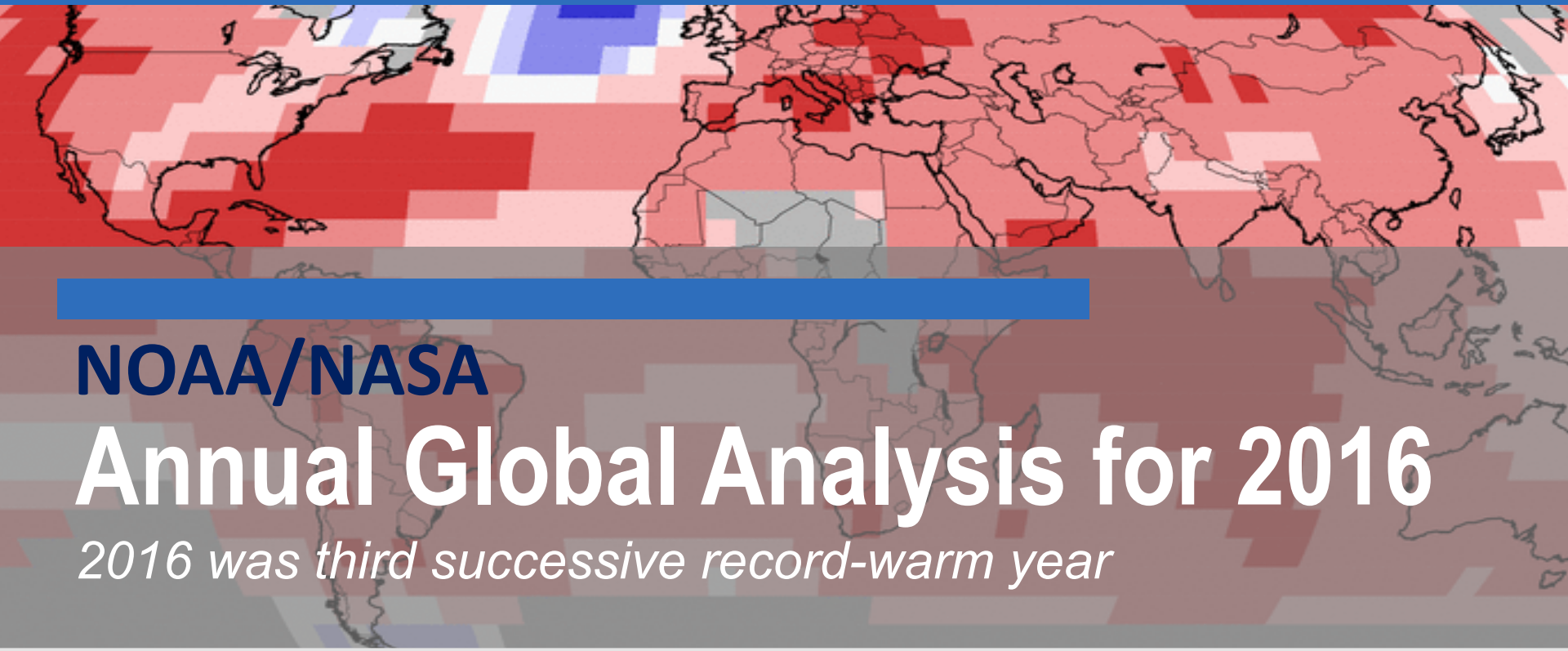


NOAA/NASA

Annual Global Analysis for 2016

2016 was third successive record-warm year

Gavin A. Schmidt

Director, NASA's Goddard Institute for Space Studies

Derek Arndt

Chief, Monitoring Branch, NOAA's National Centers for Environmental Information

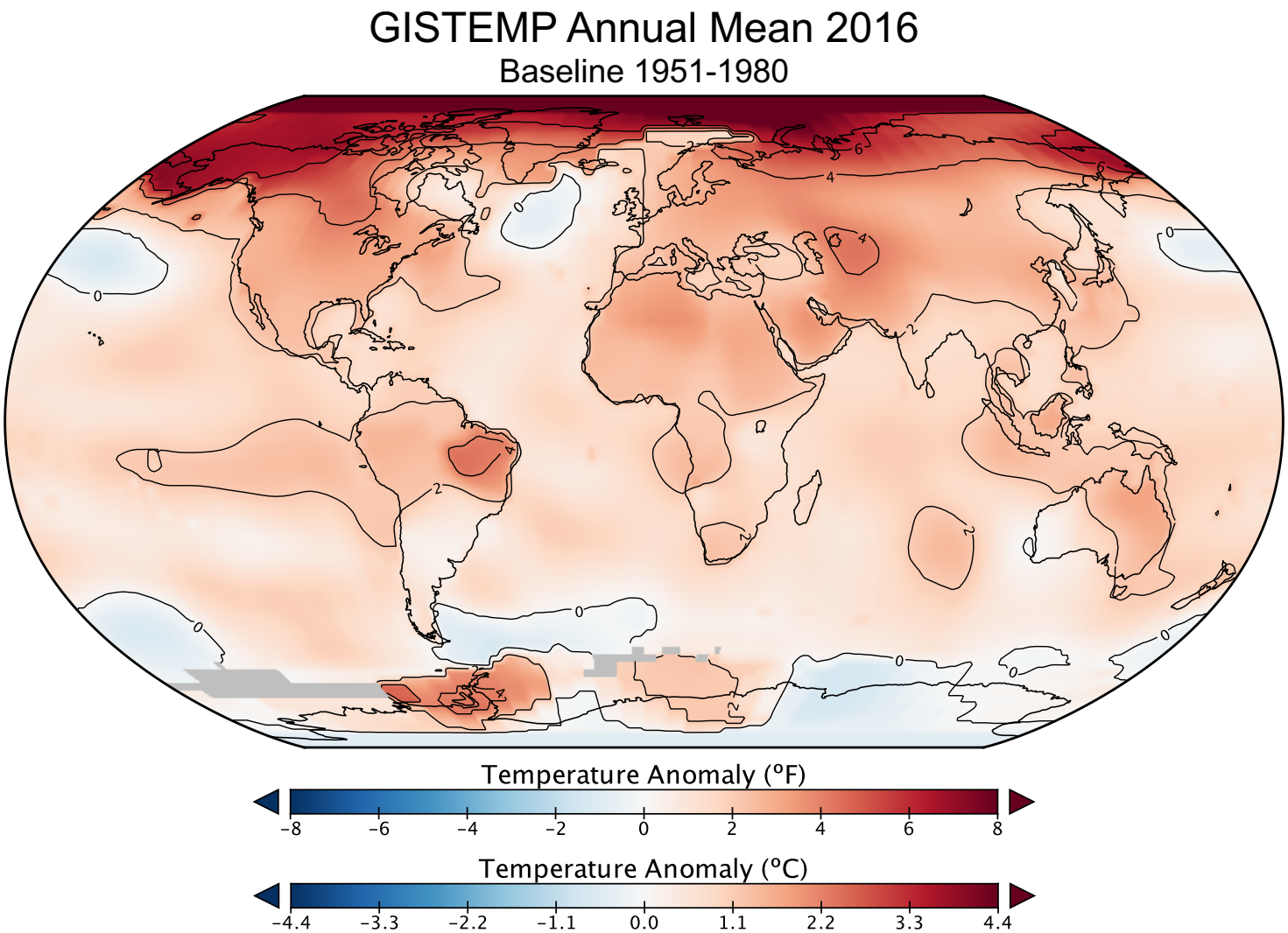
January 2017

NASA 2016 Global Temperature

2016:

