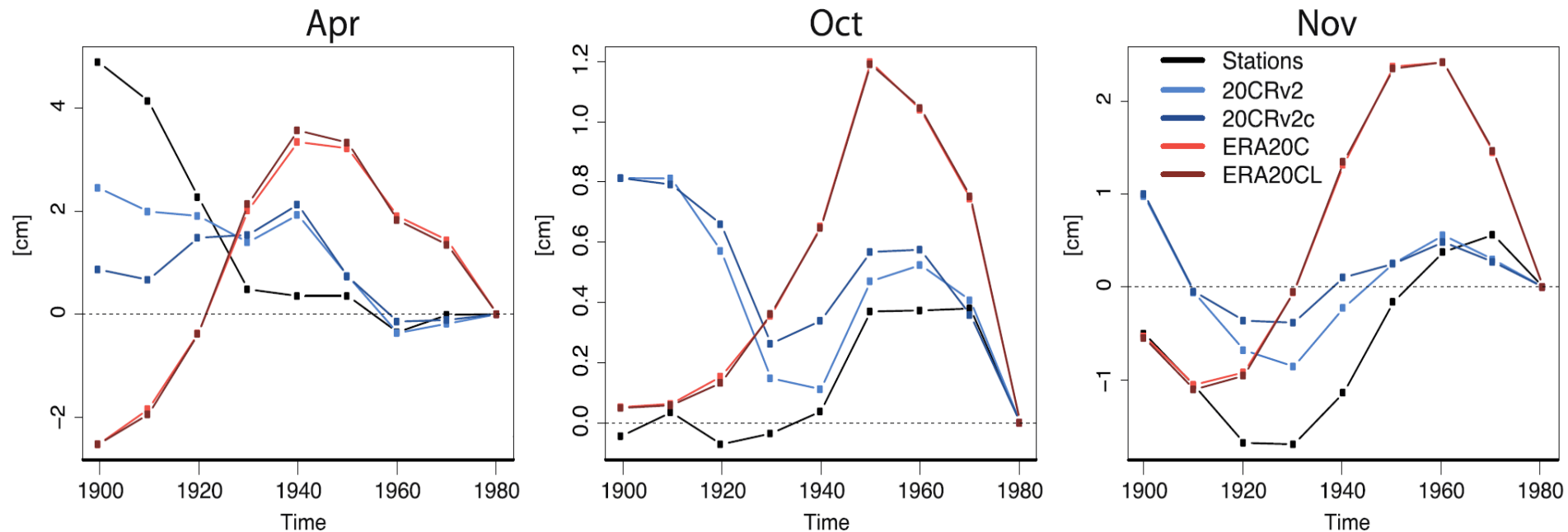# WP 4 Contribution of UNIBE

Stefan Brönnimann

Oeschger Centre for Climate Change Research

Institute of Geography

University of Bern

Outline

> Assessment and analyses of re-analyses
> **Tropical cyclones**
> Case study: Avalanches in 1916
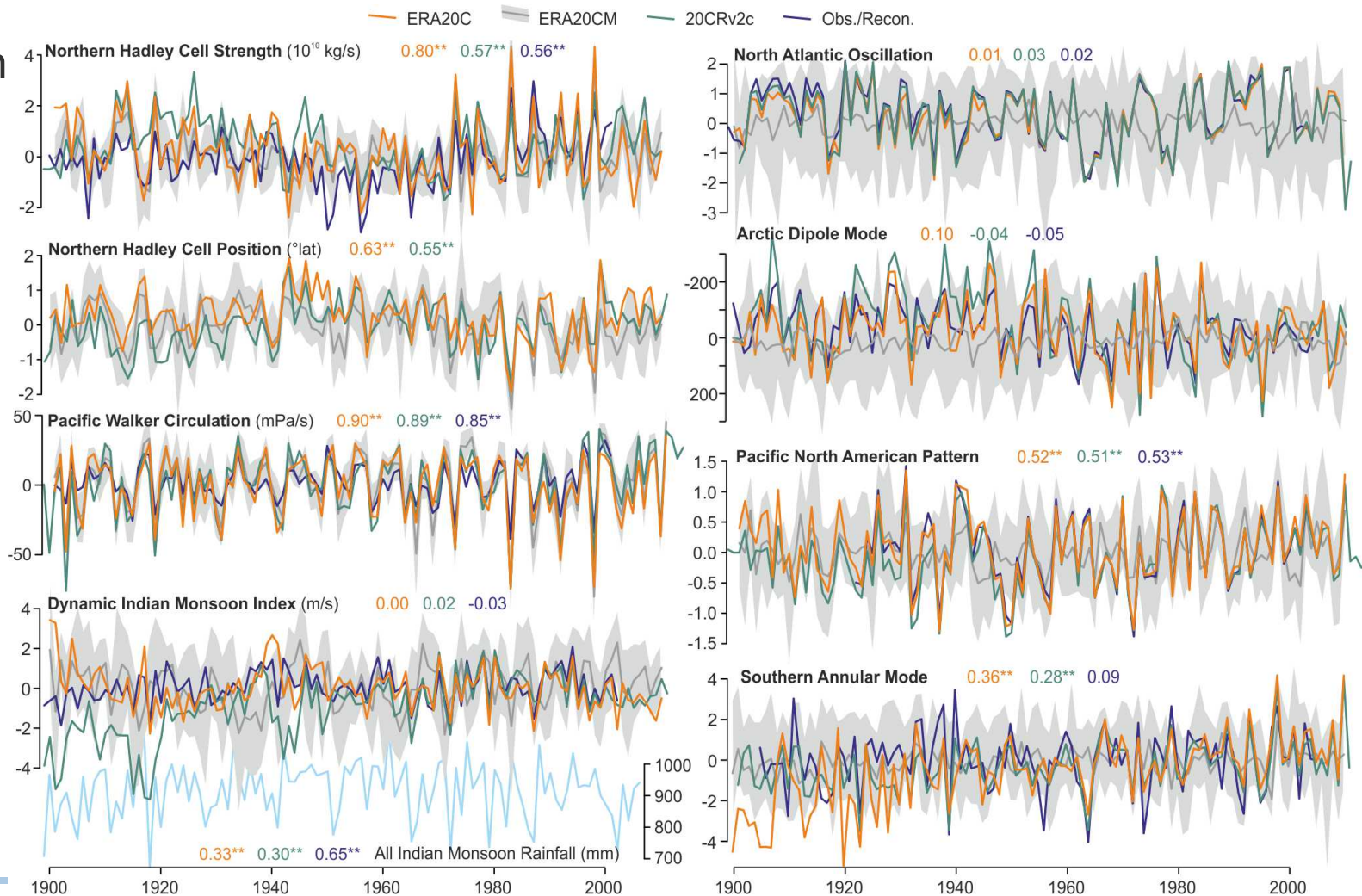
Assessment and analyes of re-analyses

