WMO Statement on the State of the Global Climate

Preliminary conclusions for 2018

and

WMO Greenhouse Bulletin

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WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

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World Meteorological Organization
Organisation météorologique mondiale

Statement on the State of the Global Climate

- Complements IPCC Assessment Reports and Special Reports
- Includes assessment from the annual WMO Greenhouse Bulletins on atmospheric concentrations of LL GHG – complements UN Environment annual GAP Report on Emissions
- Since 1993 - Annual updates on key climate climate indicators of changing conditions of the state of the climate; includes multy-year (5 and 10 years) trends
- Provides a snap shot on key climate indicators and extreme events with historical and geographical context
- Allows analysis of climate change signals separated more clearly from natural modes of variability (e.g. El Niño-Southern Oscillation)
- Final release in March 2019

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Main contributors

- Lead experts (12)
- Member States direct contributions through the National Meteorological and Hydrological Services (64)
- International specialized institutions (17)
- United Nations organisations (7)

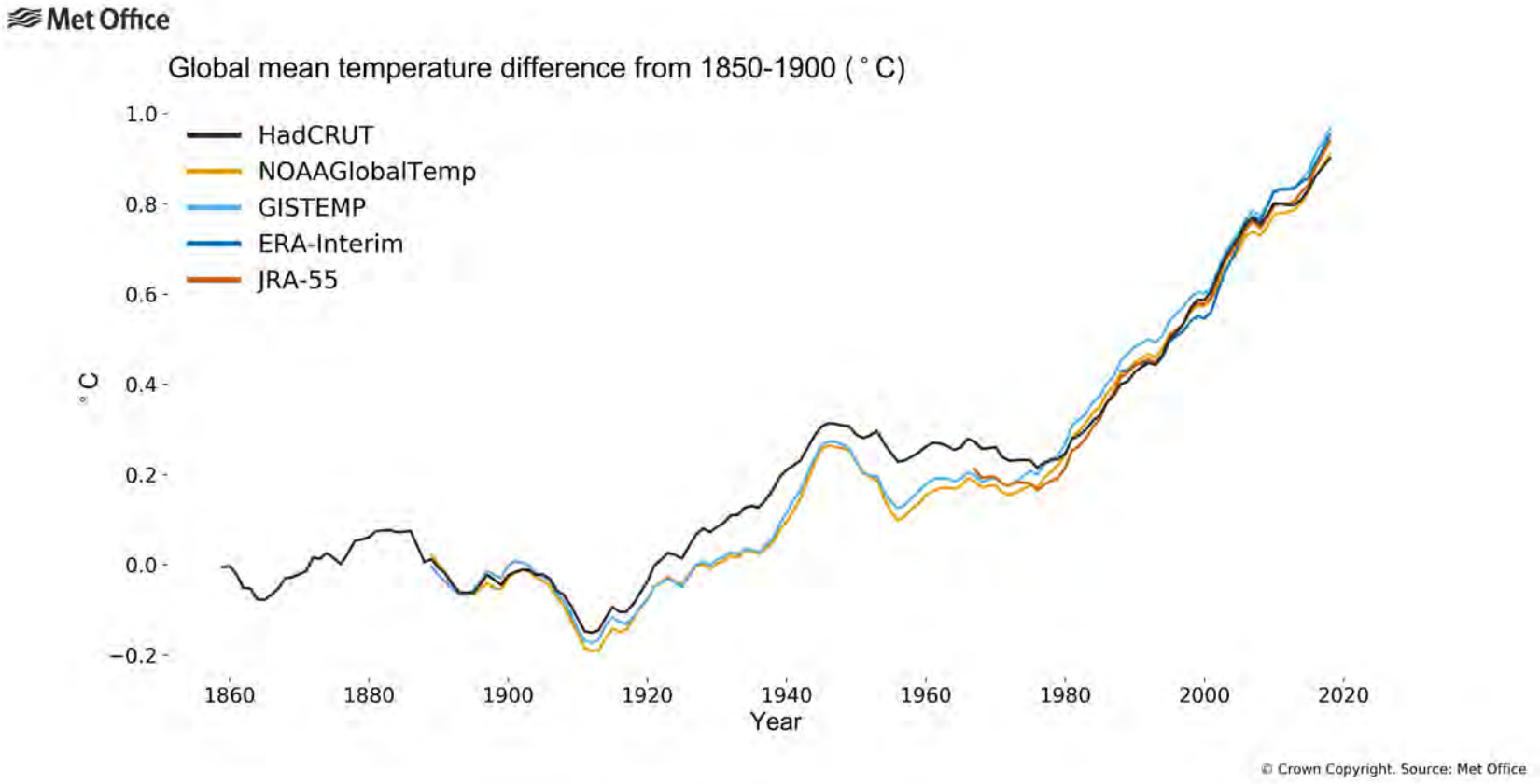
Structure of the Statement

- Key Climate Indicators
- Climate risks and associated impacts

Key Climate Indicators

Key Climate Indicators	Annual 2018	5 year 2014-2018	10 year 2009-2018	10 year 2006-2015	Other
Global temperature (change from 1850-1900 pre-industrial period)	**0.98** ±0.12°C	1.04±0.09°C	0.93±0.07°C	0.87°C	2015, 2016, 2017, 2018 four warmest years
Greenhouse gases					
- CO2 (ppm, atmospheric concentration)	**405.5** ± 0.1 ppm (2017)	400.5 ppm (2013-2017)	394.7 ppm (2008-2017)	390.3 ppm. (2006-2015)	CO2, CH4 and N2O also highest on record
- CO2 (rate of increase)	2.2 ppm/yr (2016)	2.5 ppm/yr (2012-2016)	2.2 ppm/yr (2007-2016)	2.1 ppm/yr (2006-2015)	
Cryosphere – Sea Ice (vs 1981-2010)					
- March Arctic sea ice extent change %	**-7.4%**	-6.7%	-5.2%	-3.9%	
- September Arctic Sea ice change %	**-27.7%**	-26.6%	-27.5%	-25.1%	
- September Antarctic Sea ice change %	**-4.8%**	-2.1%	-0.6%	+0.9%	
Sea Level					
- Global average rate/year	n/a	4.5±0.3 mm/yr	4.6±0.15 mm/yr	3.8±0.1 mm/yr	3.1±0.1 mm/yr (1993-2017)
- Total change since 1993	**78 mm**	70 mm (2015)	60 mm (2014)	42mm (2009)	
- SE-Asia rate per year					4.5±0.4 mm/yr (1993-2017)
- Caribbean rate per year					2.9±0.2 mm/yr (1993-2017)
Ocean heat content					
- 700 meters (10^{22} J wrt 1981-2010)	**12.8**	11.1	9.1	7.4	1st/2nd highest each qtr
- 2000 meters (10^{22} J wrt 1981-2010)	**18.2**	16.5	13.2	10.2	1st/2nd highest each qtr
Ocean acidification					