0.99°C / 1.8°F above 1951-80 average

Warmest year of NASA GISTEMP record



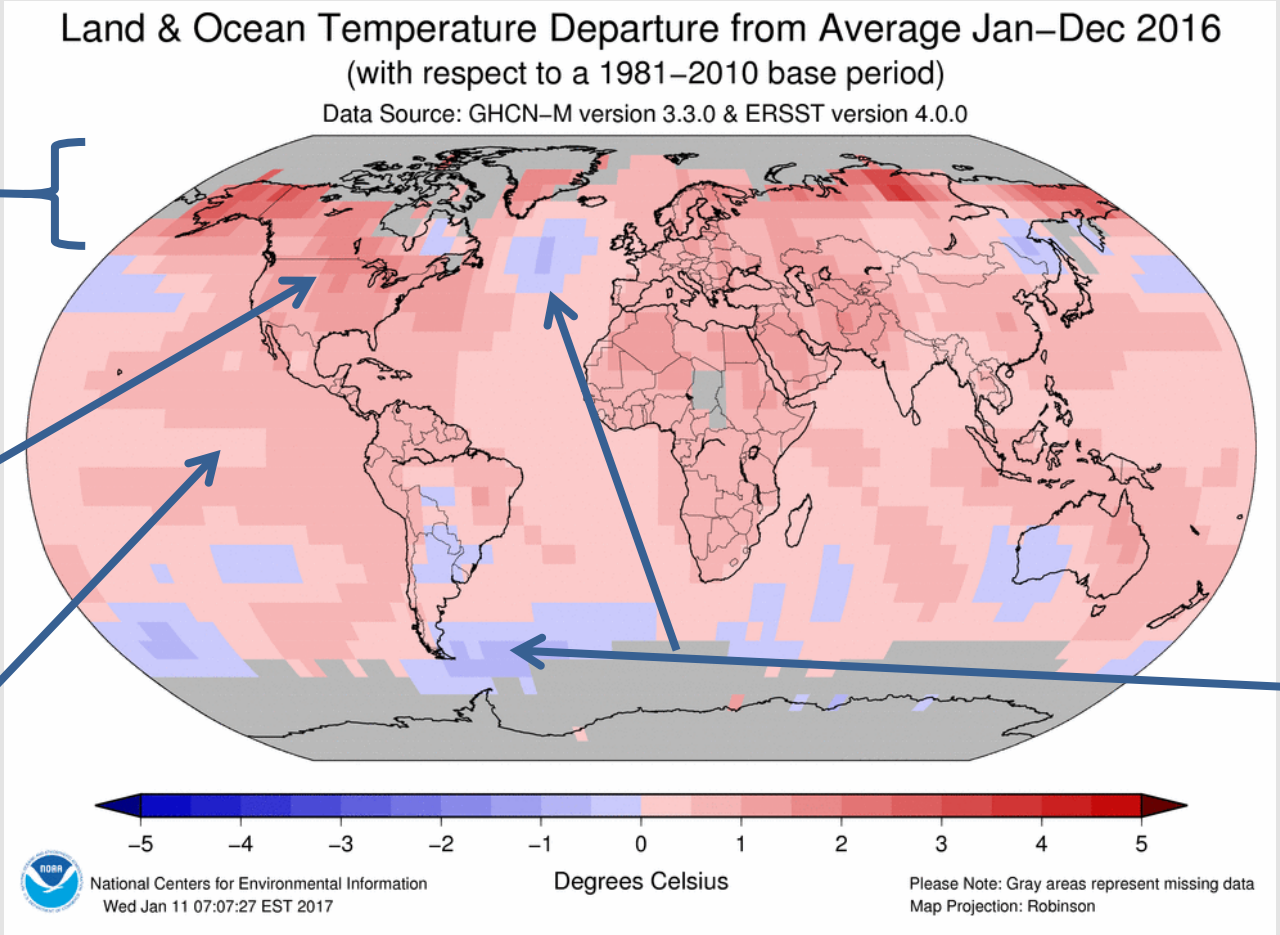
NOAA 2016 Global Temperature

0.94ºC / 1.69ºF above 1901-2000 average; warmest year of record

North of 60°N latitude:
Warmest year of record by 0.94°F

USA - CONUS
2nd warmest year
Wetter than average
Alaska
Warmest year

Tropical Pacific
El Niño fades in early 2016



Continental Temperatures
records begin 1910

N. America
