Climate Change and Receiverships: Increasing Insurance Industry Risks from a Changing Climate

2020 IAIR Insurance Resolution Workshop
Charleston, S.C., February 26 – 28

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Session Goals

- ✓ Define the Basic Underlying Science Behind Climate Change;
- ✓ Review potential ways in which weather patterns will change in response to a warming atmosphere;
- ✓ Identify Current and Potential Future Regional Impacts Related to Climate Change;

Session Goals

- ✓ Describe Current Legal Developments Related to Climate Change;

The Basic Science

Climate vs. Weather

- WEATHER: Weather consists of the short-term changes in the atmosphere – low and high pressure systems; a thunderstorm; heat wave; blizzard, etc. Think short-term changes in temperature, humidity, precipitation, cloudiness, visibility, wind.

Weather!

Source: T-Storm: © J. Lee..

Source: Blizzard of 1978: - WIBC Blog - https://www.wibc.com/blogs/wibc-blog/9-frosty-facts-about-blizzard-1978

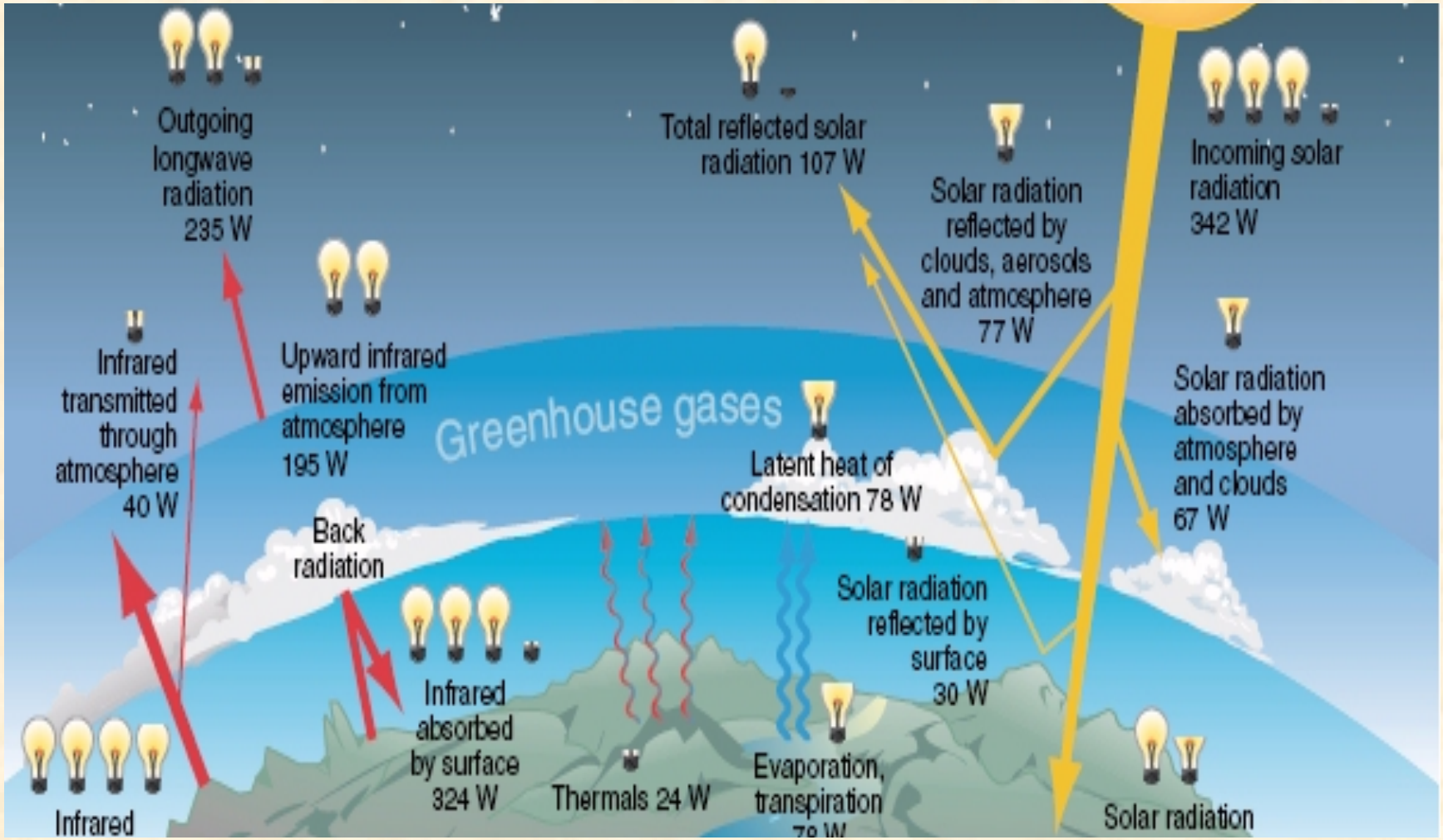
Climate vs. Weather

- CLIMATE: Climate is the average of weather over time and space, generally for 30-years. It is frigid in the arctic in winter; it is hot and humid along the Gulf States in summer; there is lake-effect snow every winter by the Great Lakes, etc.

Climate!