> Snow: Decadal snow depth variations not good in any reanalysis

Wegmann et al. (2016), *Cryosph. Disc.*
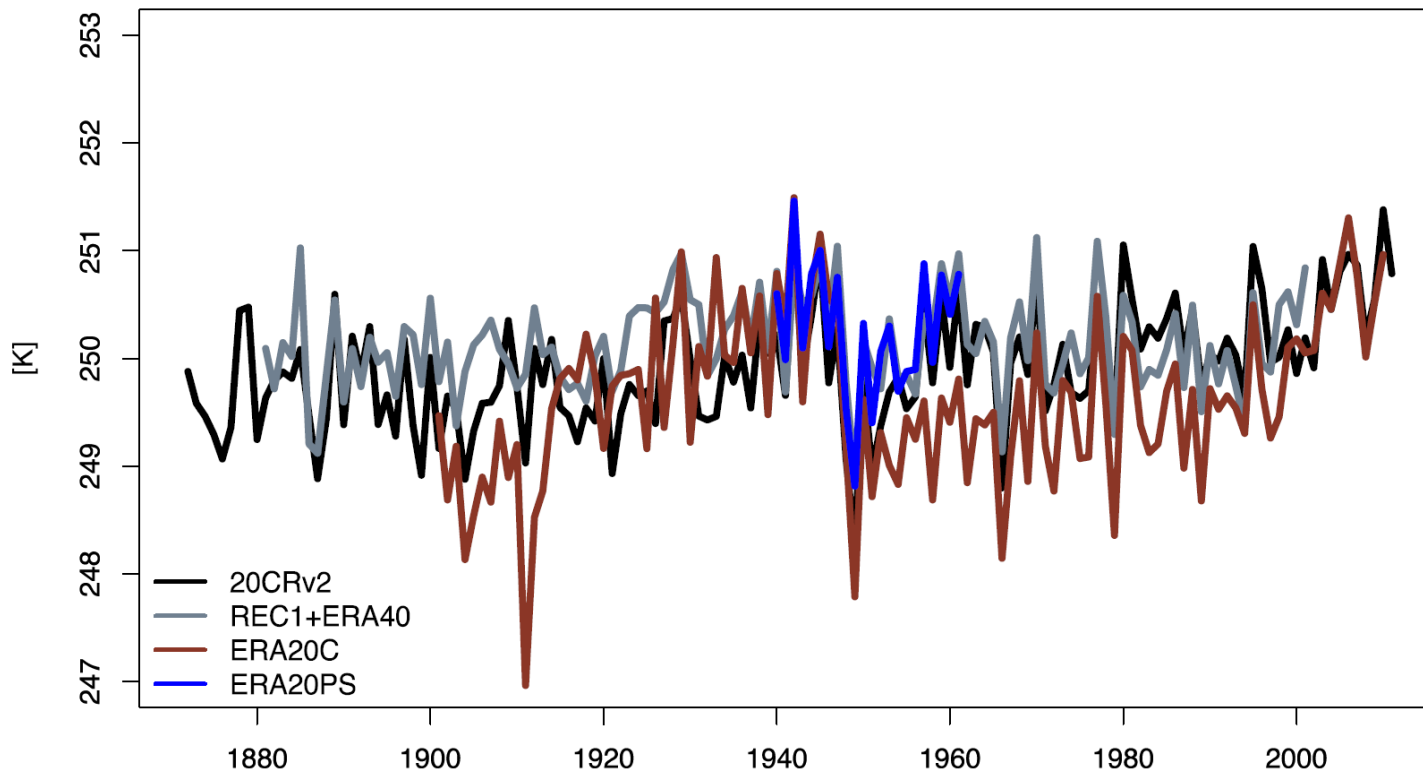
Assessment and analyes of re-analyses

> Circulation
indices:
ERA-20C
good!

(in preparation)

Assessment and analyes of re-analyses
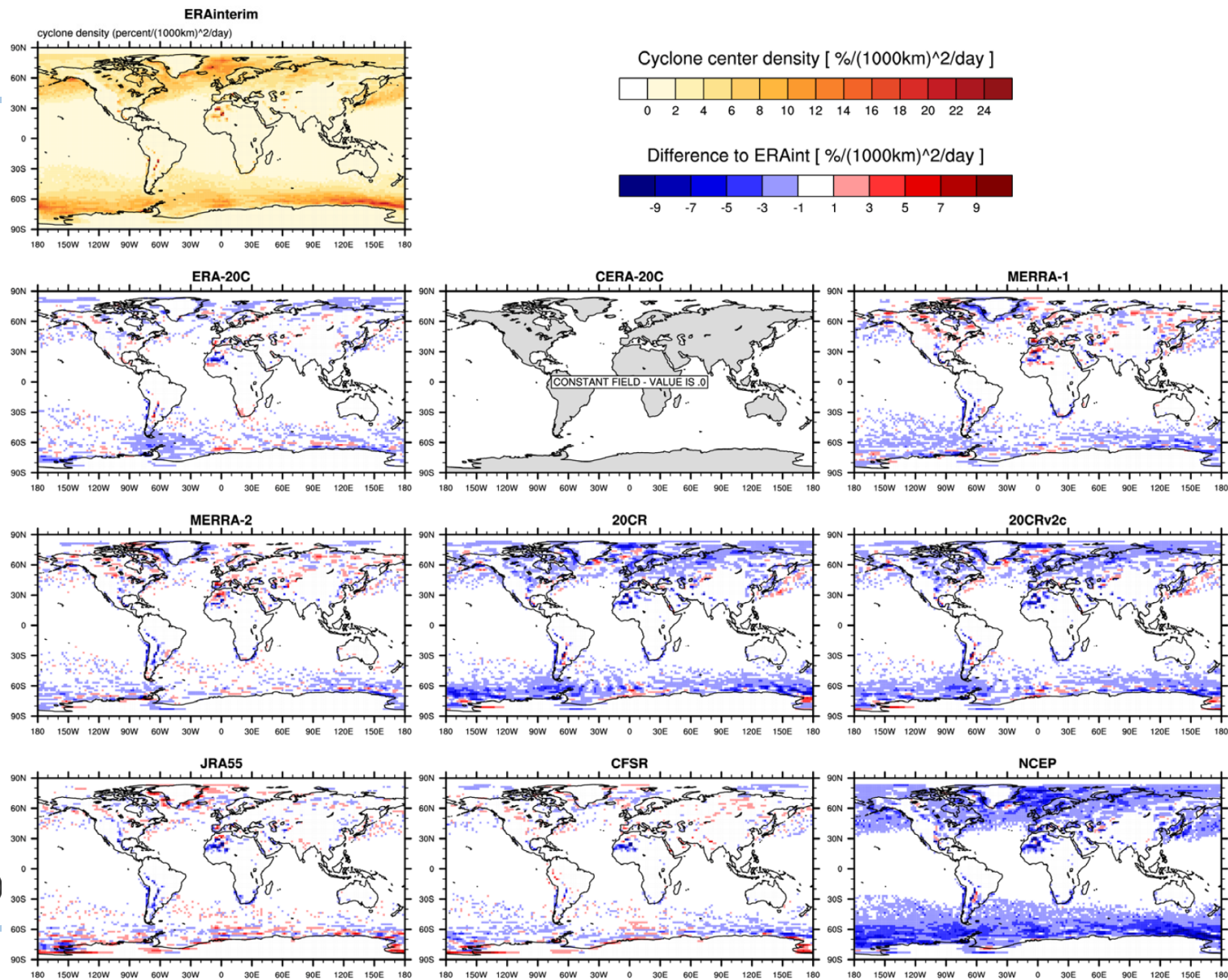
> Arctic temperature (DJF, 700hPa): ERA20C a little cold