Warmest year

Africa, S. America
2nd warmest year

Asia, Europe
3rd warmest year

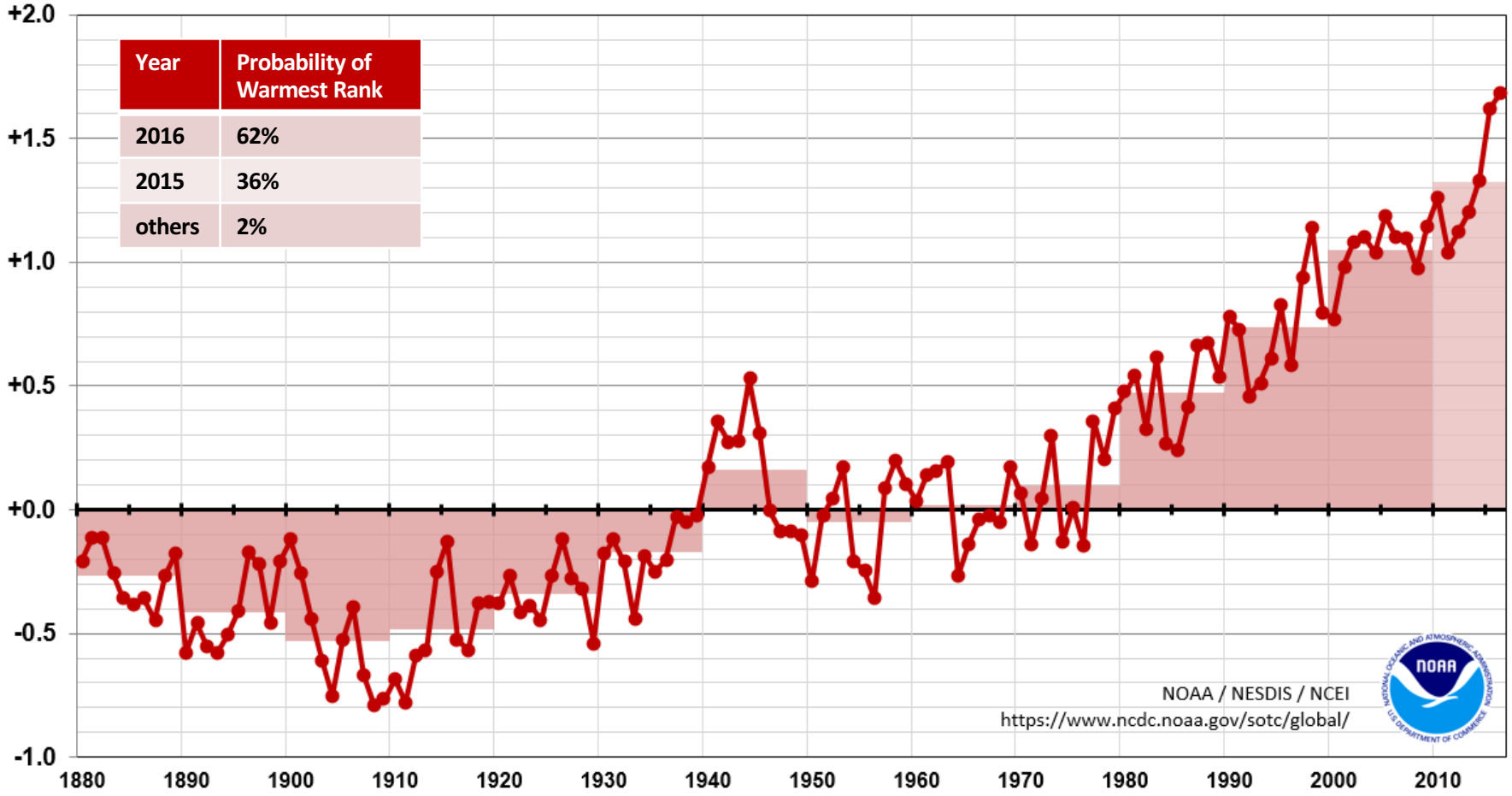
Oceania
5th warmest year

N. Atlantic cool spot fades somewhat
S. Atlantic spot persists

Global Temperature Time Series

NOAA GlobalTemp

Annual Global Temperature: Difference From 20th Century Average, in °F

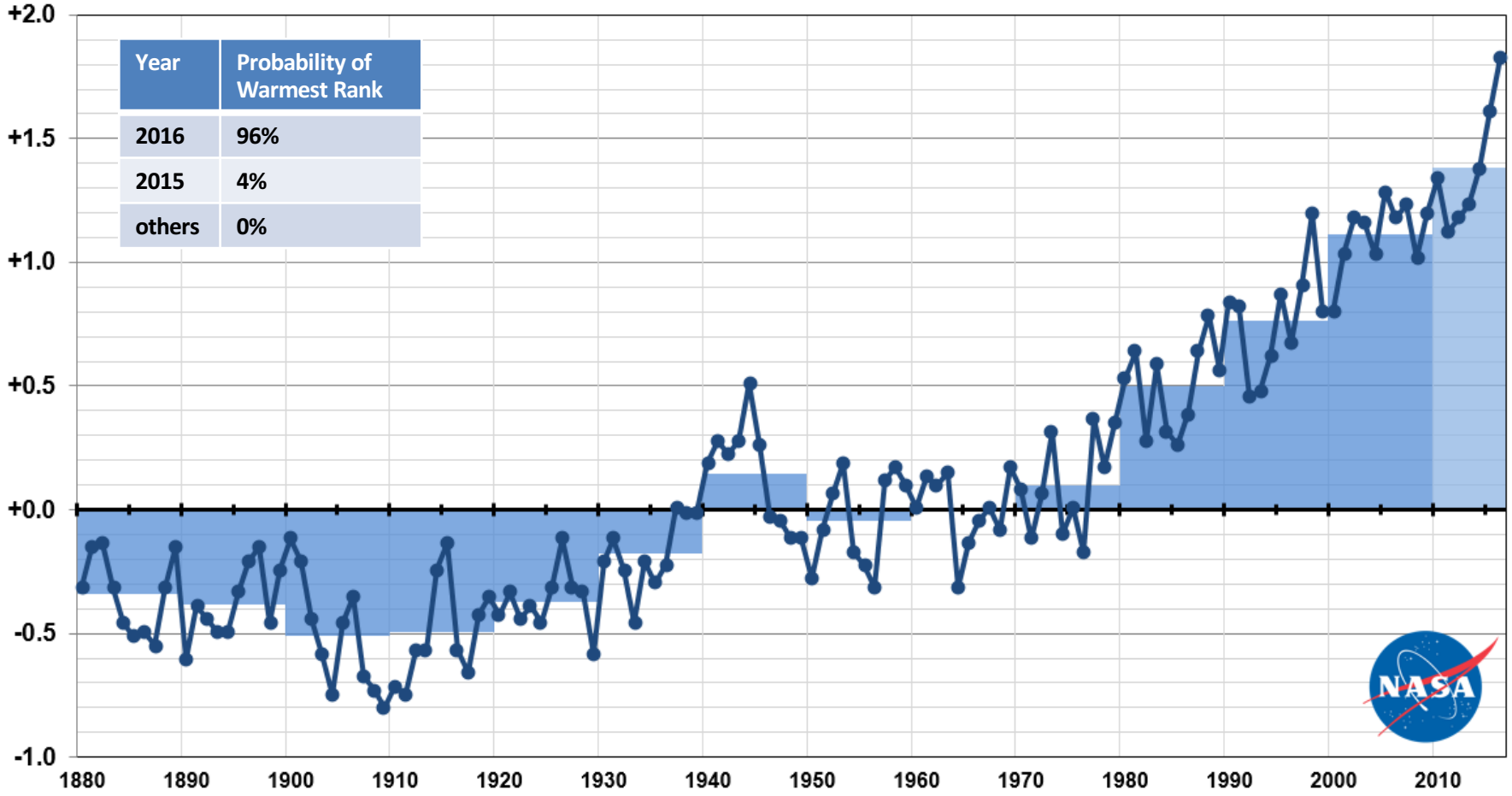


Year	Probability of Warmest Rank
2016	62%
2015	36%
others	2%

Global Temperature Time Series