Source: © J. Lee

Earth's Energy Balance



CIMSS.SSEC.wisc.edu

Common Greenhouse Gasses:

- The most common greenhouse gas is water vapor.
  Here are some others:

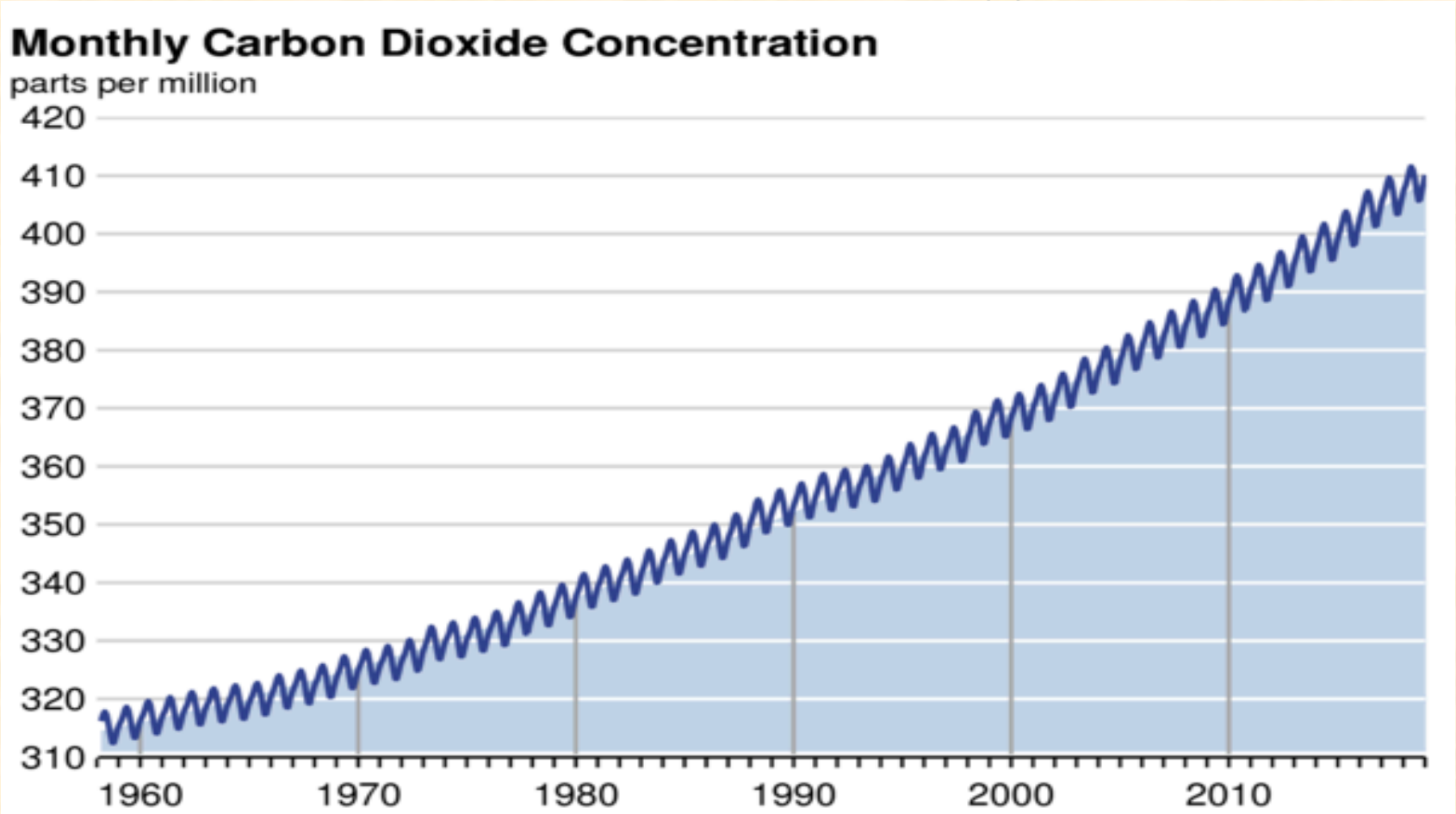
GHG	SYMBOL	PERCENT OF ALL GHG EMISSIONS	Warming Potential (wrt CO_2)	Lifetime in the Atmosphere
Carbon Dioxide	CO_2	80%	1	~100 yrs
Methane	CH_4	10%	25	12 yrs
Nitrous Oxide	N_2O	6%	300	115 yrs

Top 10 Warmest Years

RANK PERIOD OF RECORD: 1880–2019	YEAR	ANOMALY °C	ANOMALY °F
1	**2016**	**0.94**	**1.69**
2	**2019**	**0.93**	**1.67**
3	**2015**	**0.90**	**1.62**
4	**2017**	**0.84**	**1.51**
5	**2018**	**0.77**	**1.39**
6	**2014**	**0.74**	**1.33**
7	**2010**	**0.70**	**1.26**
8	**2013**	**0.66**	**1.19**
9	**2005**	**0.65**	**1.17**
10	**2009**	**0.64**	**1.15**

