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Keeping on Track: *Risk & Uncertainty at the Nexus of Water, Food & Biodiversity*

*A Presentation by
R.W. Sandford
EPCOR Chair, Water and Climate Security
United Nations University
Institute for Water, Environment & Health*





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Minot, North Dakota, November 2016





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Climate change is a hoax ...





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Three Ways for the U.S. to Exit the Paris Accord





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COP 22

The Paris Accord in the balance



MARRAKECH
COP22 | **2016** | CMP12



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Follow the Water:

Worldwide Distribution of Population Growth





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Follow the Water: Global Health



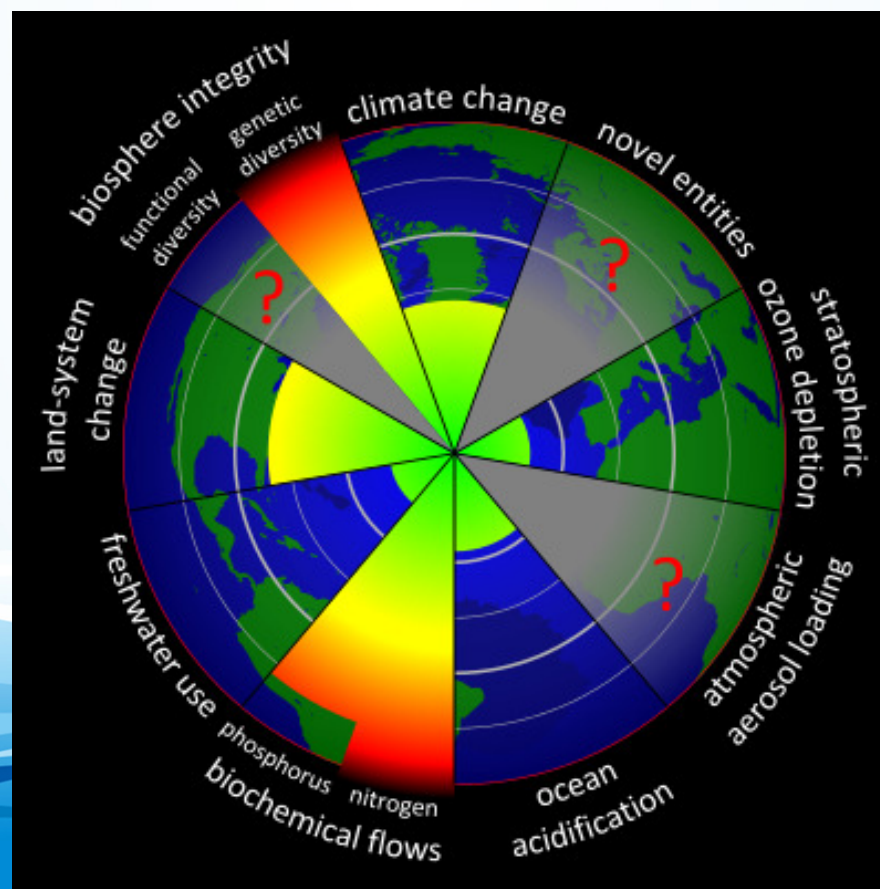


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Follow the Water: Earth system boundaries





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Follow the Water: Rising Global Carbon Dioxide Concentrations