Global Temperature – warmest 5 & 10 years



5 years: 2014-2018: 1.04 ± 0.09°C

10 years: 2009-2018: 0.93 ± 0.07°C

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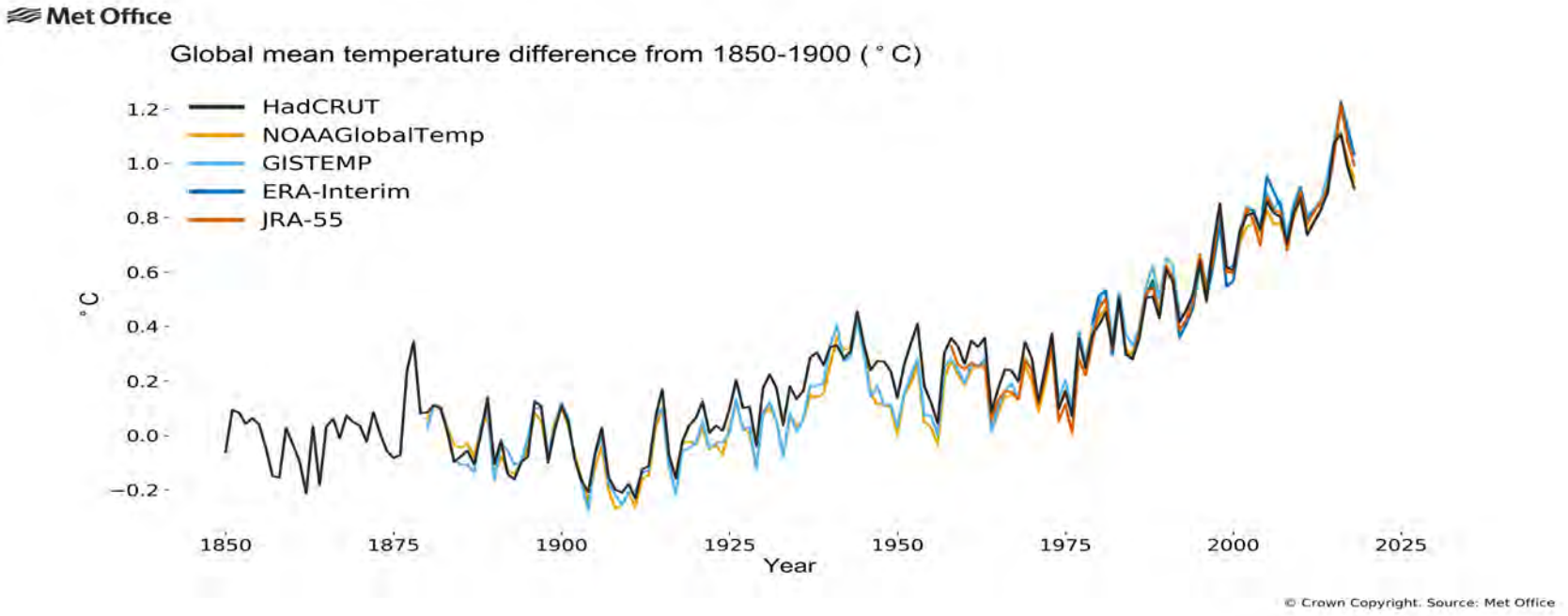
Global Temperature - 4th warmest year



0.98 ± 0.12°C above 1850-1900

set to be 4th warmest year on record

The 4 warmest years on record are the last 4 (2015-2018)

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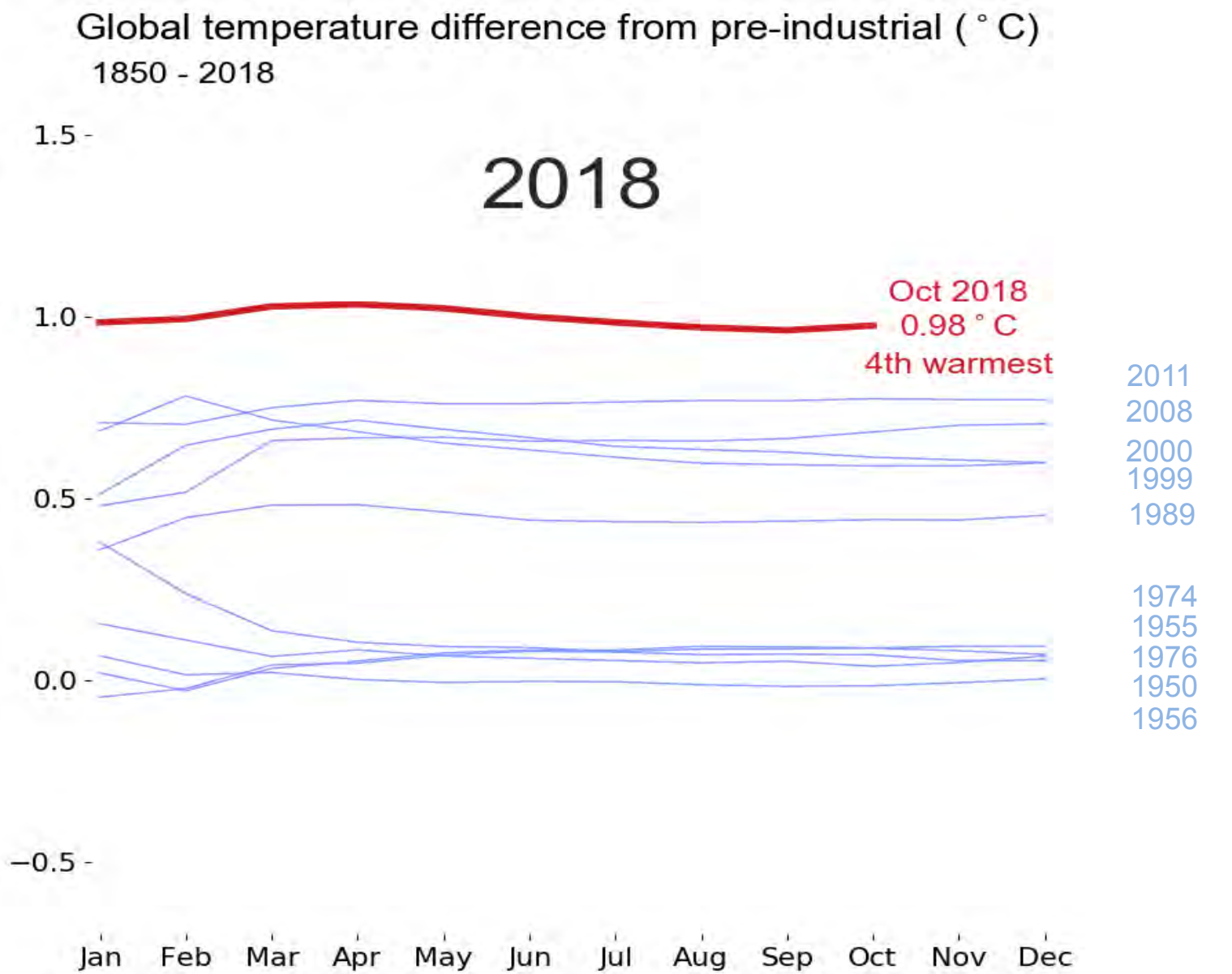
Warmest La Niña year