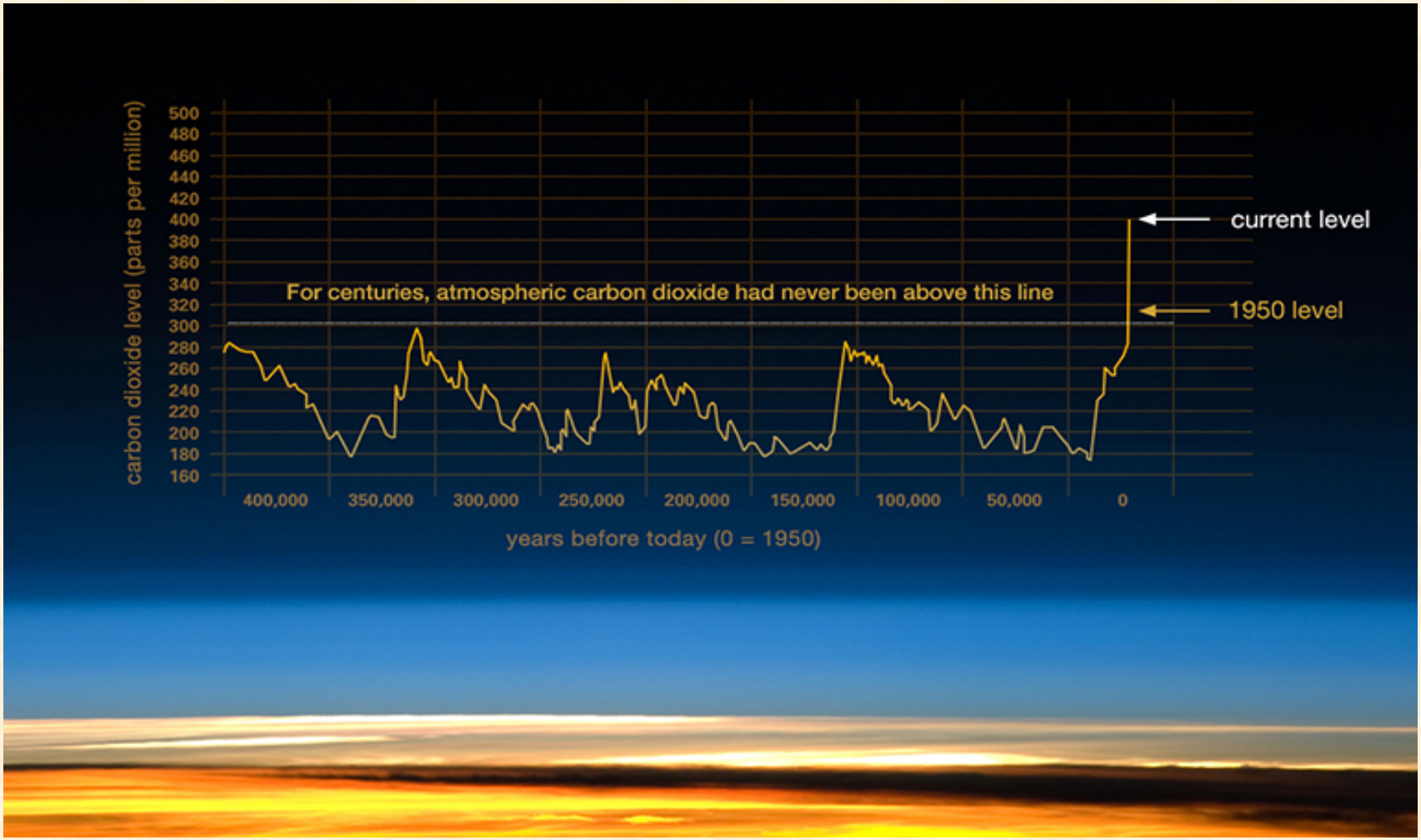
NOAA National Centers for Environmental Information, State of the Climate: Global Climate Report for Annual 2018, published online January 2019, retrieved on February 7, 2019 from https://www.ncdc.noaa.gov/sotc/global/201813.

Keeling Curve
CO_2 Concentrations at Mauna Loa Observatory
1960 – 2019 - 315→413 ppm



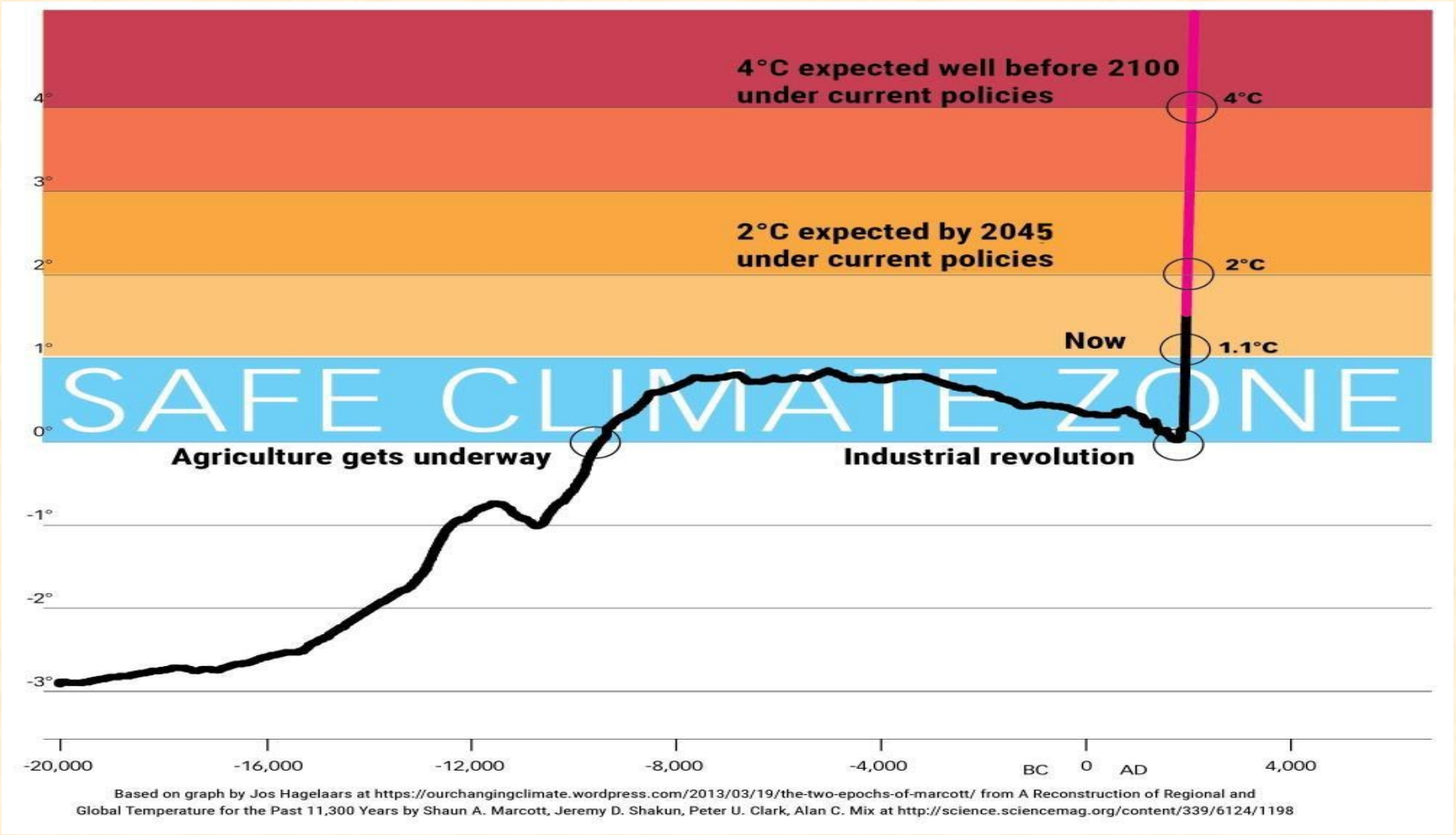
Scripps Oceanography – www.scrippsco2.ucsd.edu