Wegmann et al. (2016), *Clim. Dyn.*

Assessment and analyes of re-analyses

> Cyclones:
Excellent
in ERA20C

Rohrer et al. (in prep.)

Assessment and analyes of re-analyses

> QBO:
Holton-Tan
effect good
in ERA20C

Table 1. Standardized difference in indices between easterly and westerly QBO phases in different observation-based data sets as well as in the climate model simulations (F13, F14, F23 and F24 denote the simulation numbers; also shown is the result for the pooled simulations). Bold and italics denote significance at the 95 and 90 % levels, respectively. REC + NNR is the combination of reconstructed indices up to 1947 and NCEP/NCAR Reanalysis thereafter.

Index	1908–2014	1908–1957	1957–2014	1979–2015	F13	F14	F23	F24	Pooled
Z100 (REC + NNR)	0.226	−0.037	0.425	0.343	**0.304**	*0.206*	**0.279**	0.163	**0.238**
Z100 (20CRv2c)	−0.242	−0.443	−0.123	−0.184					
Z100 (ERA20C)	0.025	−0.057	0.162	0.206					
Z100 (ERA-Interim)				0.251					
NAO (20CRv2c)	0.088	0.356	−0.100	0.000	−0.002	*−0.213*	−0.183	−0.081	*−0.120*
Berlin Temp (GHCN)	**0.513**	**1.217**	0.015	0.116	*0.209*	−0.158	0.012	0.159	0.056
PWC_{DJF} (REC + NNR)	0.049	0.004	−0.003	0.003	**0.280**	**0.340**	**0.367**	0.026	**0.253**
PWC_{DJF} (20CRv2c)	0.111	0.002	0.002	0.015					
PWC_{DJF} (ERA20C)	0.143	0.006	0.001	0.531					
PWC_{JAS} (REC + NNR)	*−0.497*	−0.381	−0.676	**−1.406**	**0.356**	0.108	**0.235**	−0.127	**0.143**
PWC_{JAS} (20CRv2c)	−0.289	−0.323	−0.254	**−1.300**					
PWC_{JAS} (ERA20C)	−0.248	−0.239	−0.244	**−1.186**					
$DIMI_{JAS}$ (REC + NNR)	0.164	−0.239	0.713	0.520	−0.044	0.040	−0.091	0.005	−0.022
$DIMI_{JAS}$ (20CRv2c)	0.250	0.108	0.509	0.746					
$DIMI_{JAS}$ (ERA20C)	−0.187	−0.359	0.031	−0.461					

Brönnimann et al. (2016)

Assessment and analyes of re-analyses

> ## Seminar Works (book in process)
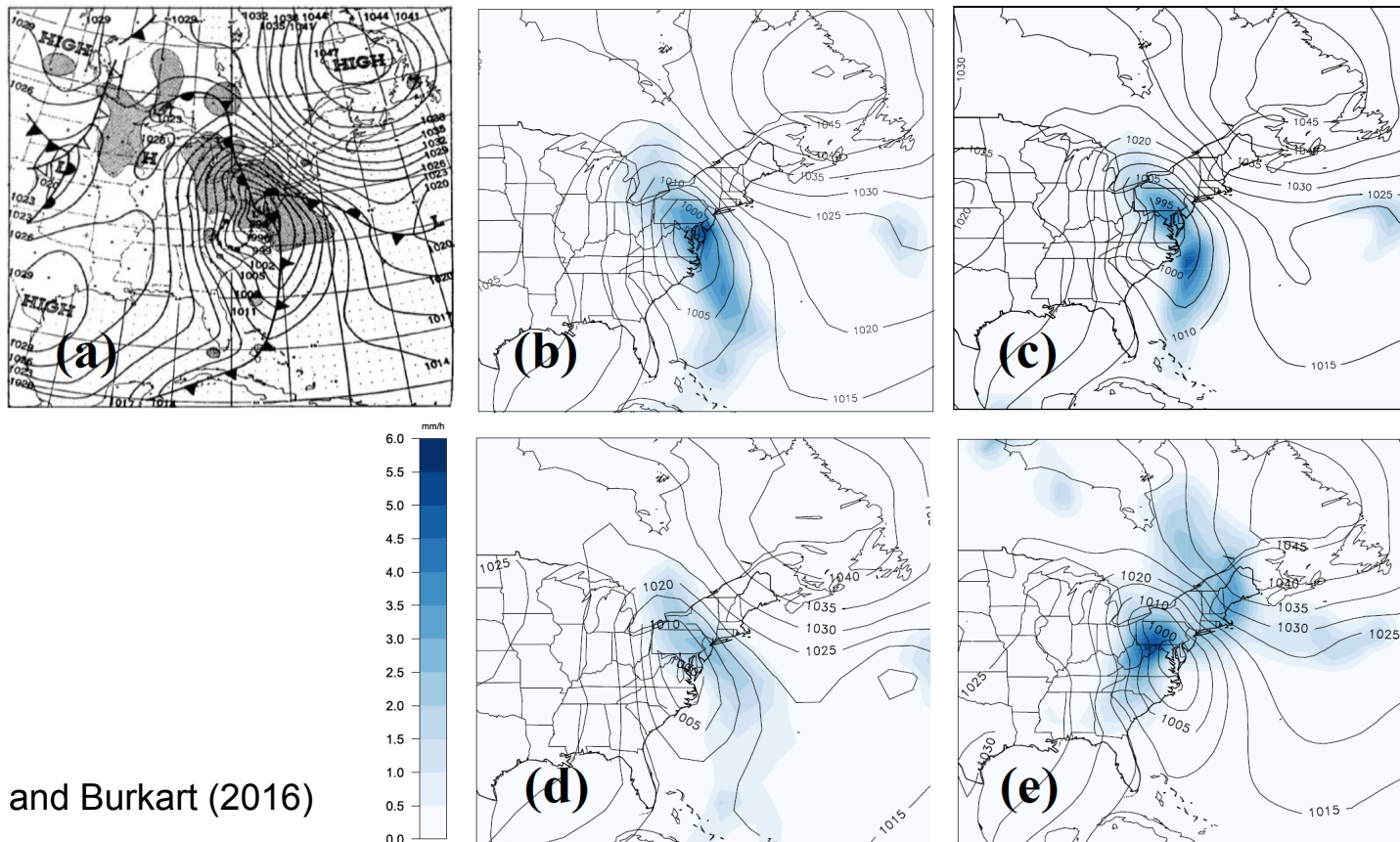
Wyss and Burkart (2016)