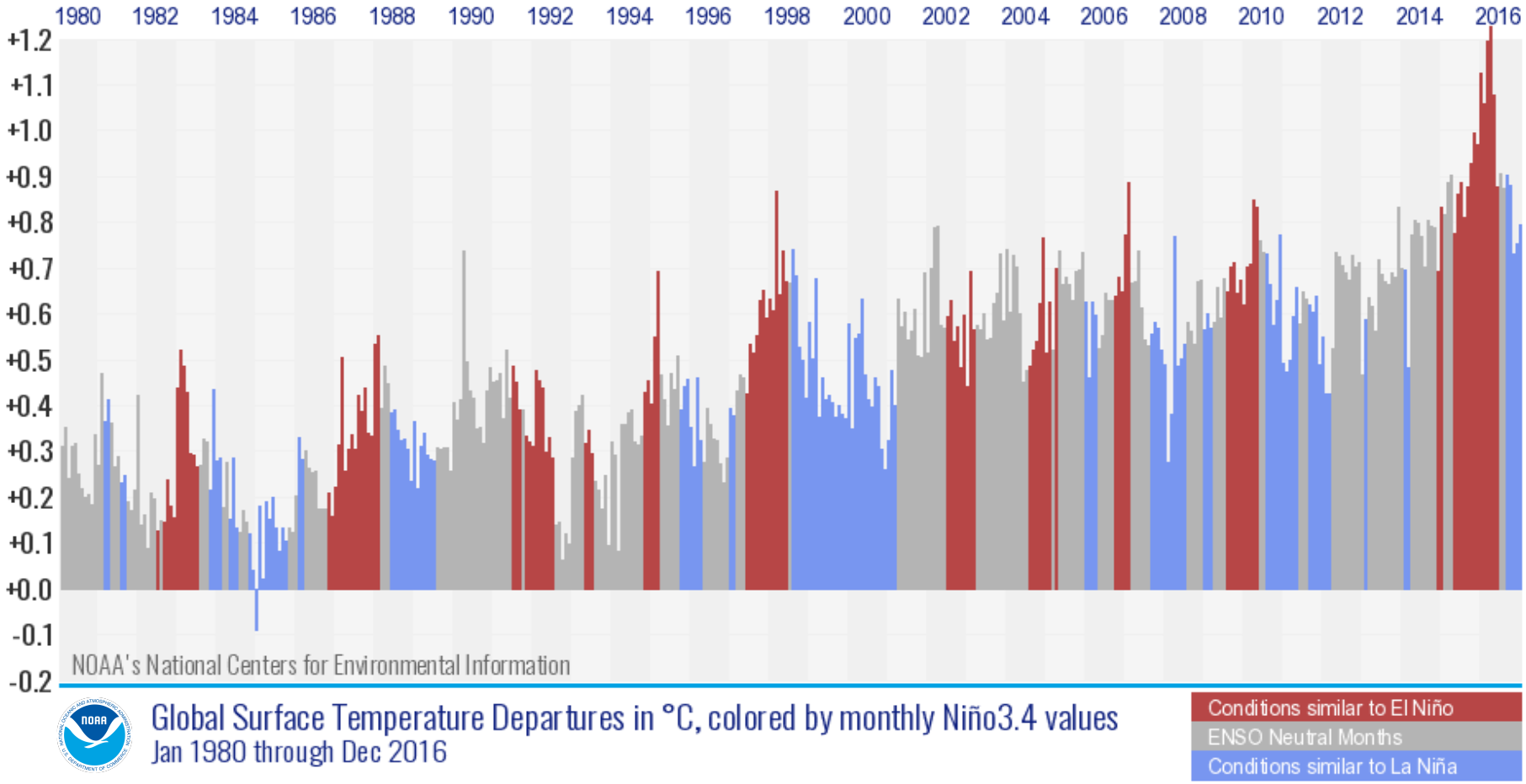
NASA GISTEMP

Annual Global Temperature: Difference From 20th Century Average, in °F



Year	Probability of Warmest Rank
2016	96%
2015	4%
others	0%

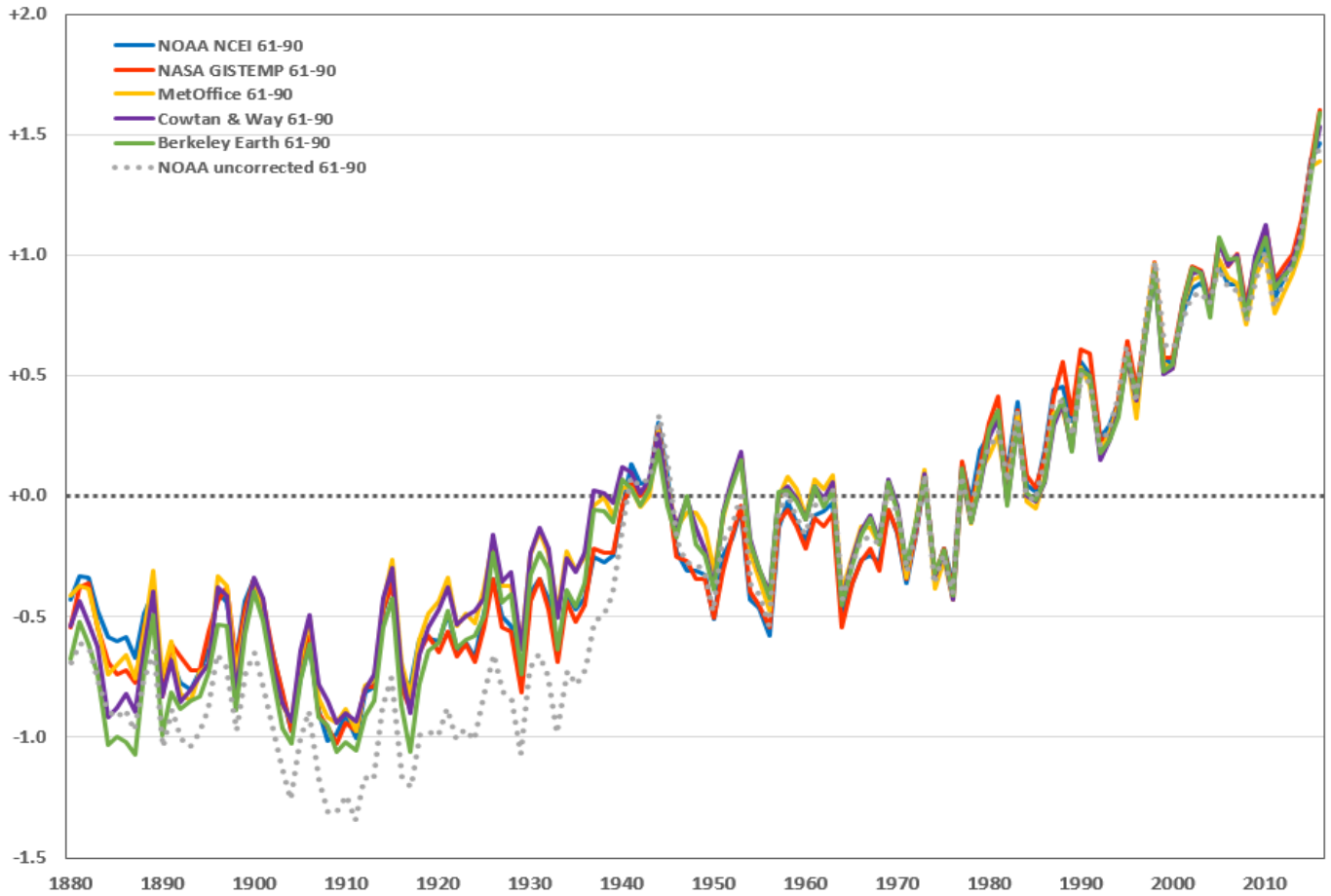
El Niño / La Niña & Global Temperature



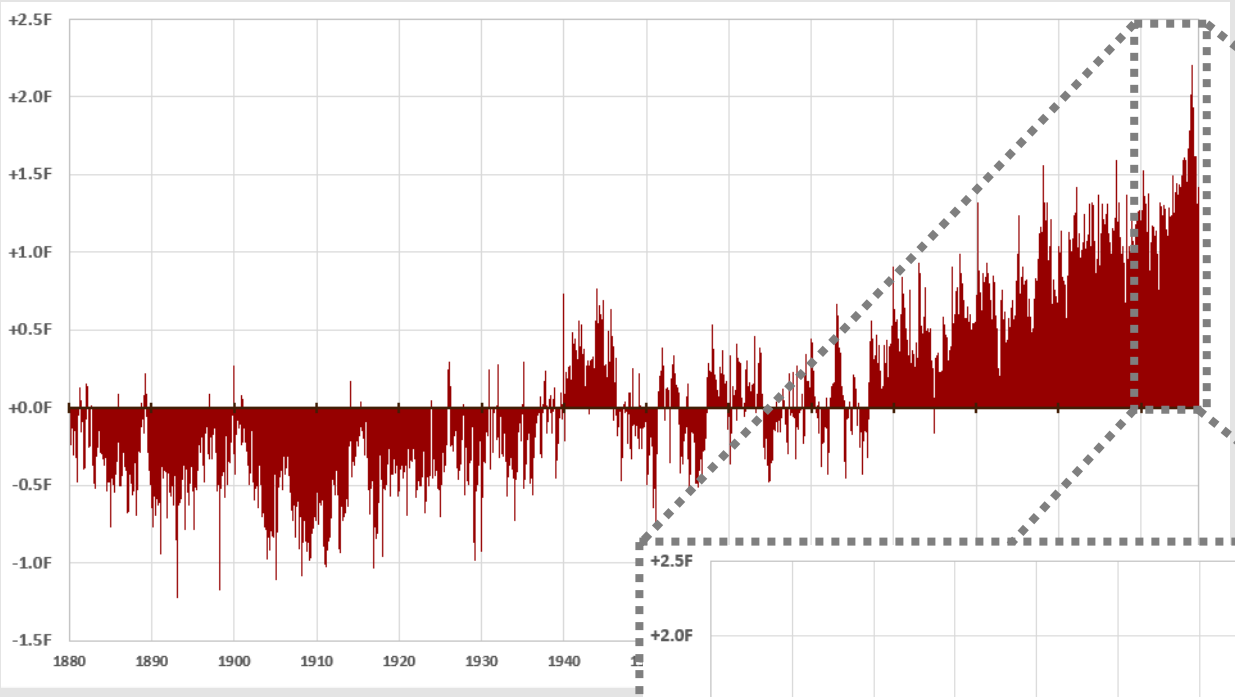
Months with La Niña sea-surface temperature conditions in blue
Months with El Niño sea-surface temperature conditions in red