Atmospheric CO_2 Concentration



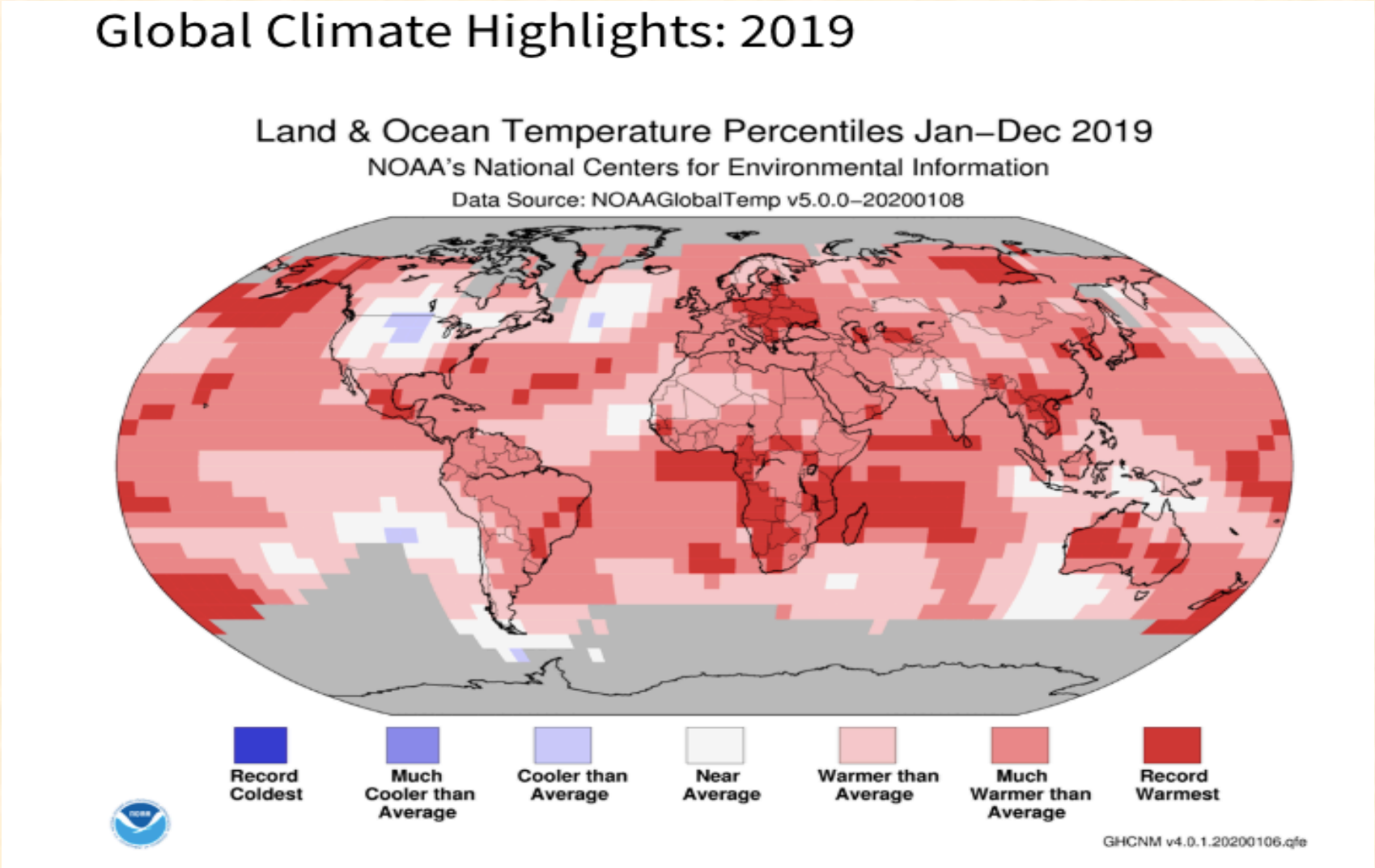
Vostok ice core data/J.R. Petit et al.; NOAA Mauna Loa CO_2 record. Climate.NASA.gov