Figure 2: *November 25th, 1950; Pressure (contour lines) and precipitation rate (shading based on active precipitation rate, the darker the more intense) (a) at 1230 GMT; based on Smith (1950) (b) at 1200 GMT; analyzed with 20CR v2c (c) at 1200 GMT; analyzed with ERA-20C (d) at 1200 GMT; analyzed with NCEP/NCAR (e) at 1200 GMT; analyzed with CERA-20C.*

Tropical cyclones

> Previous student works revealed missing tropical cyclones
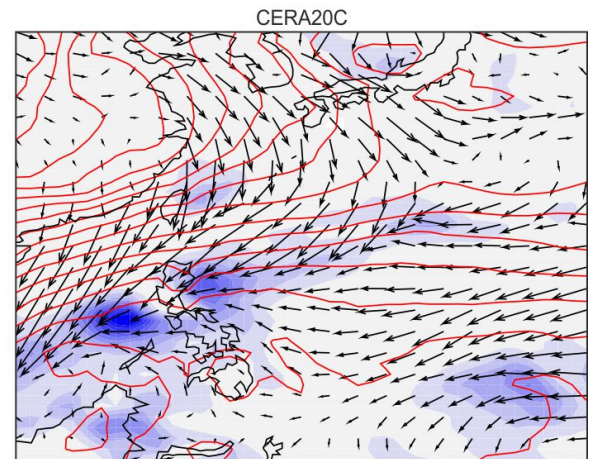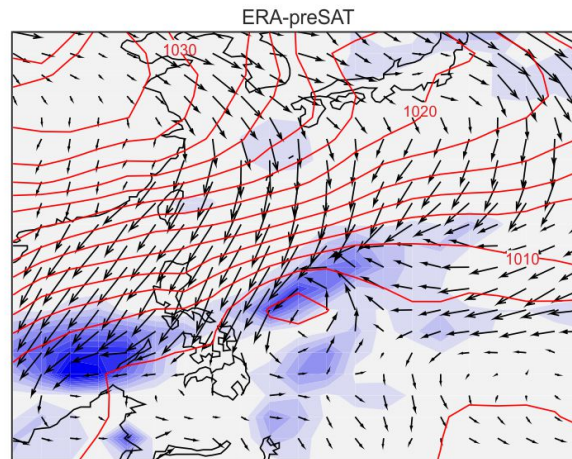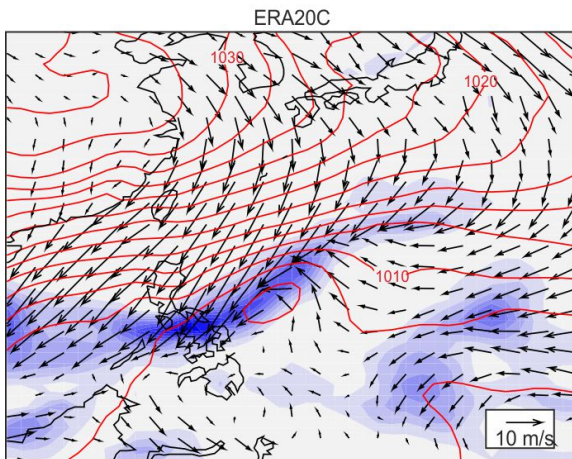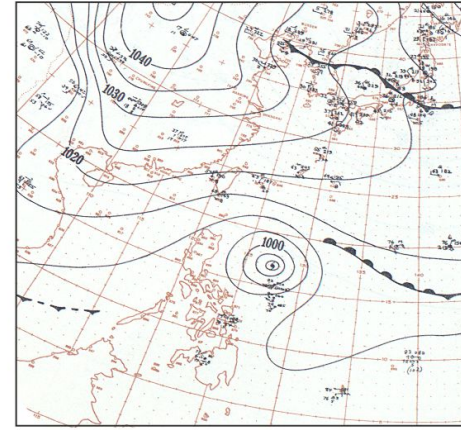(Example: Typhoon Cobra, Dec 1944)
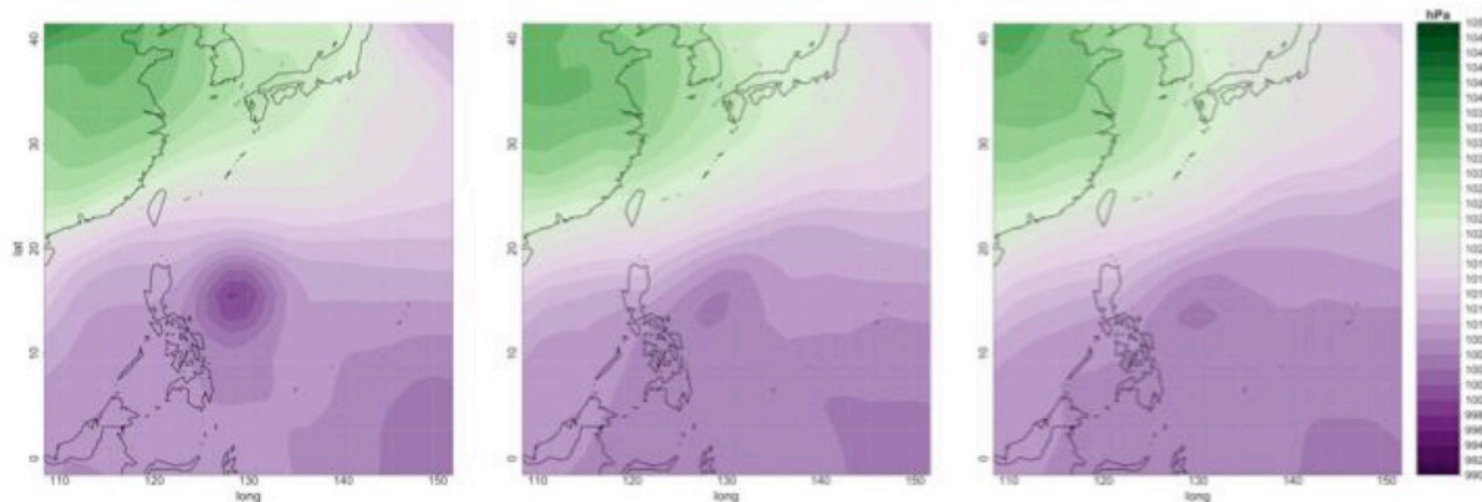
Figure 2. Contours indicate isobars of 6 hourly mean SLP in [hPa] on
18 December 1944 06 UTC (bottom) from
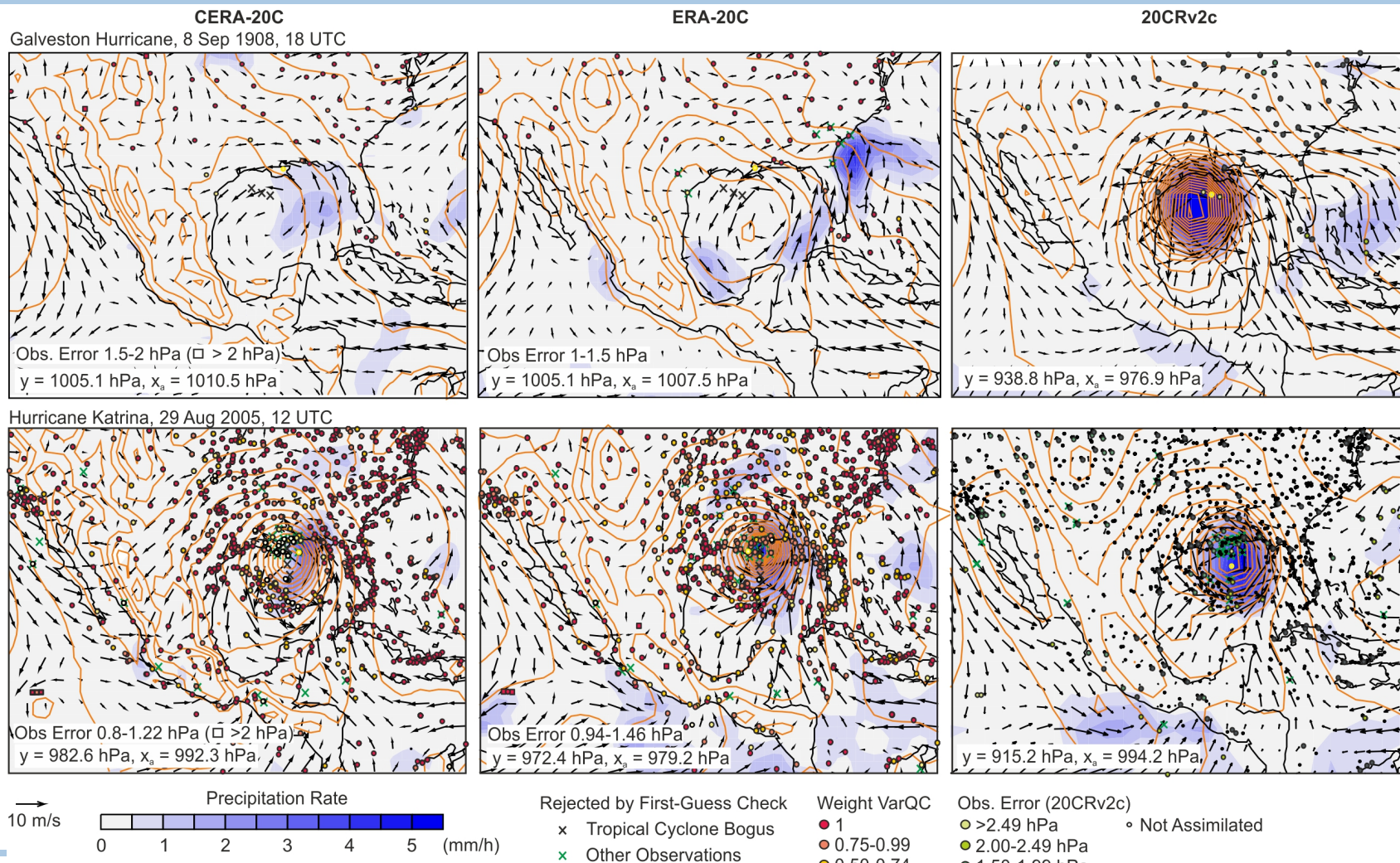20CR (left), ERA-20C (middle) and ERA-PreSAT (right).

Typhoon Cobra 1944
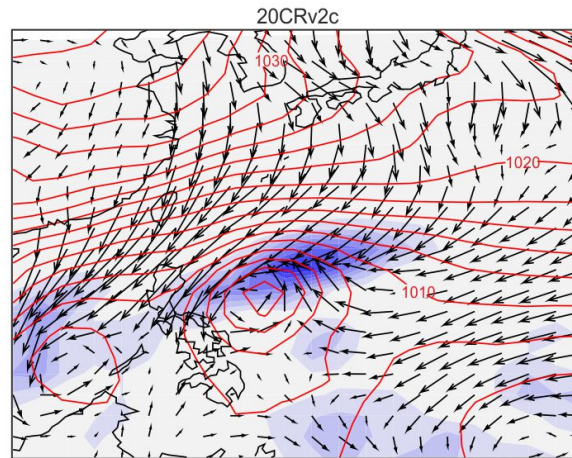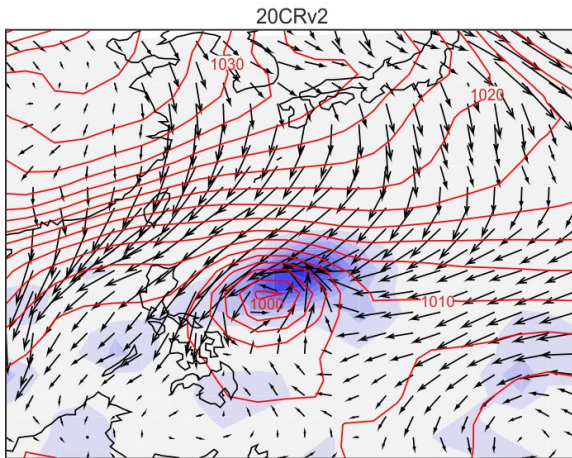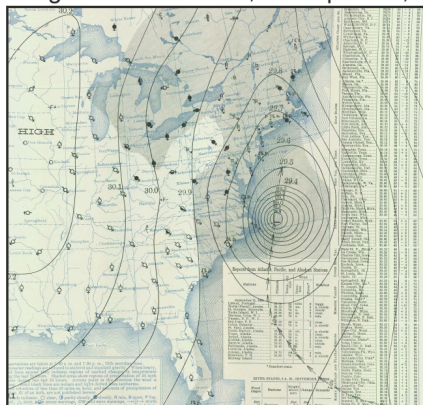

