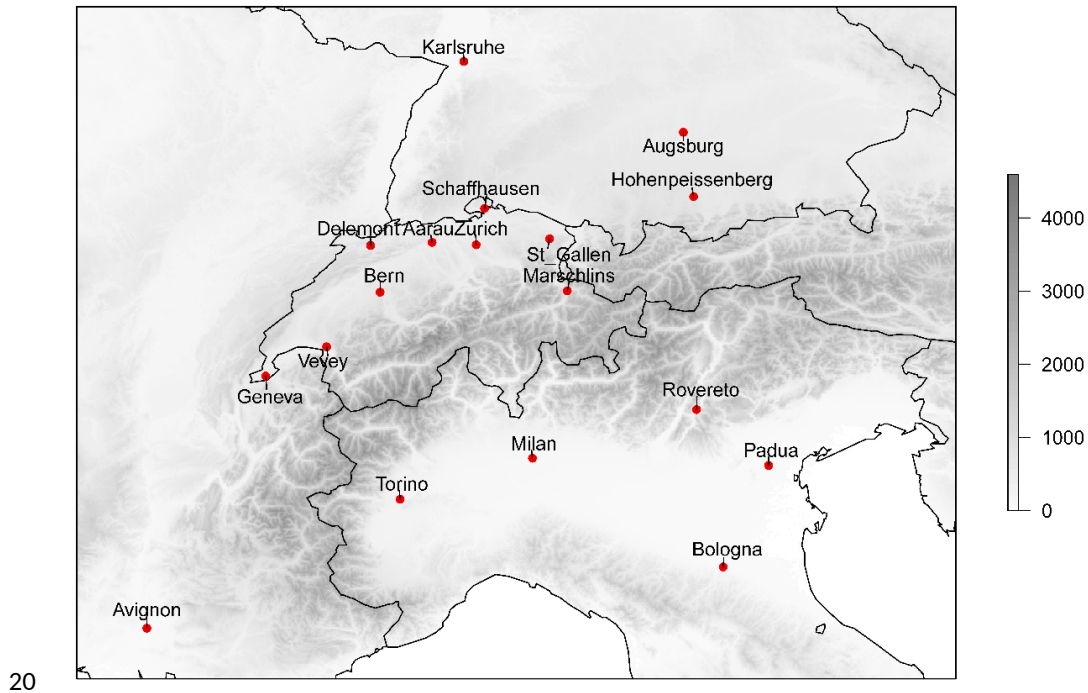

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Figure S2: Researched stations (red dots) for the WRF data assimilation experiment and elevation (shade, m a.s.l.). Refer also to Table 1 in the main article.
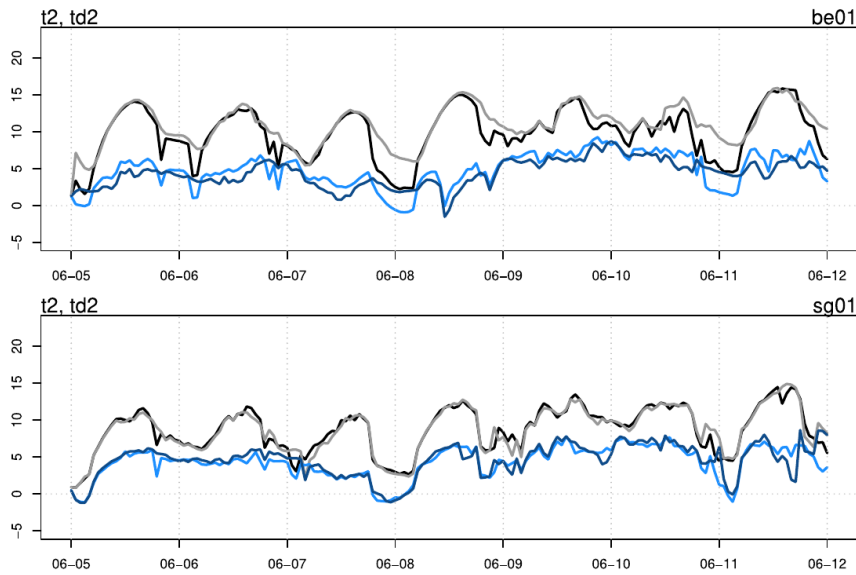
Figure S3: comparison of a WRF NODA simulation based on historical land use categories with WRF NODA simulation based on modern land use categories, for the period between 5 and 11 June 1816 (x-axis). Shown are air temperature (black line for historical, grey line for modern land use; °C 2 m above ground) and dew-point temperature two meters above ground (blue line for historical, dark blue line for modern land use; °C 2 m above ground) for the stations of Bern (top) and St. Gall (bottom).