Historic Temperature Record

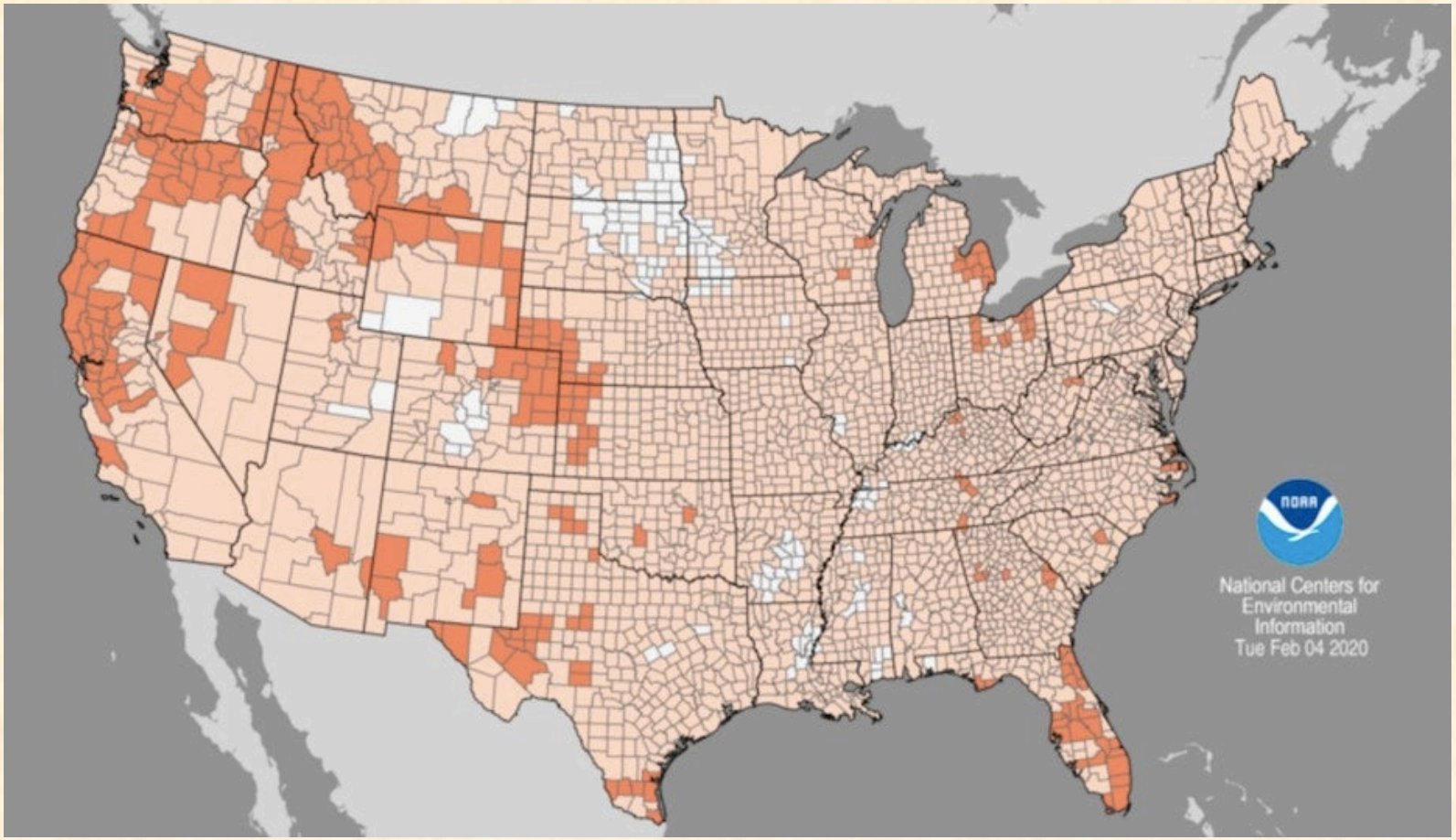


Based on graph by Jos Hagelaars at https://ourchangingclimate.wordpress.com/2013/03/19/the-two-epochs-of-marcott/ from A Reconstruction of Regional and Global Temperature for the Past 11,300 Years by Shaun A. Marcott, Jeremy D. Shakun, Peter U. Clark, Alan C. Mix at http://science.sciencemag.org/content/339/6124/1198