Global Analyses Side by Side

Several major datasets: Relative to a common 1961-90 base period

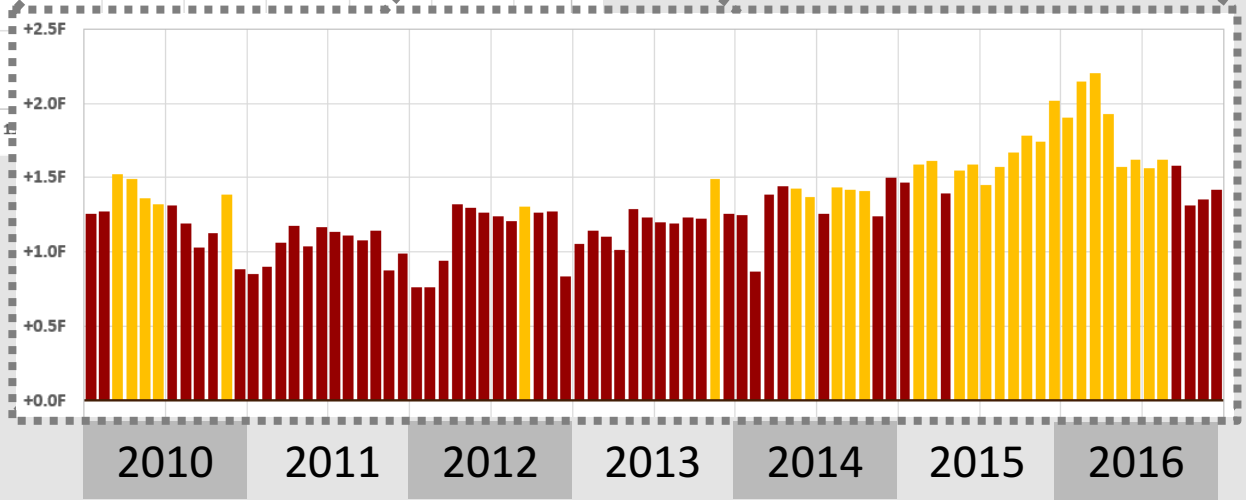


Global Temperature by the Month



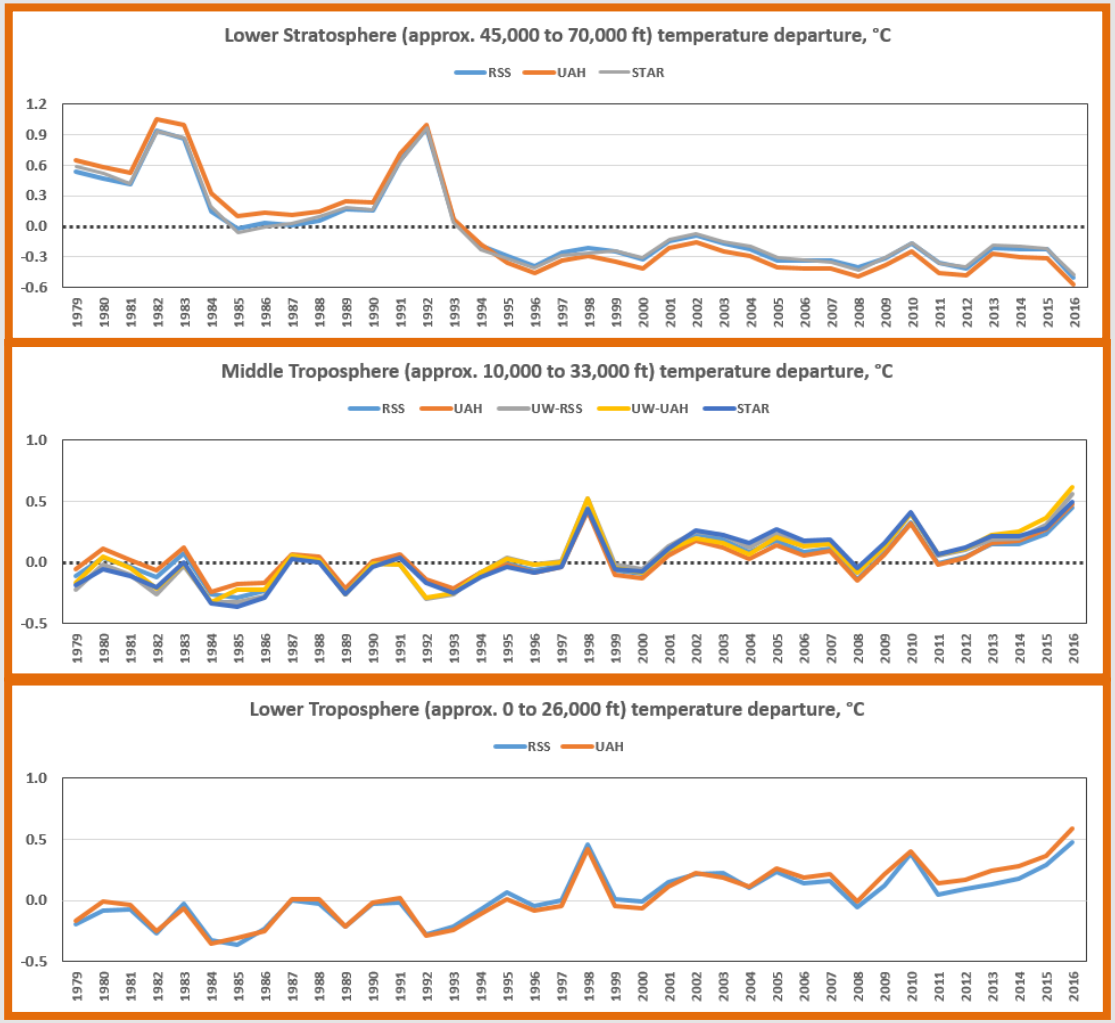
NOAA GlobalTemp

16 successive months (May '15 through Aug '16) broke or tied the previous record for that month. Record months since 2010 are shown in gold (incl. those that have since been broken).

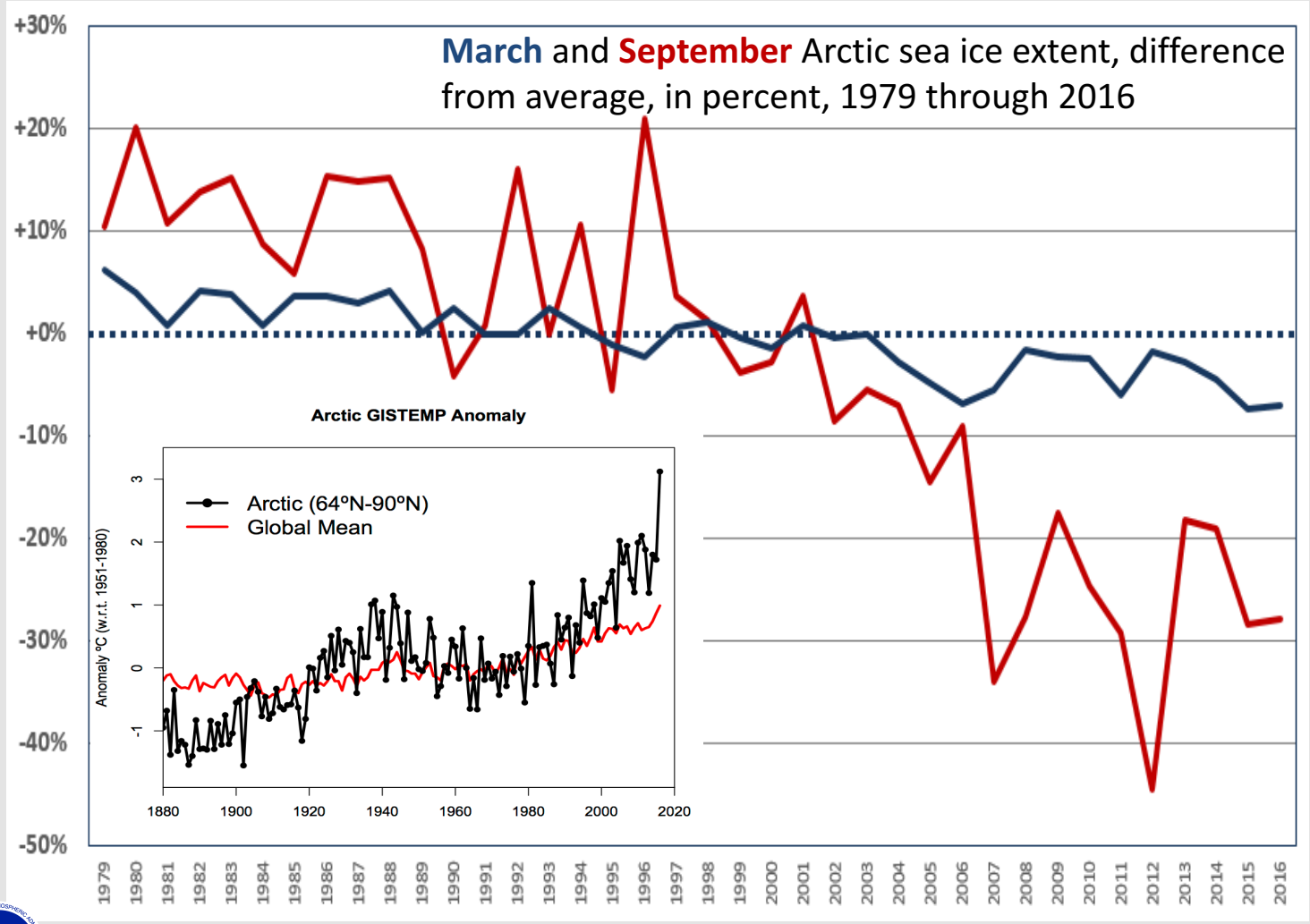


Looking at the Atmosphere

- Lower Stratosphere (37-yr record)
  - All datasets (UAH, RSS, NESDIS): ***coolest*** on record
- Middle Troposphere (37-yr record)
  - All datasets (UAH, UW-UAH, RSS, UW-RSS, NESDIS): warmest on record
- Lower Troposphere (37-yr record)
  - All datasets (UAH, RSS): warmest on record
- Radiosonde / balloon data (58-yr record, not shown)
  - ~5,000 ft (850mb): warmest
  - ~10,000 ft (700mb): warmest
  - ~18,000 ft (500mb): warmest
  - ~30,000 ft (300mb): warmest
  - ~40,000 ft (200mb): 2nd warmest