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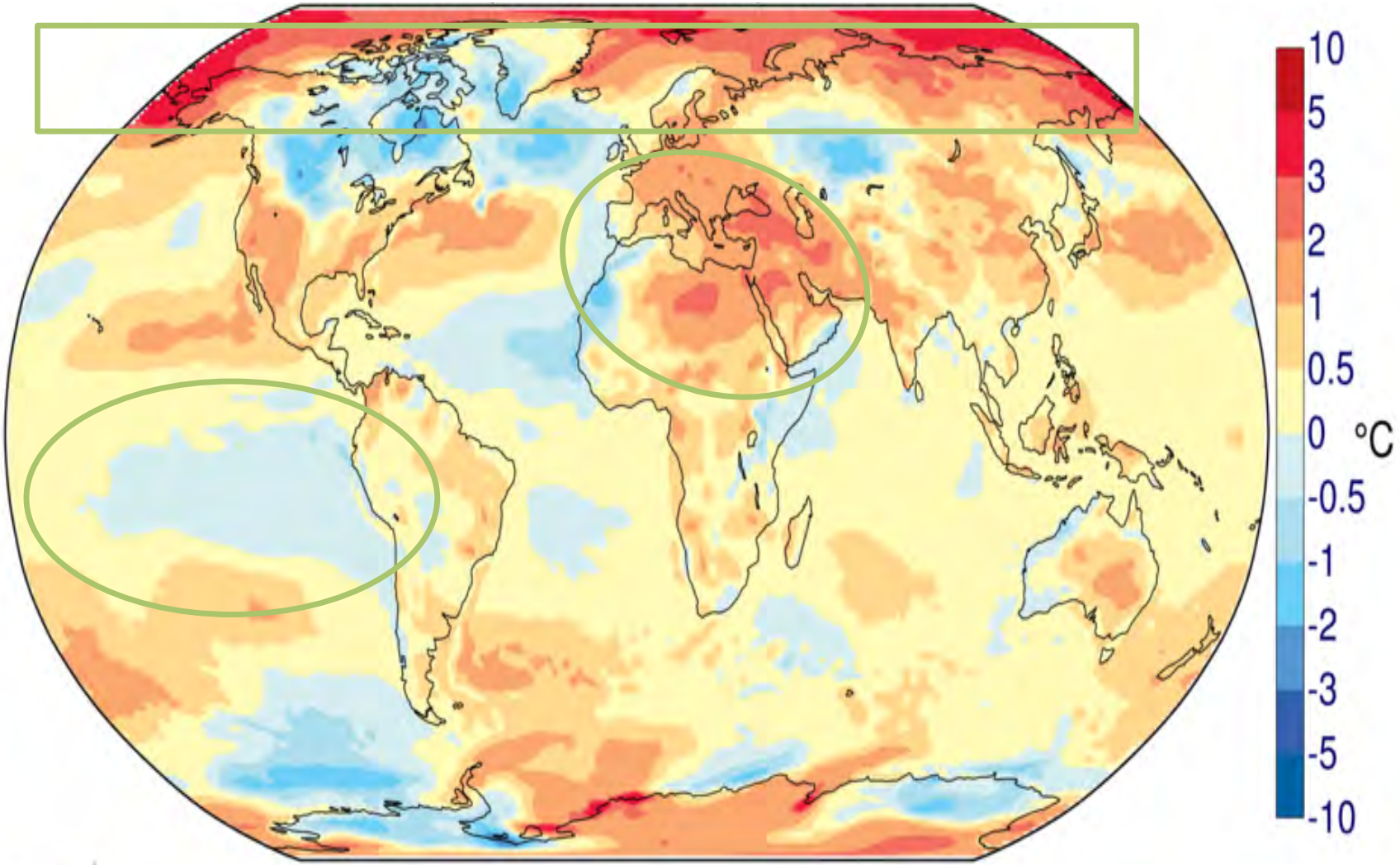
Surface air temperature anomaly
Jan-Oct 2018



Copernicus

Climate Change Service

ECMWF

Greenhouse gas levels reach new

	CO_2 record	CH_4	N_2O
2017 global abundance	405.5 ± 0.1 ppm	1'859 ± 2 ppb	329.9 ± 0.1 ppb
2017 abundance relative to 1750	146 %	257 %	122 %
2016-2017 absolute increase	2.2 ppm	7 ppb	0.9 ppb
2016-2017 relative increase	0.55 %	0.38 %	0.27 %
Mean annual absolute increase of last 10 years	2.24 ppm yr^{-1}	6.9 ppb yr^{-1}	0.93 ppb yr^{-1}