Temperature Percentiles Jan-Dec 2019



Dec 2019 – Jan 2020 - Warmest on Record

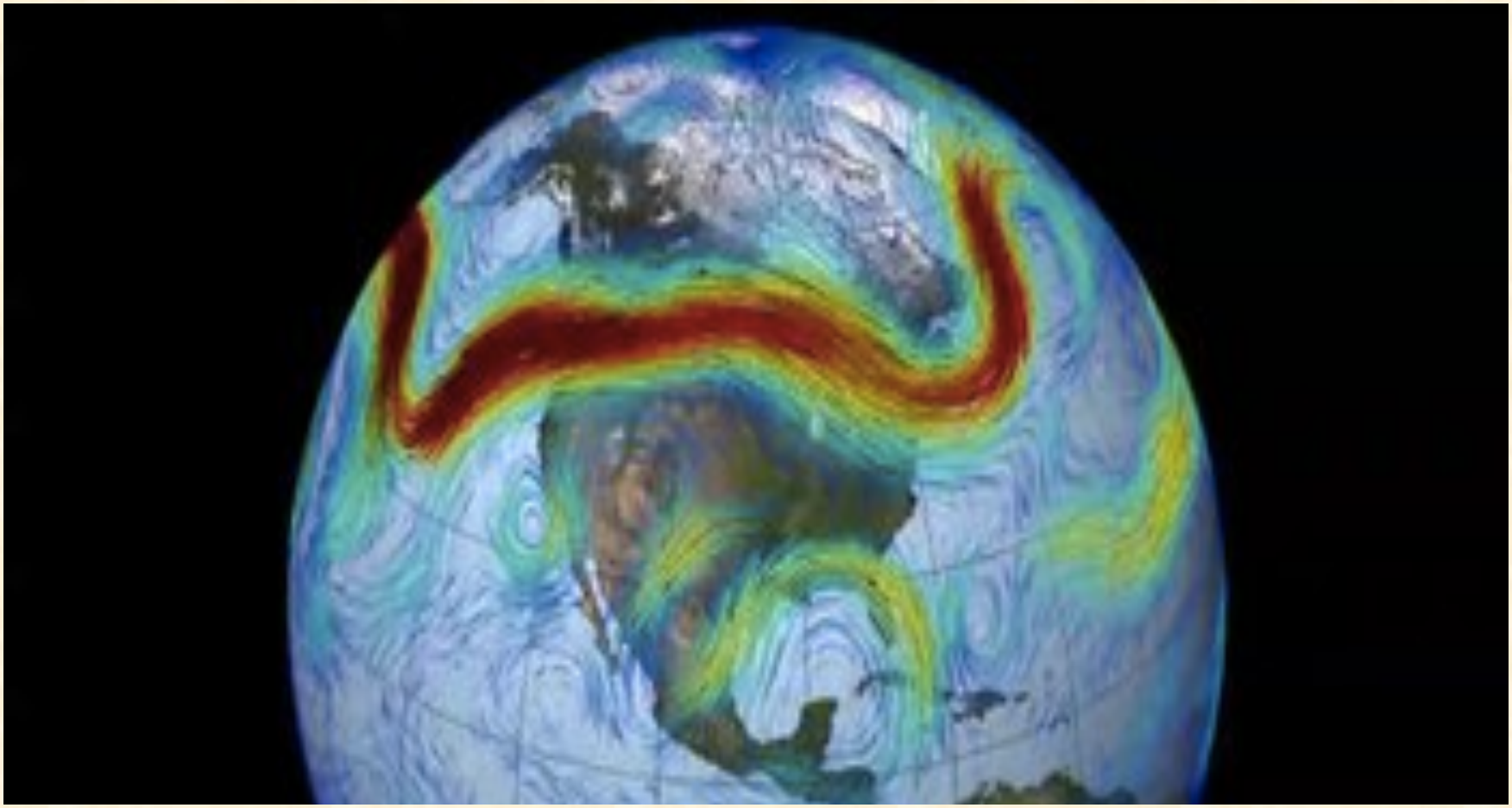


US County Map – Nov. 1, 2019 to Jan. 31, 2020.
NOAA National Center for Environmental Information, Feb. 2020

Climate Snapshot

- 2015-2019 – Warmest 5-year period on record;
- Continued Decrease of Sea Ice Volume and Mass;
- Accelerating Sea-level Rise and Ocean Acidity;
- Increasing Global CO_2 Emissions;
- Paris Agreement Emission Reductions for 1.5C Temperature Increase Unlikely to be Met