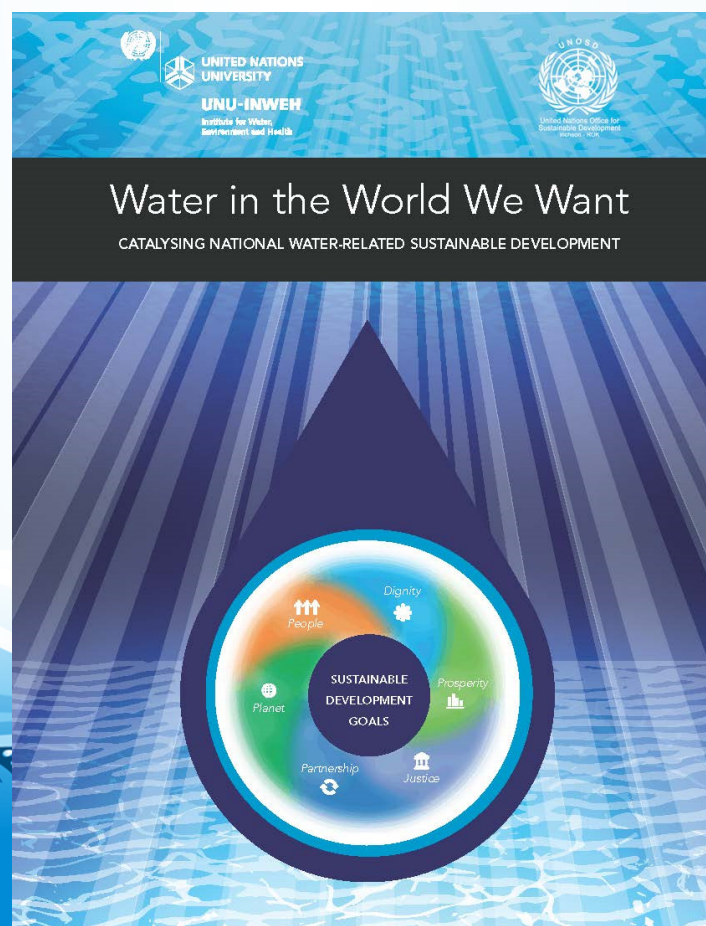


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Water Security: The UN post-2015 sustainable development goals





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Water & Climate Security: Land Use & Cover Changes



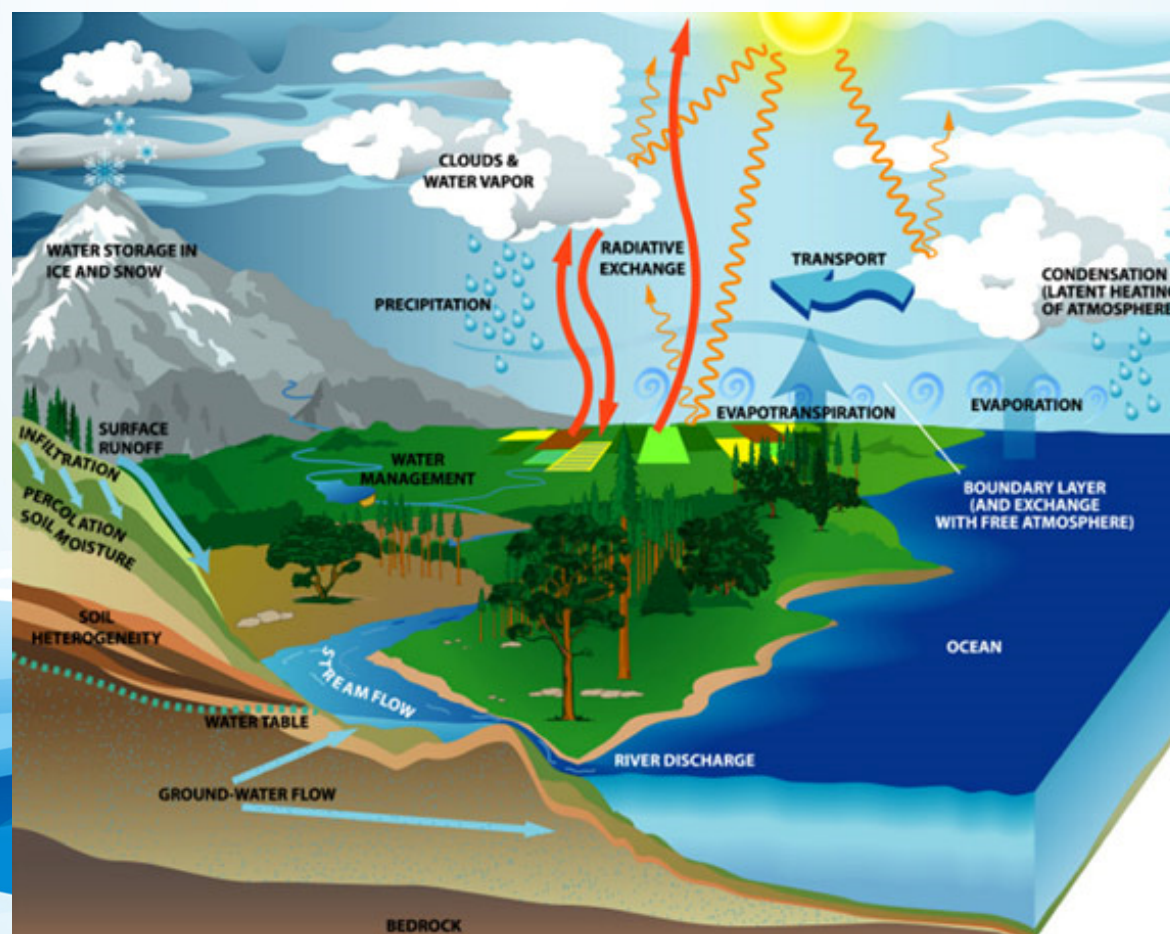


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Water & Climate Security: Follow the water