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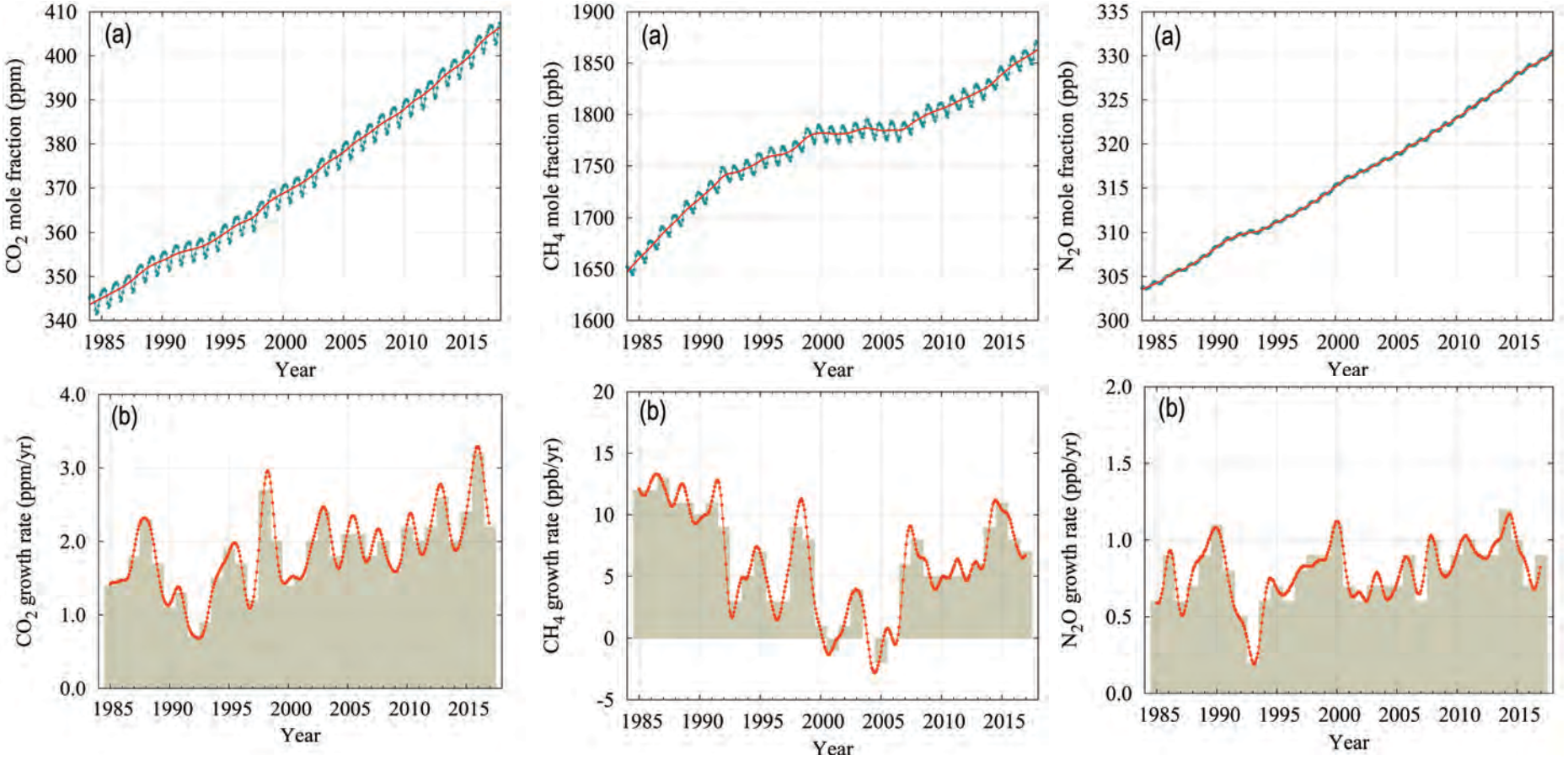
Source: WMO Greenhouse Bulletin No. 14, November 2018

Greenhouse gas levels reach new record

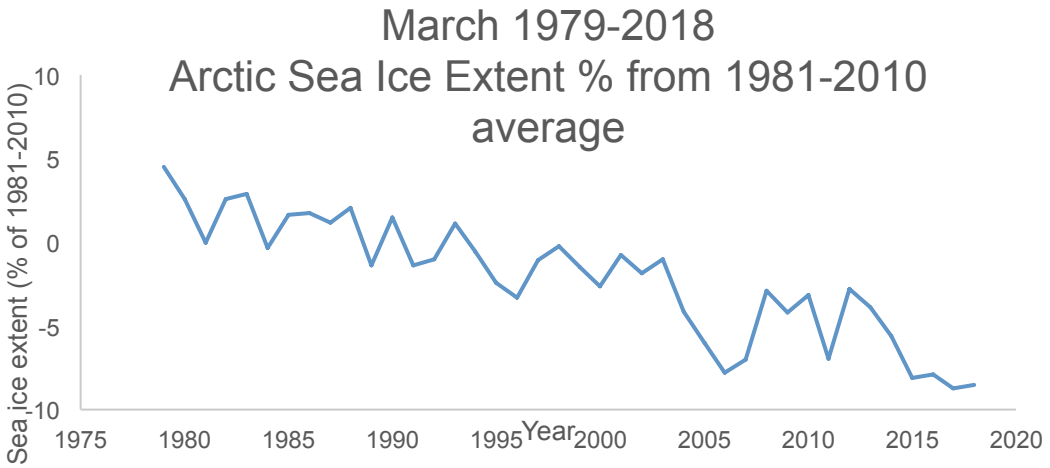
CO_2	CH_4	N_2O



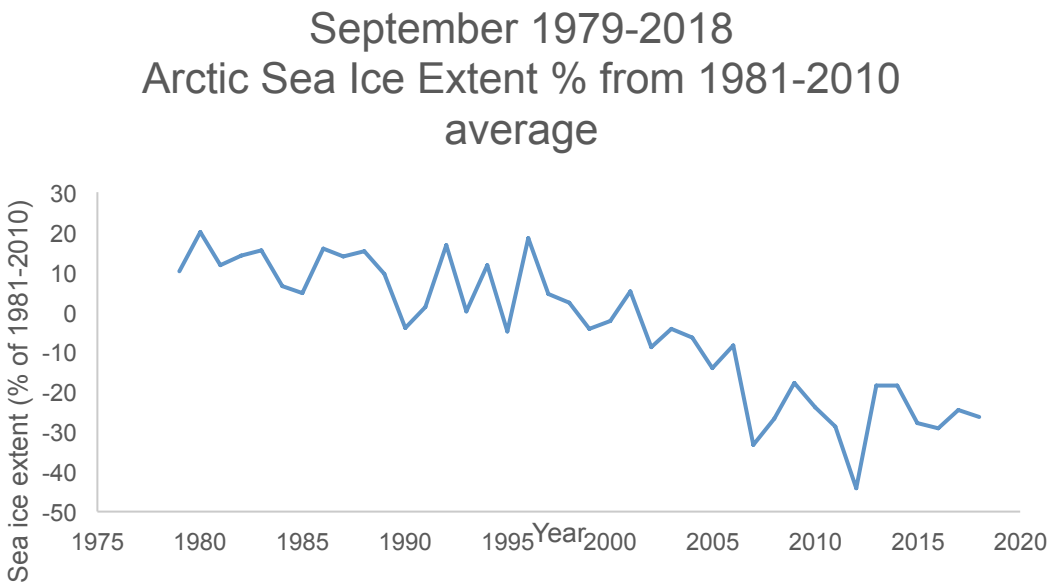
Globally averaged mole fraction (a) and its growth rate from 1984 to 2017 (b). Increases in successive annual means are shown as the shaded columns in (b). The red line in (a) is the monthly mean with the seasonal variation removed. The blue dots in and line depict the monthly averages.