20CRv2

20CRv2c

Weather Bureau Surface Chart, 18-Dec-1944, 12:30 UTC

ERA20C

ERA-preSAT

CERA20C

10 m/s

0   1   2   3   4   5   (mm/h)

Galveston Hurricane 1900 and Katrina 2005

CERA-20C	ERA-20C	20CRv2c

Galveston Hurricane, 8 Sep 1908, 18 UTC

Obs. Error 1.5-2 hPa (□ > 2 hPa)
y = 1005.1 hPa, x_a = 1010.5 hPa

Obs Error 1-1.5 hPa
y = 1005.1 hPa, x_a = 1007.5 hPa

y = 938.8 hPa, x_a = 976.9 hPa

Hurricane Katrina, 29 Aug 2005, 12 UTC

Obs Error 0.8-1.22 hPa (□ >2 hPa)
y = 982.6 hPa, x_a = 992.3 hPa

Obs Error 0.94-1.46 hPa
y = 972.4 hPa, x_a = 979.2 hPa

y = 915.2 hPa, x_a = 994.2 hPa

10 m/s

Precipitation Rate

0 1 2 3 4 5 (mm/h)

Rejected by First-Guess Check
× Tropical Cyclone Bogus
× Other Observations

Weight VarQC
● 1
● 0.75-0.99
● 0.50-0.74
○ 0.25-0.49
○ <0.25

Obs. Error (20CRv2c)
○ >2.49 hPa   ○ Not Assimilated
● 2.00-2.49 hPa
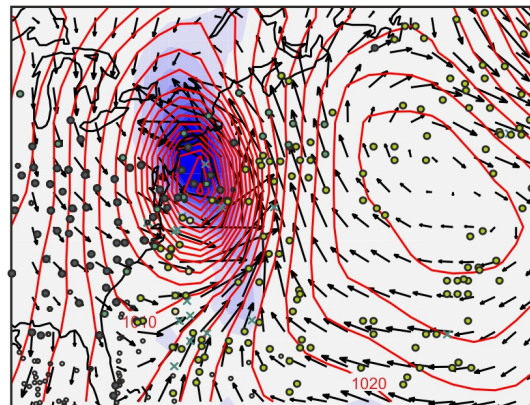● 1.50-1.99 hPa
● 1.00-1.49 hPa

Long Island Hurricane 1938 and Sandy 2012

Surface Charts / Satellites

20CRv2c

ERA20C
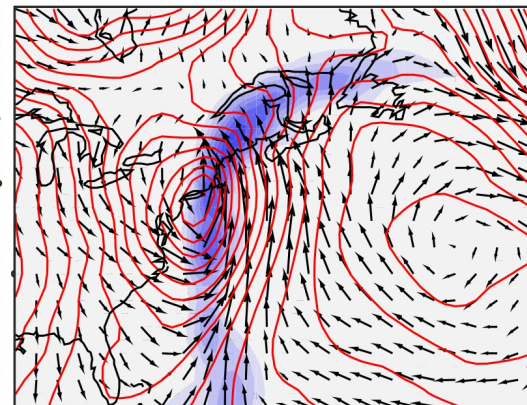
Long Island Hurricane, 21 Sep 1938, 18 UTC

Hurricane Sandy, 30 Oct 2012, 0 UTC

NOAA GOES-13, 29 Oct

ERA-Interim

Obs. Error (20CRv2c)
- ○ >2.49 hPa
- ○ 2.00-2.49 hPa
- ● 1.50-1.99 hPa
- ● 1.00-1.49 hPa
- ∘ Not Assimilated

0 1 2 3 4 5 (mm/h)

× Rejected

10 m/s

Weight VarQC (ERA20C)
- ● 1
- ● 0.75-0.99
- ● 0.50-0.74
- ○ 0.25-0.49
- ○ <0.25

Janet 1955 and Dean 2005

Hurricane Dean, 21 Aug 2007, 12 UTC

NOAA-18
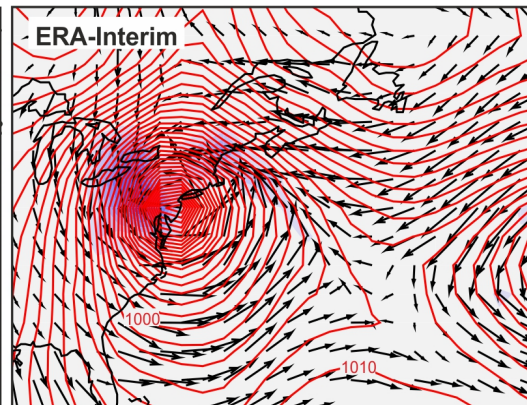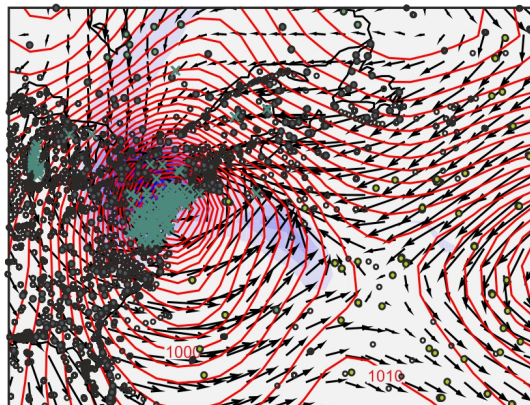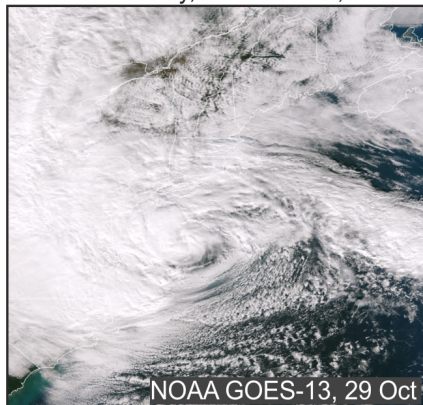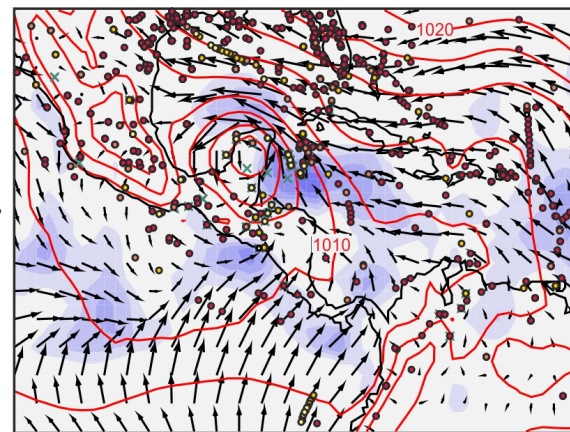
Obs. Error (20CRv2c)
- ○ >2.49 hPa
- ● 2.00-2.49 hPa
- ● 1.50-1.99 hPa
- ● 1.00-1.49 hPa
- ∘ Not Assimilated