Jet Streams and Weather



Source: en.wickipedia.org

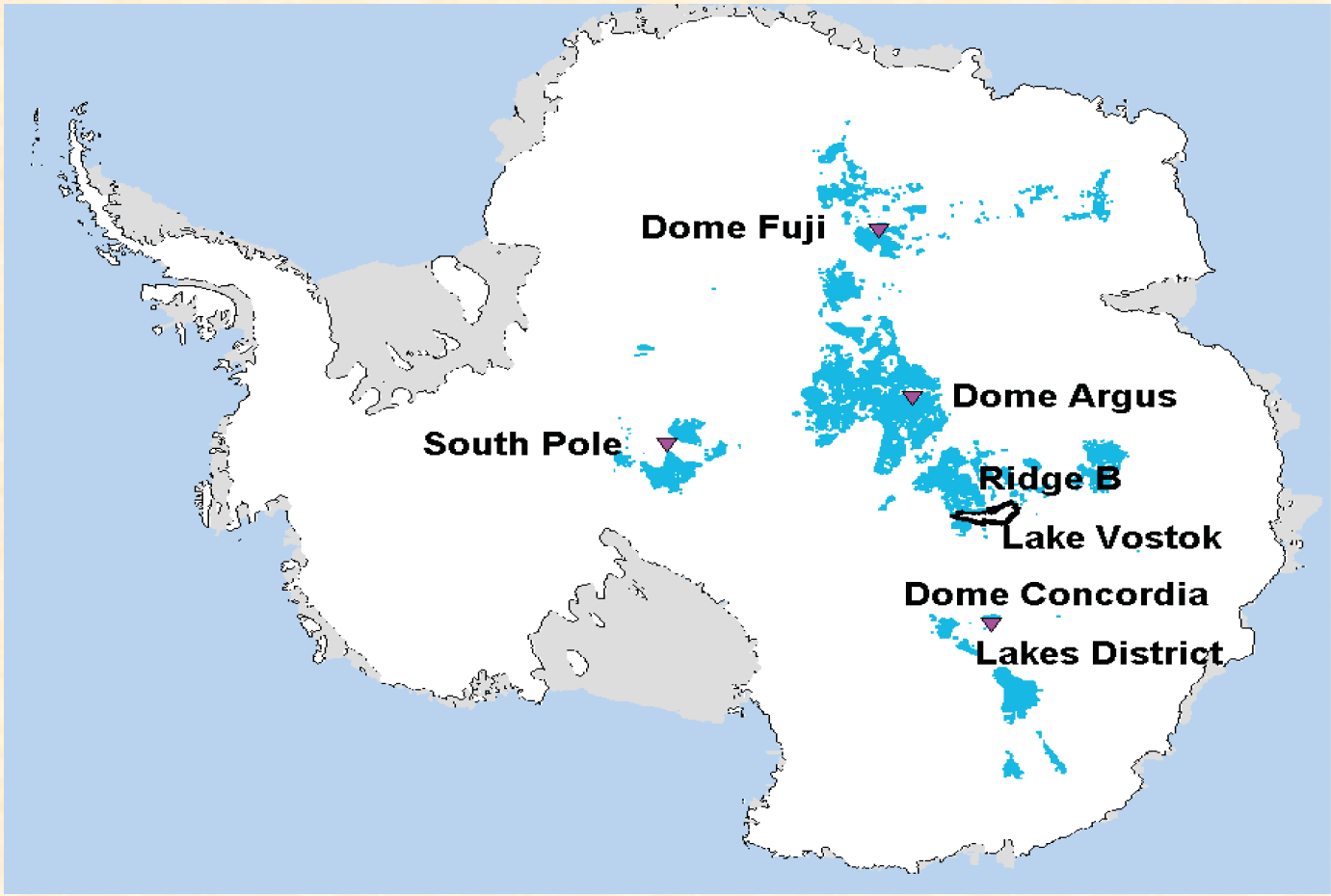
How Do We Know??

Historic Temperature/CO2 Reconstruction

Paleoclimatology Dataset Examples:

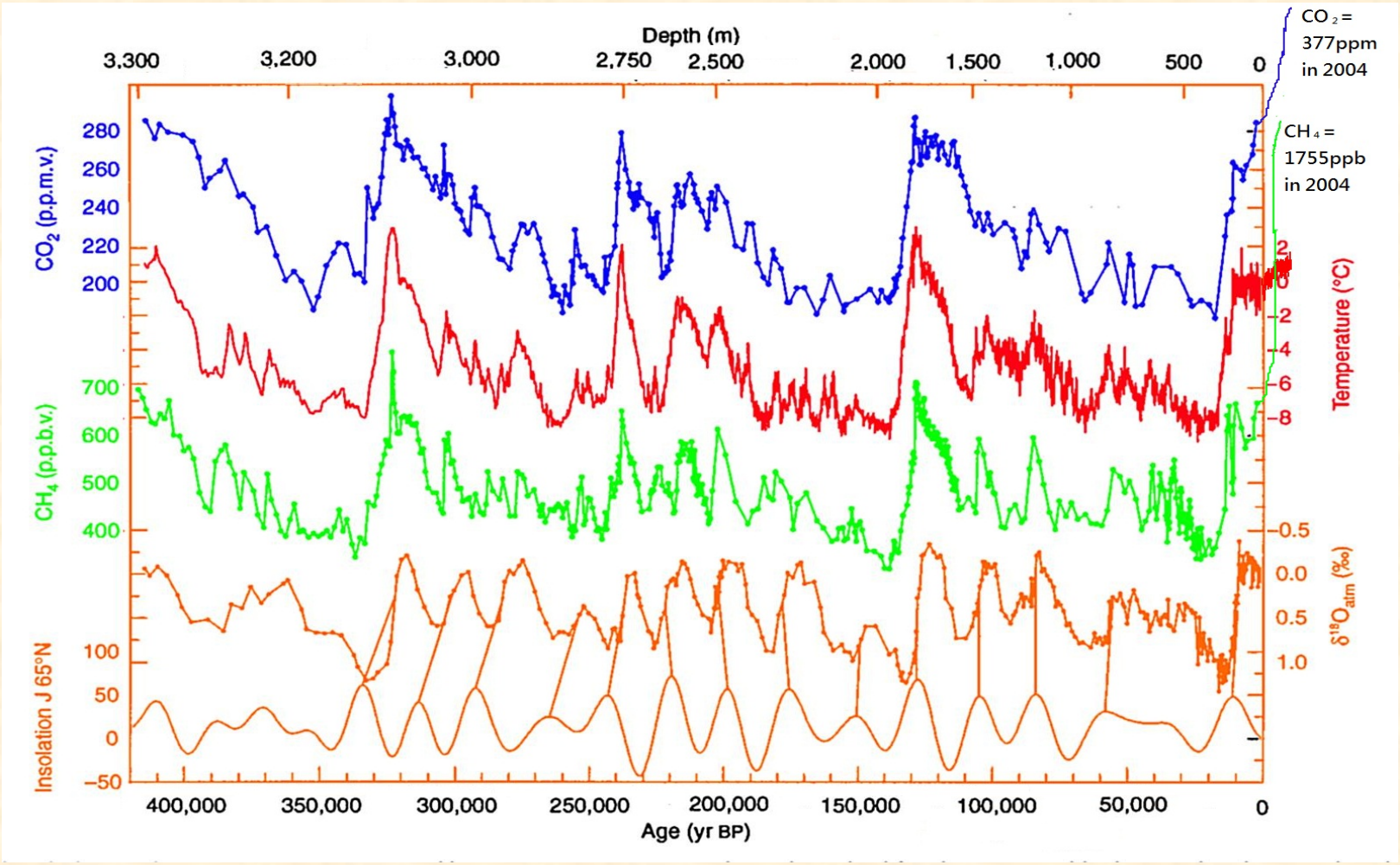
- ICE CORES – CO_2 and T – O_{18}/O_{16} isotope ratio - colder periods more O_{16} in glaciers / more O_{18} ocean sediments;
- PALEOCEANOGRAPHY - sediments
- PLANT MICROFOSSIL – temperature dependent
- POLLEN
- TREE RINGS
- CLIMATE MODELS