Sea Ice well below average

Arctic March max
14.48 million km^2,
7% below average
(1981-2010),
record low first 2 month



Arctic September min
4.62 million km^2,
28% below average
12 smallest in last 12 yrs



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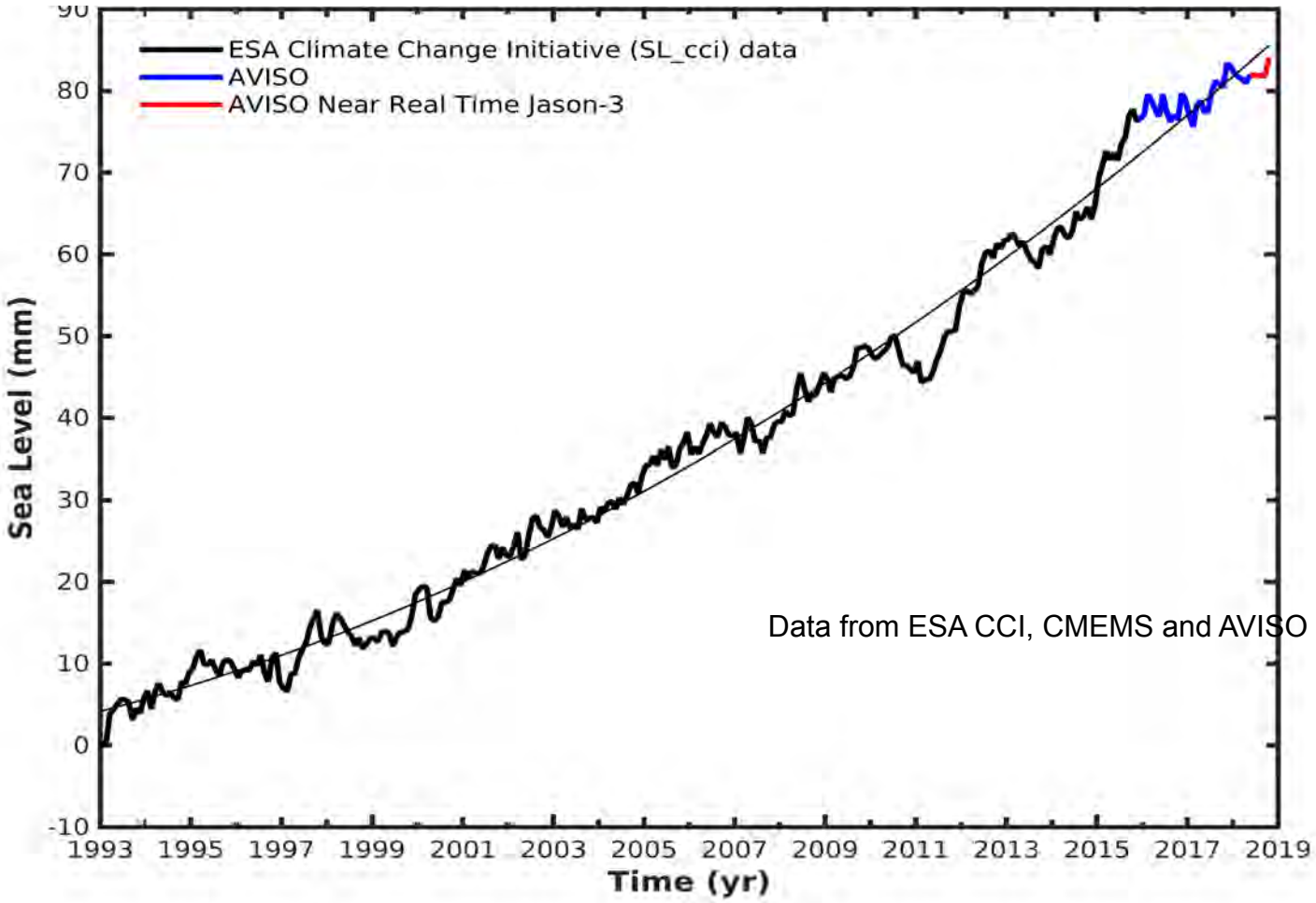
Sea Level Rising