× Rejected

[10 m/s]

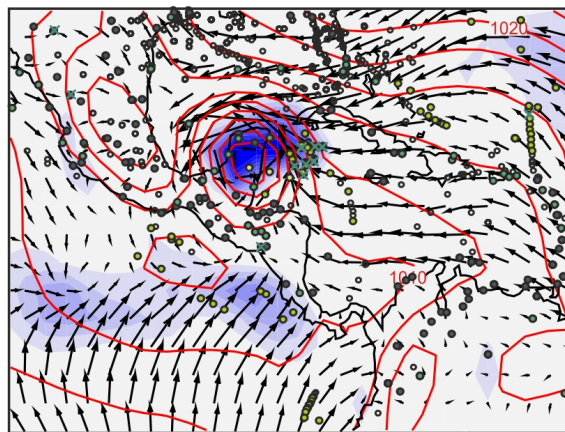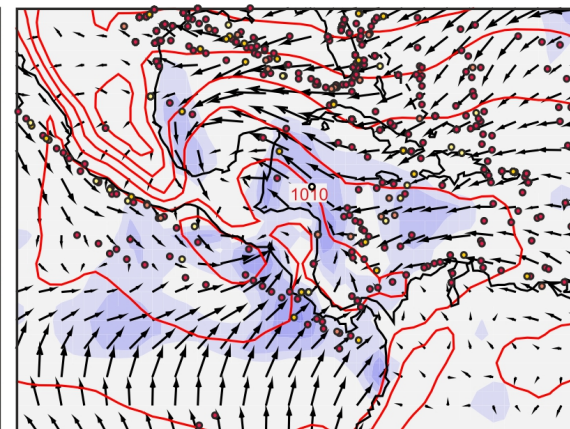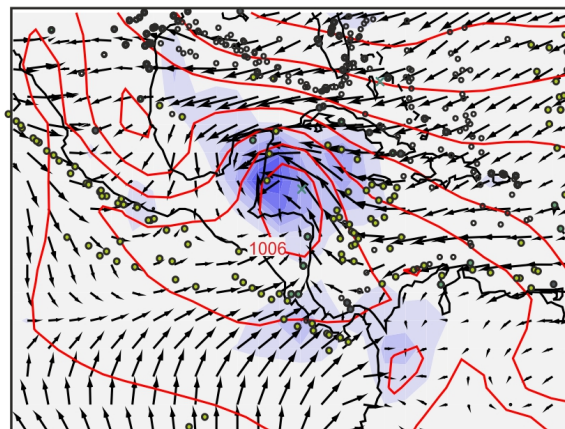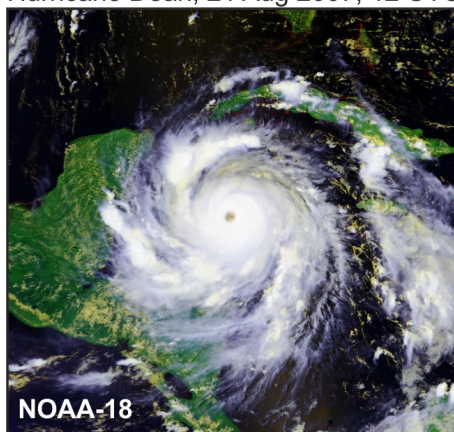Weight VarQC (ERA20C)
- ● 1
- ● 0.75-0.99
- ● 0.50-0.74
- ○ 0.25-0.49
- ○ <0.25

0 1 2 3 4 5 (mm/h)