Oldest Ice Regions in Antarctica



Locations where 1.5 myo ice could exist. Ban Liefferinge and Pattyn, *Climate of the Past*, 2013

Ice Core Record Example



AntarcticGlaciers.org. – Core data from Vostok, Antarctica research station.

Climate Model Types

- Different models for different situations, ranging from simple energy-balance models to highly complex Earth System models. Examples:
  - Atmosphere-Ocean General Circulation Models (AOGCM) – the first standard climate models. Primary function is to understand the dynamics of the climate system – atmosphere, ocean, land, sea ice, and to make predictions about these systems
  - Earth System Models (ESM) – current state of the art models, expanding on AOGCMs to include bio-chemical processes.

Natural vs Anthropogenic Influences

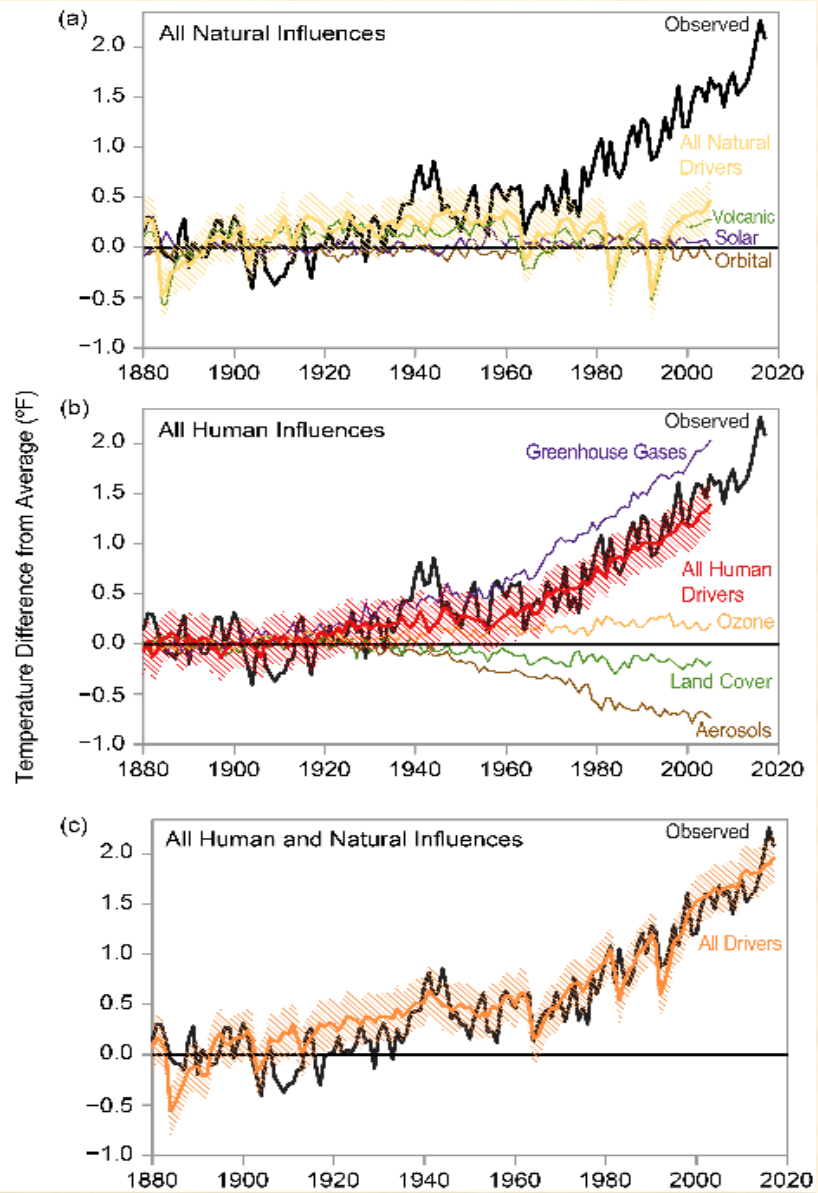


Fig. 2.1 – Ch. 2 - Hayhoe, K., D.J. Wuebbles, D.R. Easterling, D.W. Fahey, S. Doherty, J. Kossin, W. Sweet, R. Vose, and M. Wehner, 2018: Our Changing Climate. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 72–144. doi: 10.7930/NCA4.2018.CH2