Data from ESA CCI, CMEMS and AVISO

GMSL Jan - Jul 2018: 2-3 mm higher than the same period in 2017

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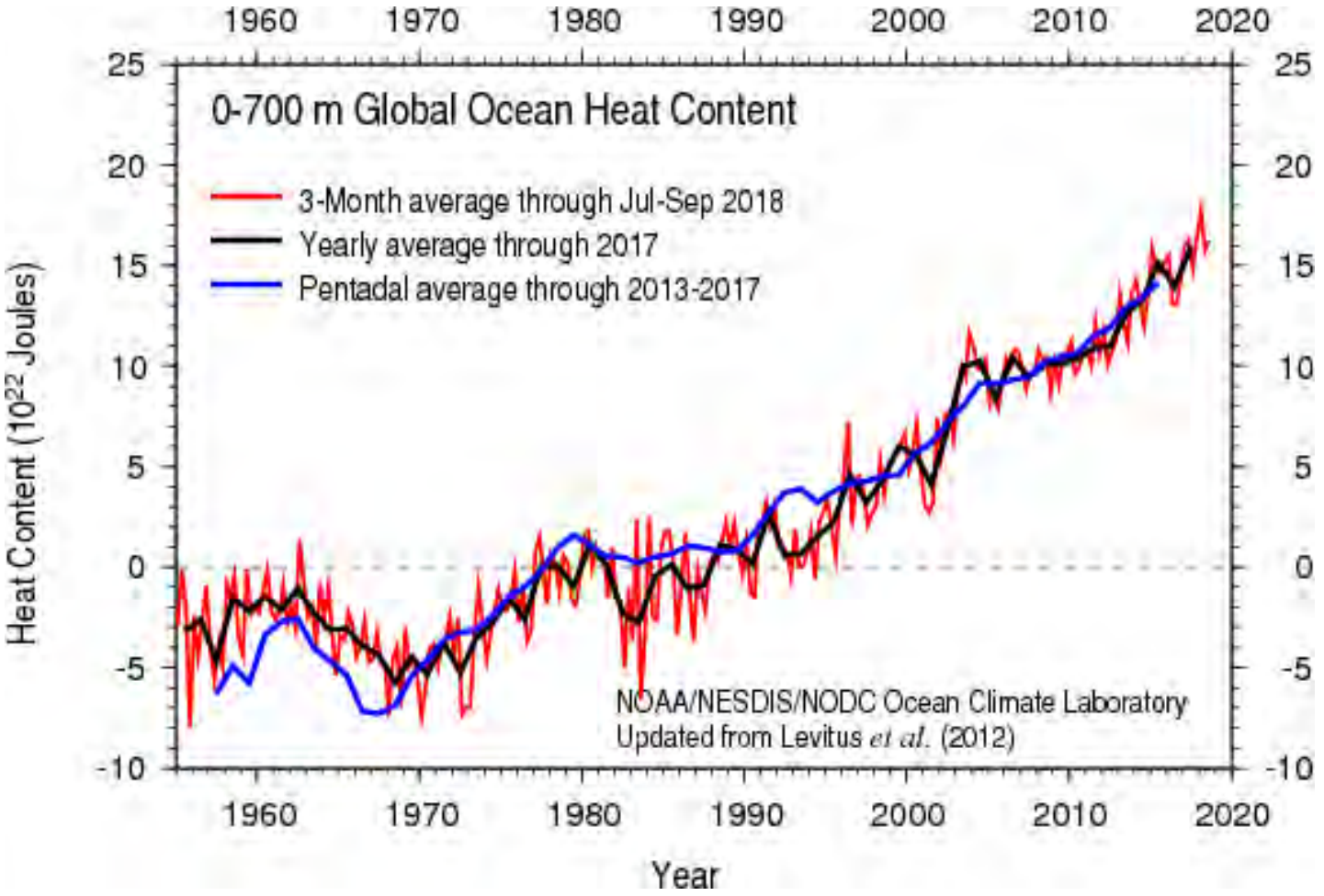
Ocean Heat Increases



Each 3-month period in 2018 (to September 2018) upper 700m (data from 1955) and 2000m (from 2005) were

the hottest or 2nd hottest (2017 hottest)

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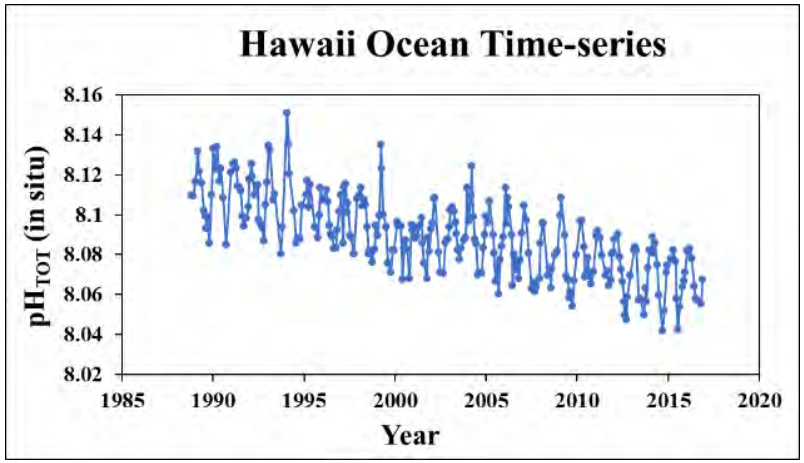
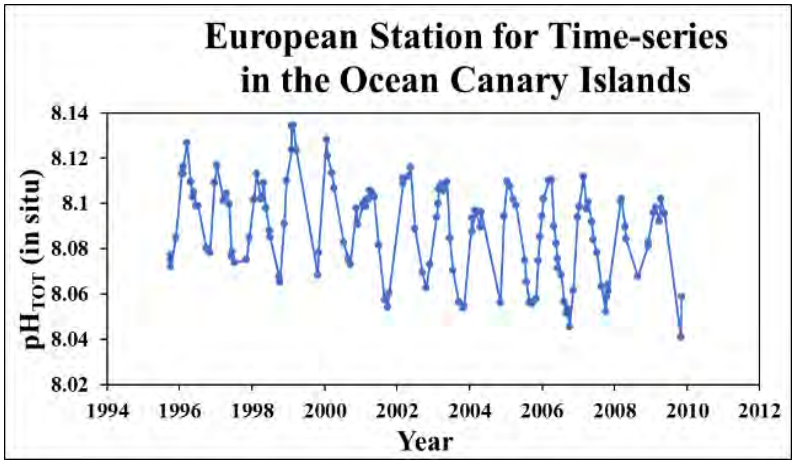
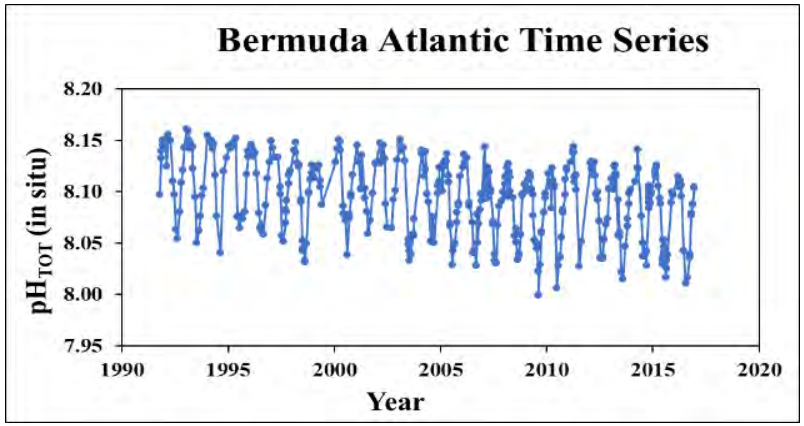
Ocean Acidification Increases







Open-ocean sources over the last 30 years have shown a clear trend of decreasing pH