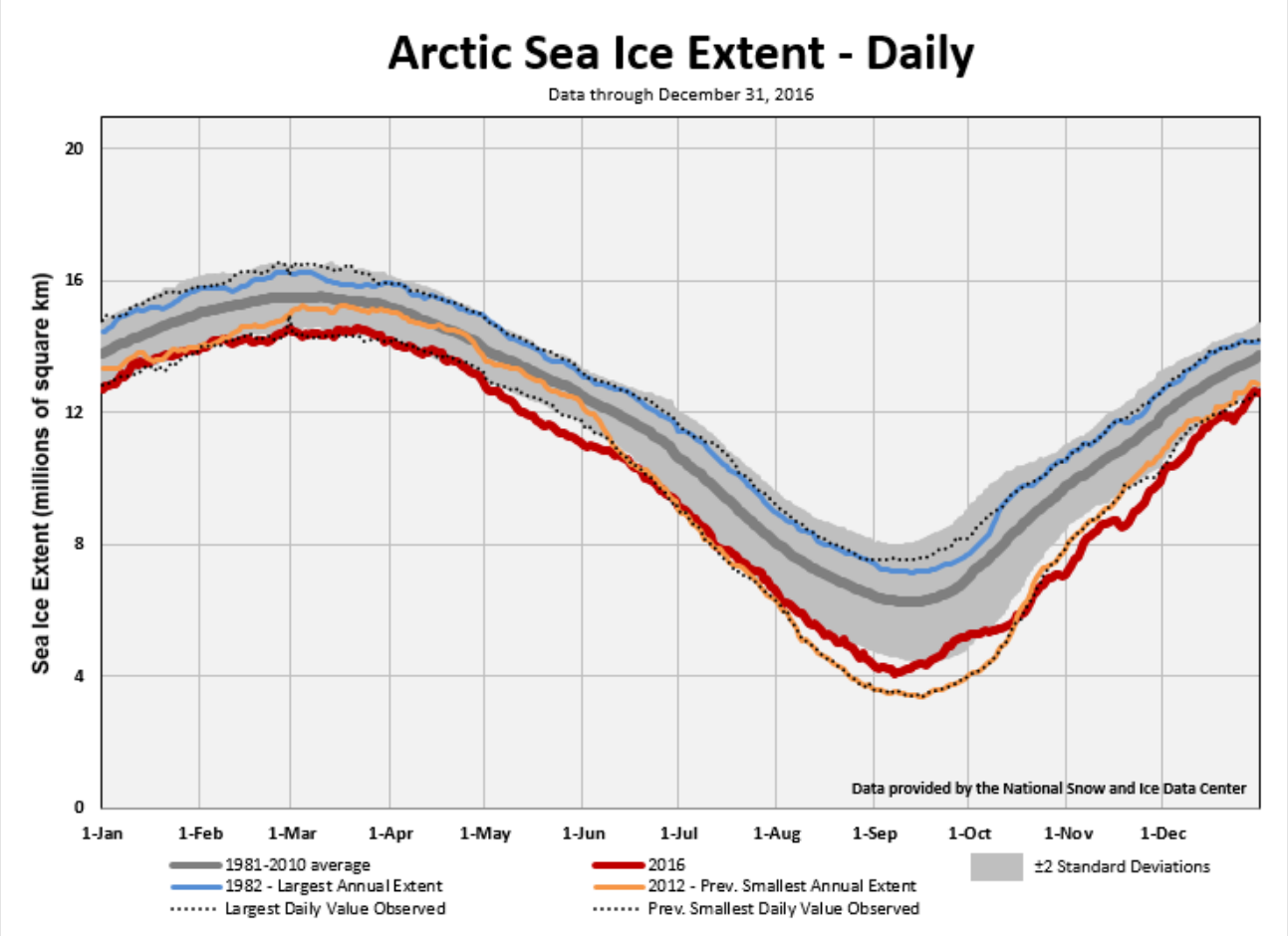


Arctic Sea Ice Since 1979



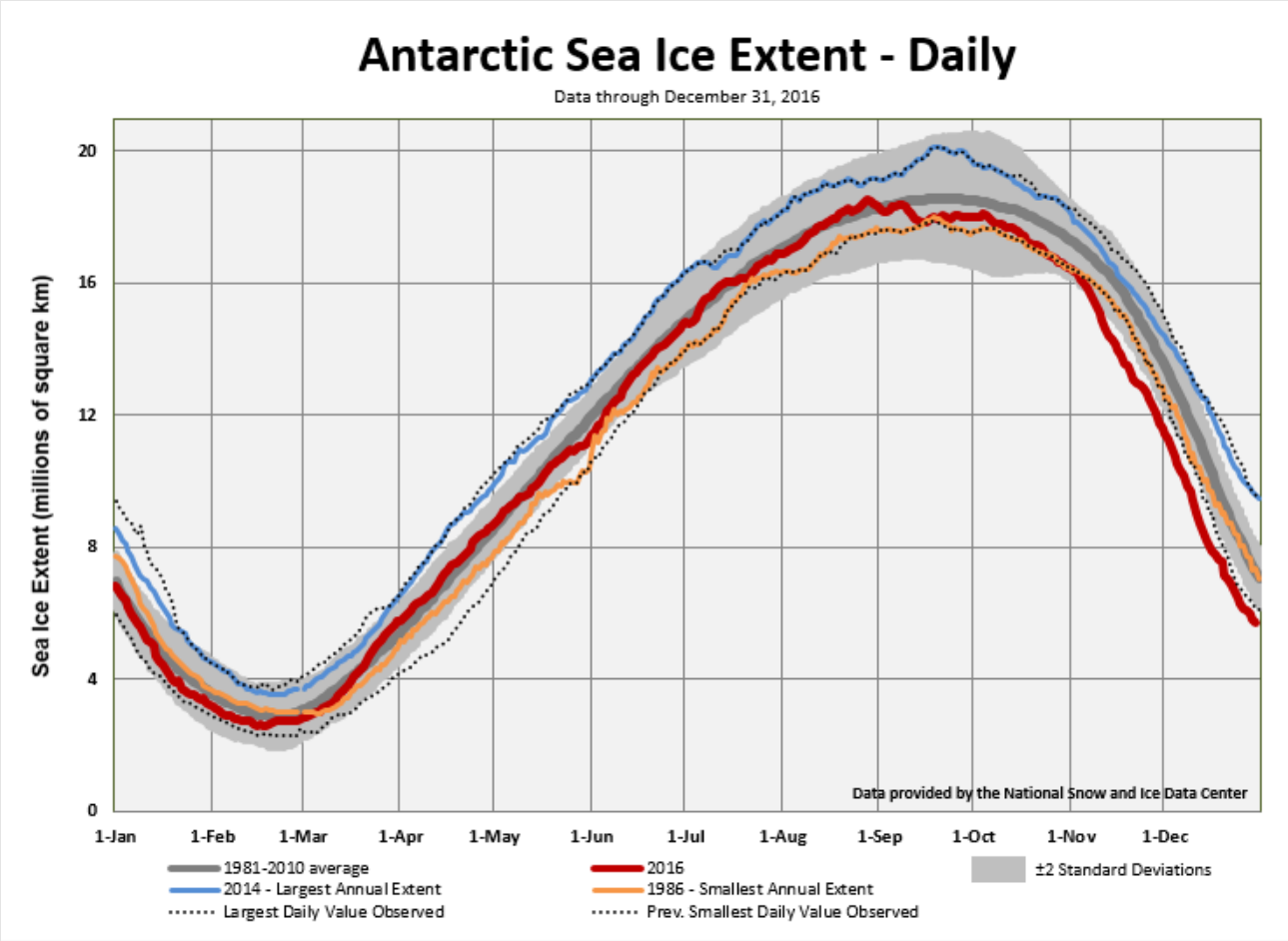
Arctic Sea Ice: Day-by-Day in 2016

Mon	% below average	Rank (of 38)
Jan	-7.14%	Smallest
Feb	-7.54%	Smallest
Mar	-7.02%	2nd smallest
Apr	-6.87%	Smallest
May	-10.19%	Smallest
Jun	-11.37%	Smallest
Jul	-16.87%	3rd smallest
Aug	-23.08%	4th smallest
Sep	-27.83%	5th smallest
Oct	-28.52%	Smallest
Nov	-17.68%	Smallest
Dec	-7.85%	2nd smallest
Year	**-12.58%**	**Smallest**



Antarctic Sea Ice: Day-by-Day in 2016

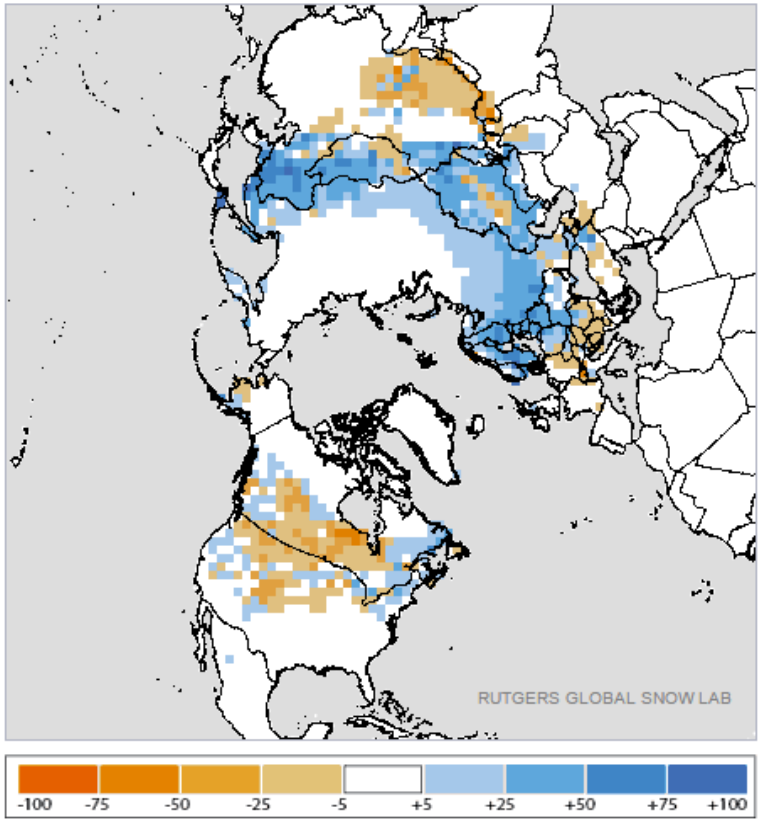
Mon	% vs average	Rank (of 38)
Jan	-4.26%	17th smallest
Feb	-9.54%	6th smallest