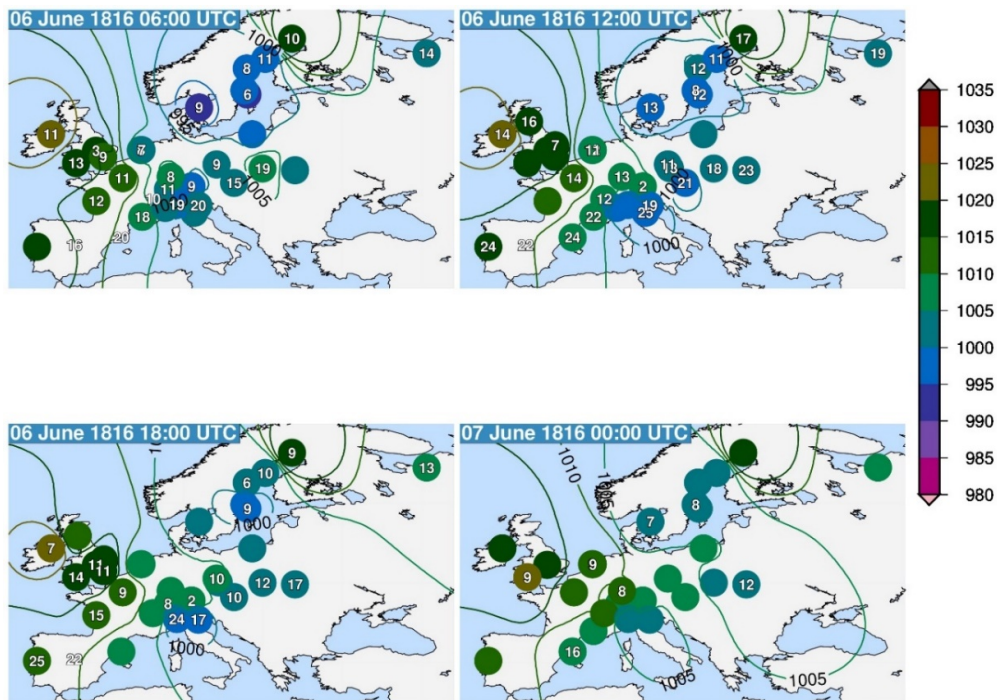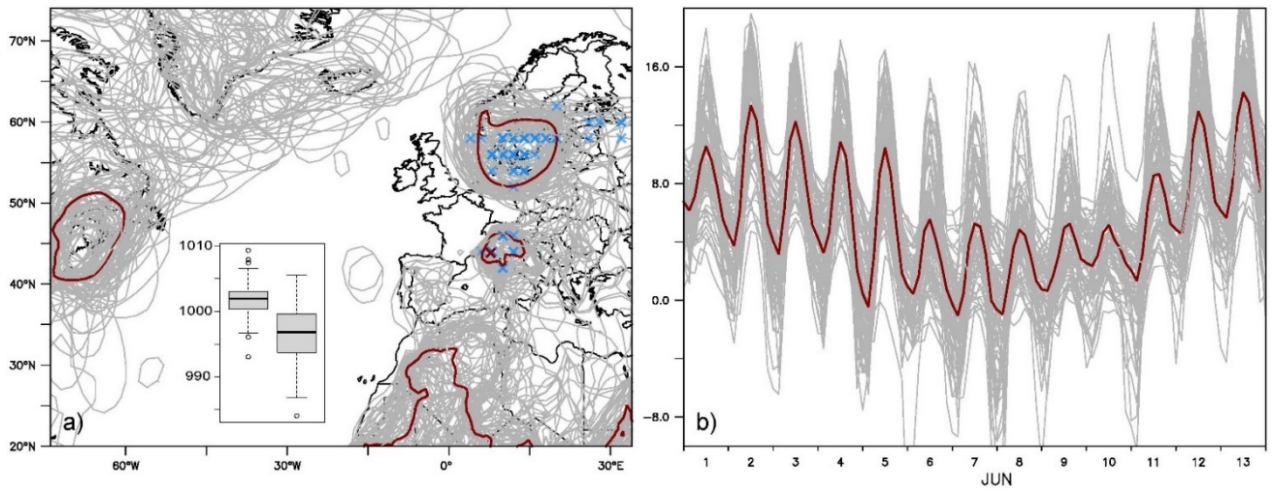

Figure S4: Measurements of surface air temperature (numbers within dots) and pressure (dots, shaded according to indications in hPa, see also color key), and interpolated sea level pressure (lines, same color scale as dots) for Europe and 6 June 1816. Cf. Brugnara et al., (2016).