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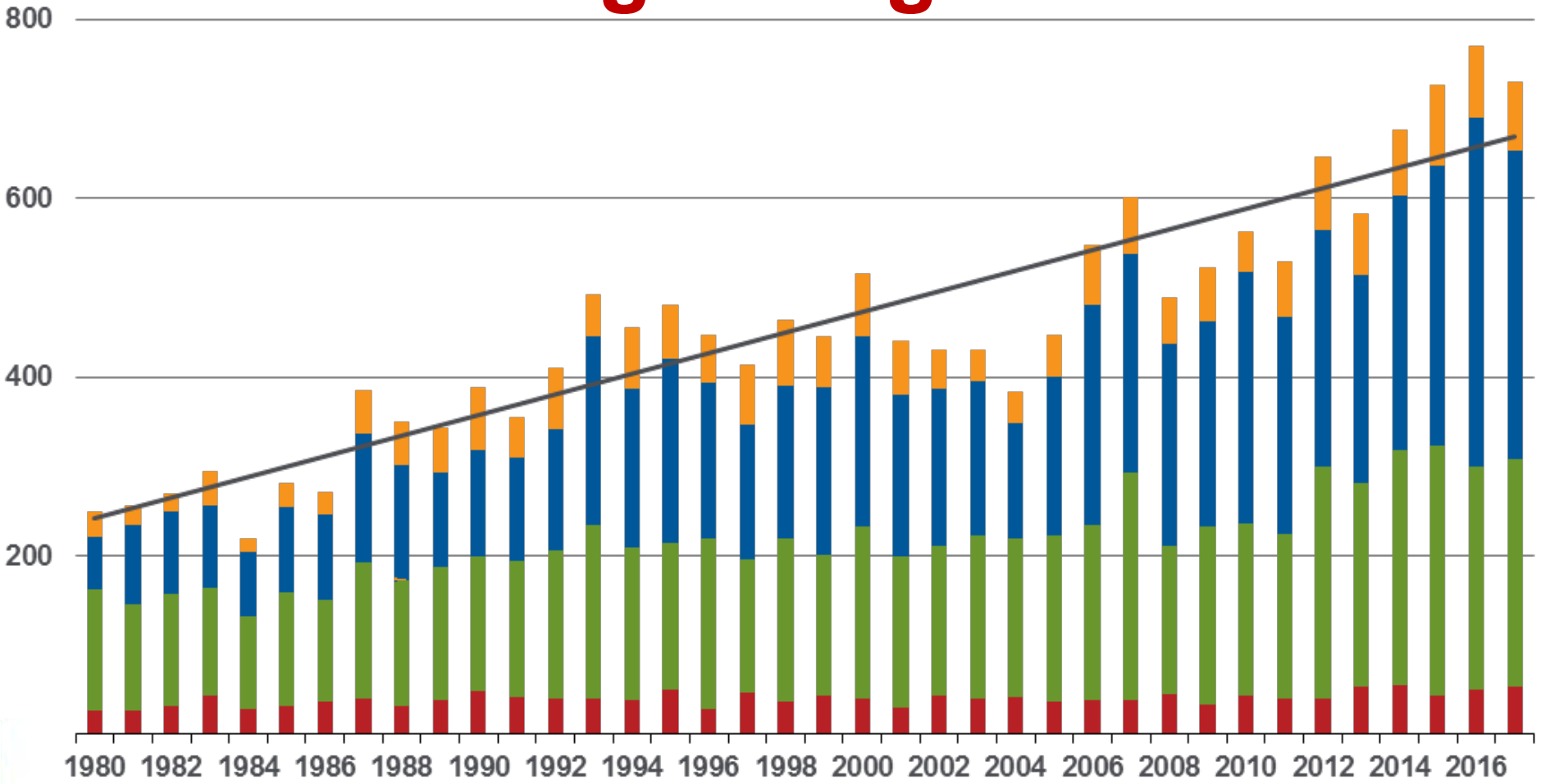
Credit: Richard Feely (NOAA- PMEL) and Marine Lebrec (IAEA OA-ICC)

Extreme events worldwide growing



Geophysical events (Earthquake, tsunami, volcanic activity)

Meteorological events (Tropical storm, extratropical storm, convective storm, local storm)

Hydrological events (Flood, mass movement)

Climatological events (Extreme temperature, drought, forest fire)

700 disasters/year (2017)

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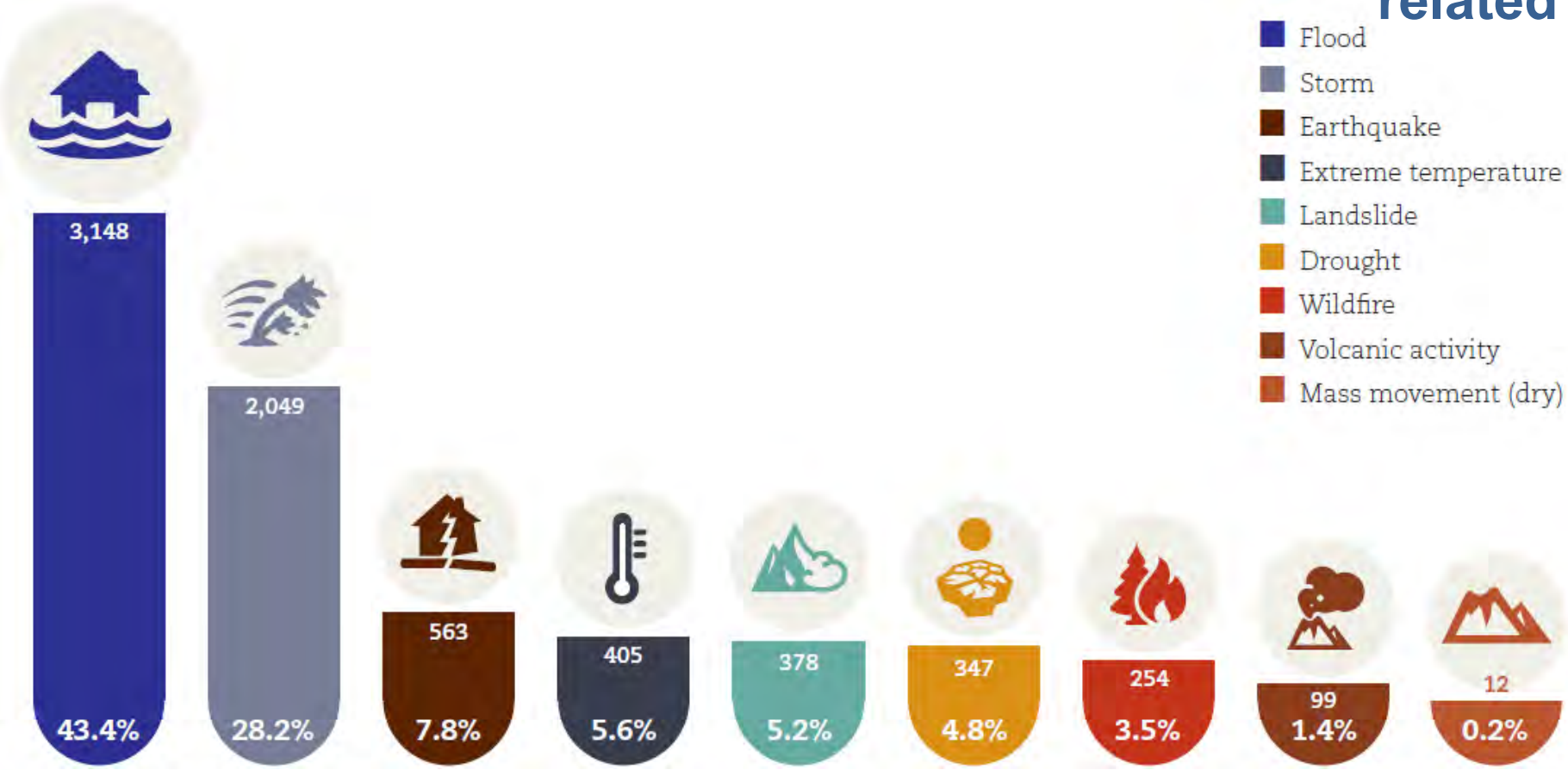
Source: NatCatService.munichre.com