Extreme snow fall event and avalanches 1916

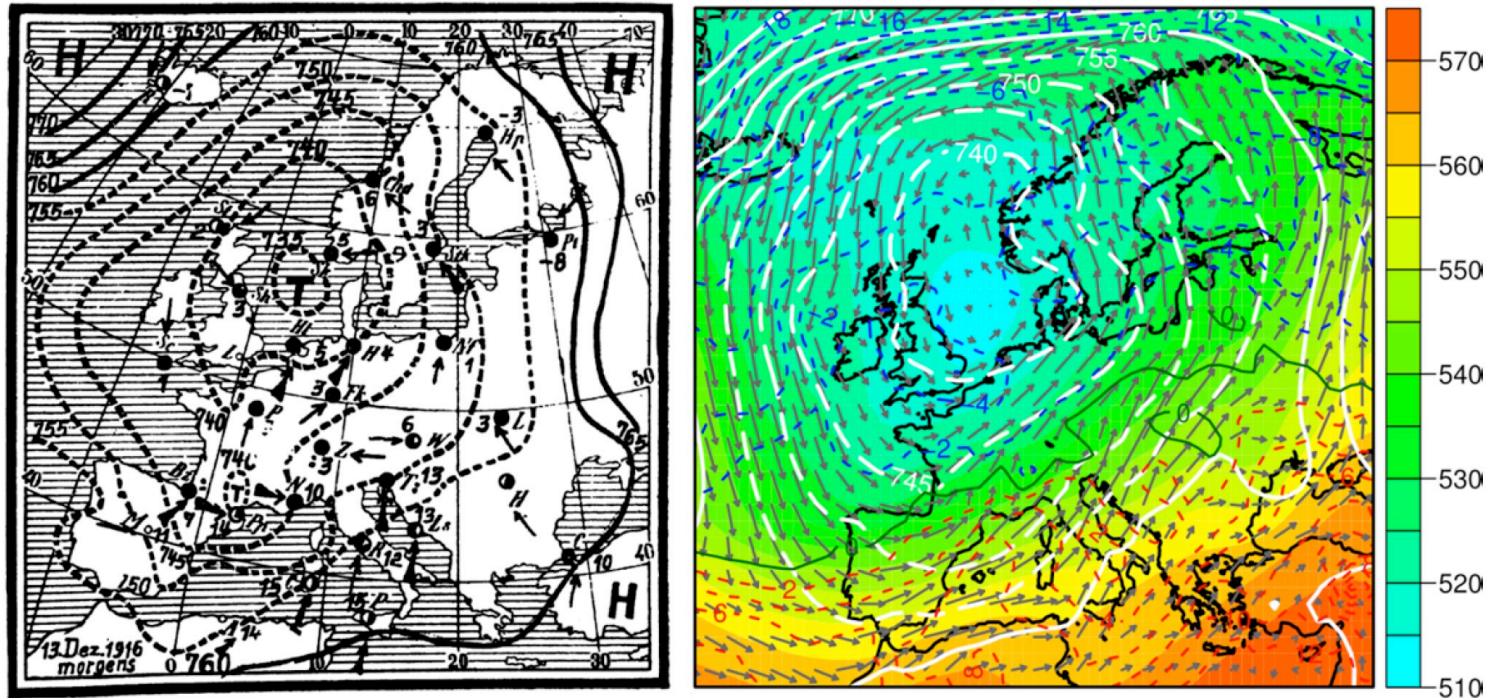# Extreme snow fall event and avalanches 1916

Figure 1. (left) Hand-drawn synoptic map of Europe for the morning of 13 December 1916[6], with black lines indicating sea level pressure (mmHg). Note that the map is based on unsynchronous observations spread over a few hours. (right) Synoptic map for 13 December 1916 at 06:00 UTC from ERA-20C reanalysis; white lines indicate sea level pressure (in mmHg for comparison), coloured lines (green for zero, red for positive, blue for negative values) and arrows indicate, respectively, temperature (°C) and wind at the isobaric level of 850 hPa (arrow length is proportional to wind speed), filled contours indicate geopotential height at 500 hPa (dam).

Extreme snow fall event and avalanches 1916
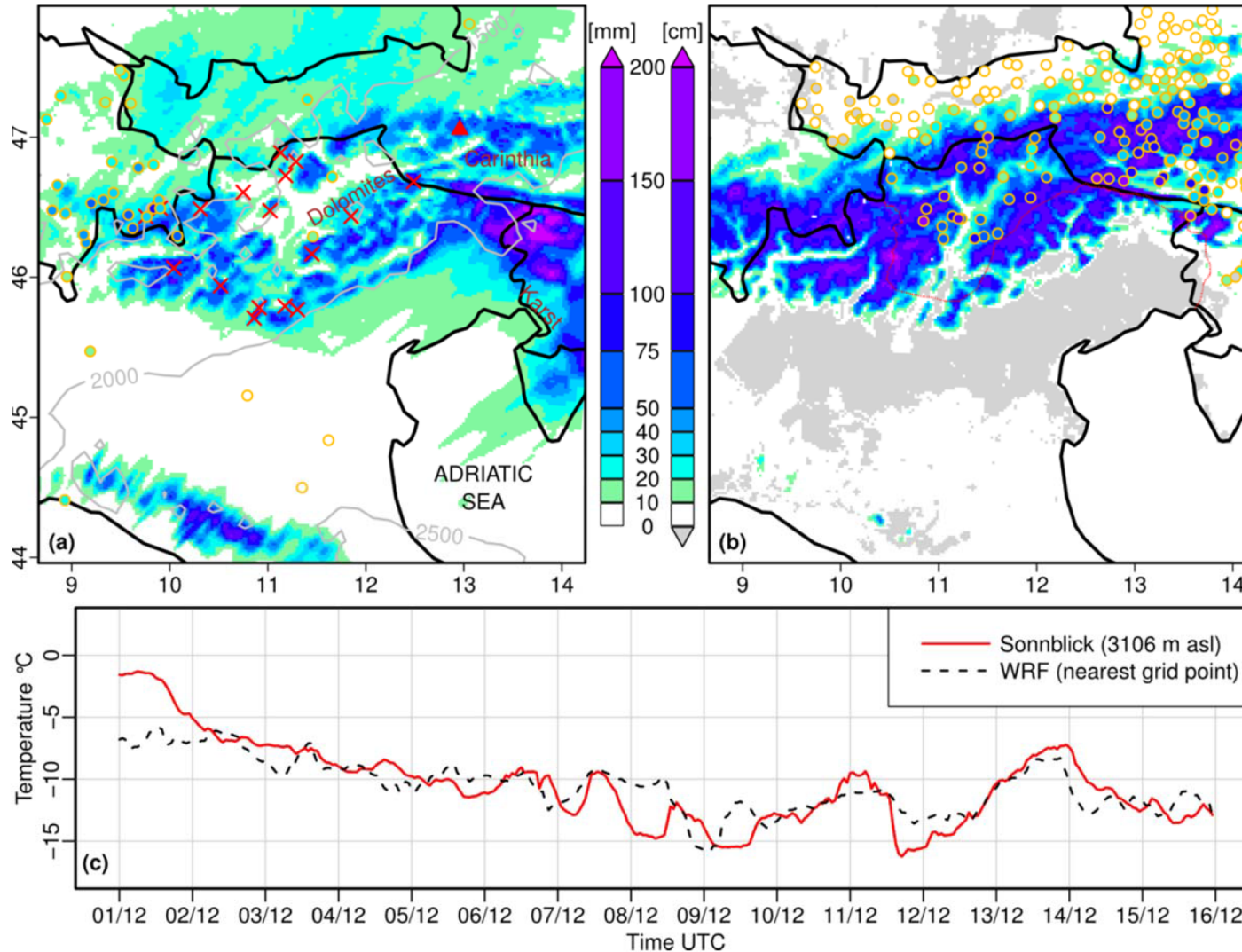
Conclusions

> Assessment and analyses of re-analyses: Strengths and weaknesses

> Tropical cyclones: Too many rejections ("white listing" necessary?)

> Case study: ERa20C + WRF can be very useful