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Figure S5: Isobars at 1005-hPa of all 80 ensemble members in 20CR (grey lines) and of the ensemble mean (red lines) for the North Atlantic region on 6 June 1816 18 UTC. Semi-transparent blue crosses mark the location of local minima over Scandinavia and the Alps / Northern Italy; darker color means more pressure minima from the ensemble are located here. The red cross marks the SLP minimum of the ensemble mean over the Alps / Northern Italy. The algorithm did not produce a single minimum for Scandinavia, so not shown. The inset shows the distribution of SLP minima (hPa) in the 80 20CR members over the Alps / Northern Italy (left) and Scandinavia (right). The SLP minimum over the Alps / Northern Italy for the ensemble mean is 1002.09. b) 20CR air temperature at 2 m above ground (°C) at 7.7 E, 47 N from 1 to 13 June 1816. Grey lines mark the 80 ensemble members, the red line the ensemble mean.
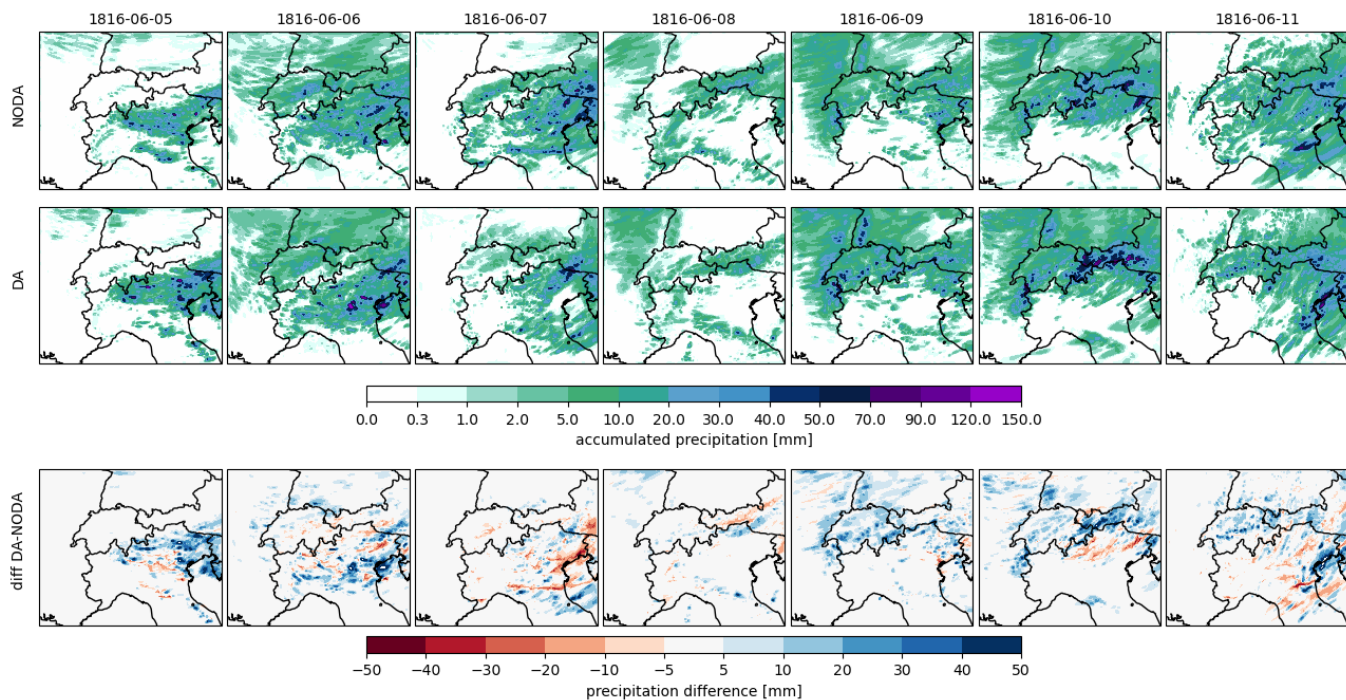
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Figure S6: daily accumulated precipitation (00 UTC – 00 UTC of the next day) from June 5 to June 11 1816. Shown are results from NODA (top) and DA (center) simulations, as well as the difference between the two simulations (bottom).

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