Accounted events have caused at least one fatality and/or produced normalized losses ≥ US$ 100k, 300k, 1m, or 3m (depending on the assigned World Bank income group of the affected country).

Natural Disasters - last 20 years

90.6 % weather related



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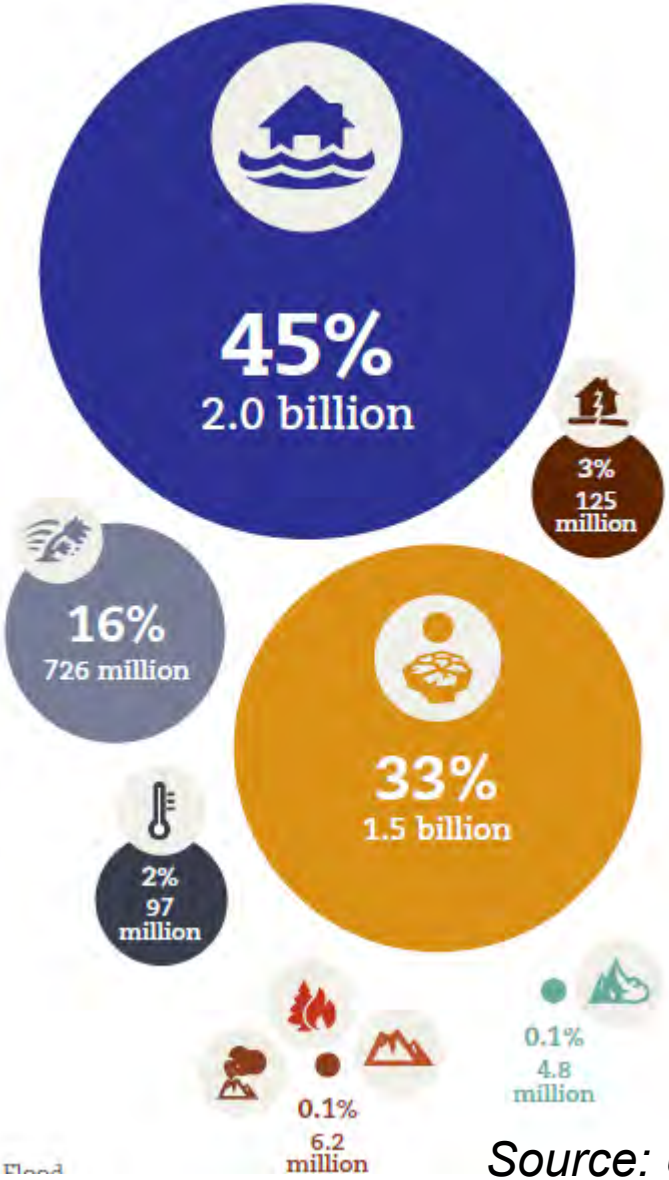
Source: UN ISDR & CRED: October 2013

4.5 Billion people affected – last 20 years

96 % weather related



million

- Flood
- Drought
- Storm
- Earthquake
- Extreme temperature
- Landslide
- Wildfire, Volcanic activity, Mass movement (dry)

Source: UN ISDR & CRED: October 2013

Climate Risks and Associated Impacts

Every life matters

- Extreme weather left a trail of devastation on all continents and led to many casualties
- Over at least **1 600 excess deaths** associated with heat waves, more than 100 with the wildfires
- A historically significant heatwave affected parts of East Asia in late July and early August. The worst-hit area was Japan. A national record of 41.1 °C was set at Kumagaya on 23 July. Over **150 deaths** in Japan were associated with the heat.
- A wildfire to the northeast of San Francisco, known as The Camp Fire, is the deadliest fire in over a century for the U.S. and, in terms of property loss, the most destructive on record for California. There have been at least **79 fatalities.**
- Large parts of western Japan experienced destructive flooding in late June and early July. At least **230 deaths** were reported and 6 695 houses were destroyed.
- In August, the southwest Indian state of Kerala suffered major flooding, reportedly the worst since 1924. **223 deaths** were reported and more than 5.4 million were affected.

Socio-economic impacts - 2018

Heavy humanitarian consequences:

In Madagascar, the number of people affected by food insecurity increased to **1.3 million** in southern regions

- Over **2 million** people were reported to be displaced in association with extreme weather and climate events
- Vulnerable Rohingya refugees severely affected: As of September 2018, up to **200 000** refugees were exposed heightened risk of landslides and flooding.

Large economic losses:

- Exceptional drought in Europe and southern America. **43% crop losses in Germany** relative to the 2013-17 average, likely to be costed in the **billions of euros**
- Florence and Michael the most significant hurricane landfalls on the United States mainland in 2018 with heavy economic losses.
- Typhoon Manghkut/Ompong, which crossed the Philippines in mid-September was associaed with agricultural losses that could reach at least **US$ 265 million**.
- Gita in the South Pacific in February 2018 was the most intense tropical cyclone ever to affect Tonga causing severe damage. Significant damage also occurred in Samoa, American Samoa and on outlying islands of Fiji

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