Mar	+5.44%	14th largest
Apr	+3.91%	14th largest
May	-0.74%	14th smallest
Jun	-0.79%	13th smallest
Jul	+0.18%	19th smallest
Aug	+0.22%	19th smallest
Sep	-2.02%	5th smallest
Oct	-4.03%	2nd smallest
Nov	-11.07%	Smallest
Dec	-22.20%	Smallest
Year	**-4.16%**	**2nd Smallest**



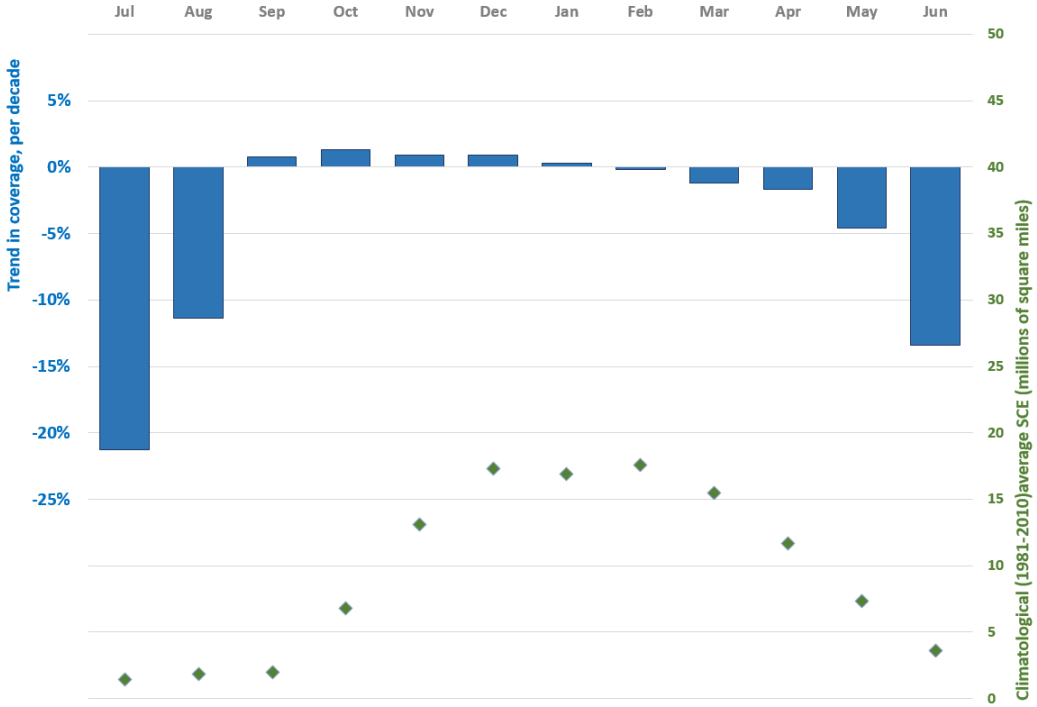
Northern Hemisphere Snow Cover Extent

Period of record: 1967-2016 (49 years)

Departure from Normal – November 2016



Northern Hemisphere Snow Cover Extent Trends



Data provided by the Rutgers Global Snow Lab
http://climate.rutgers.edu/snowcover/

Questions?

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