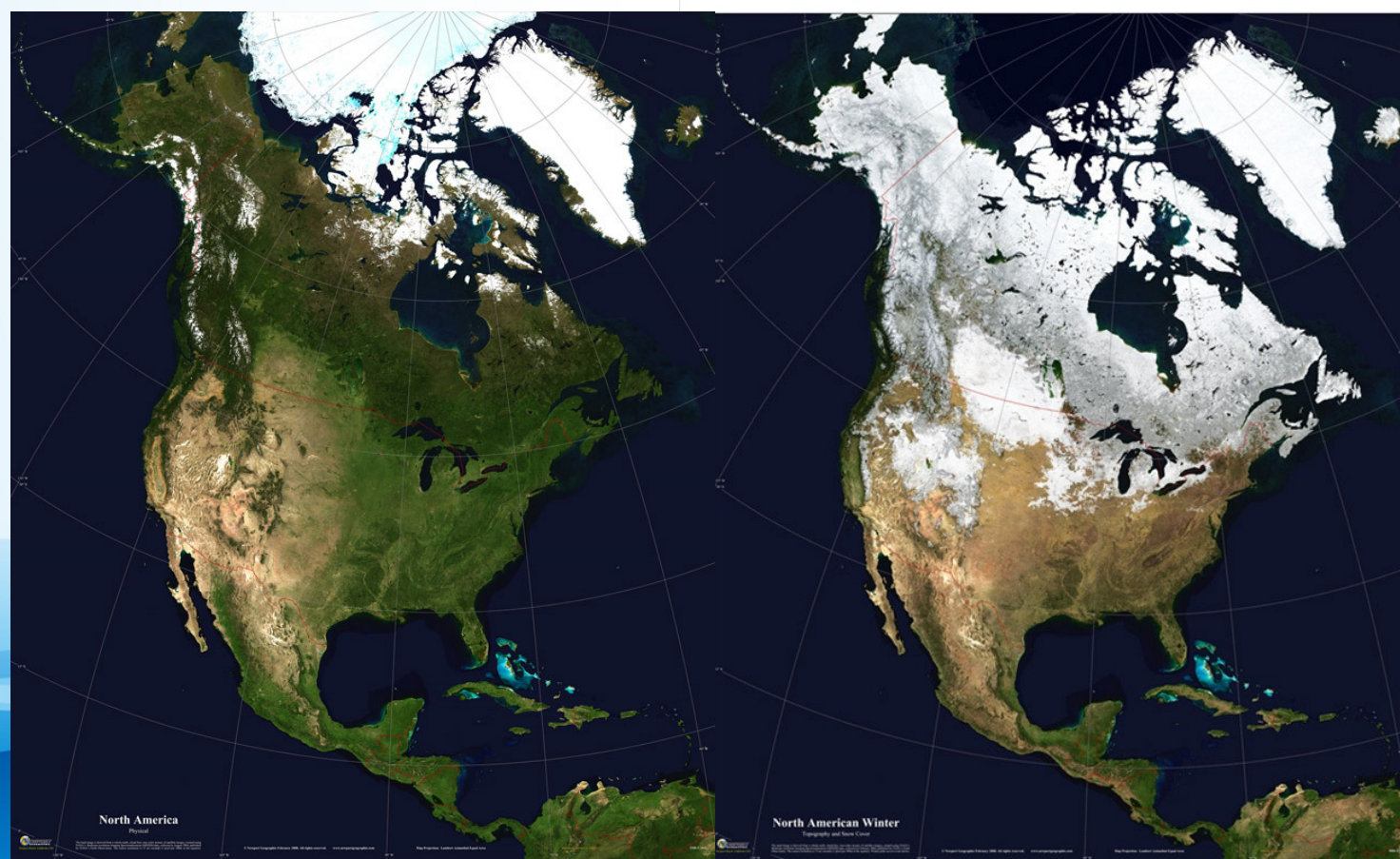


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Follow the Water: Seasonal snow cover



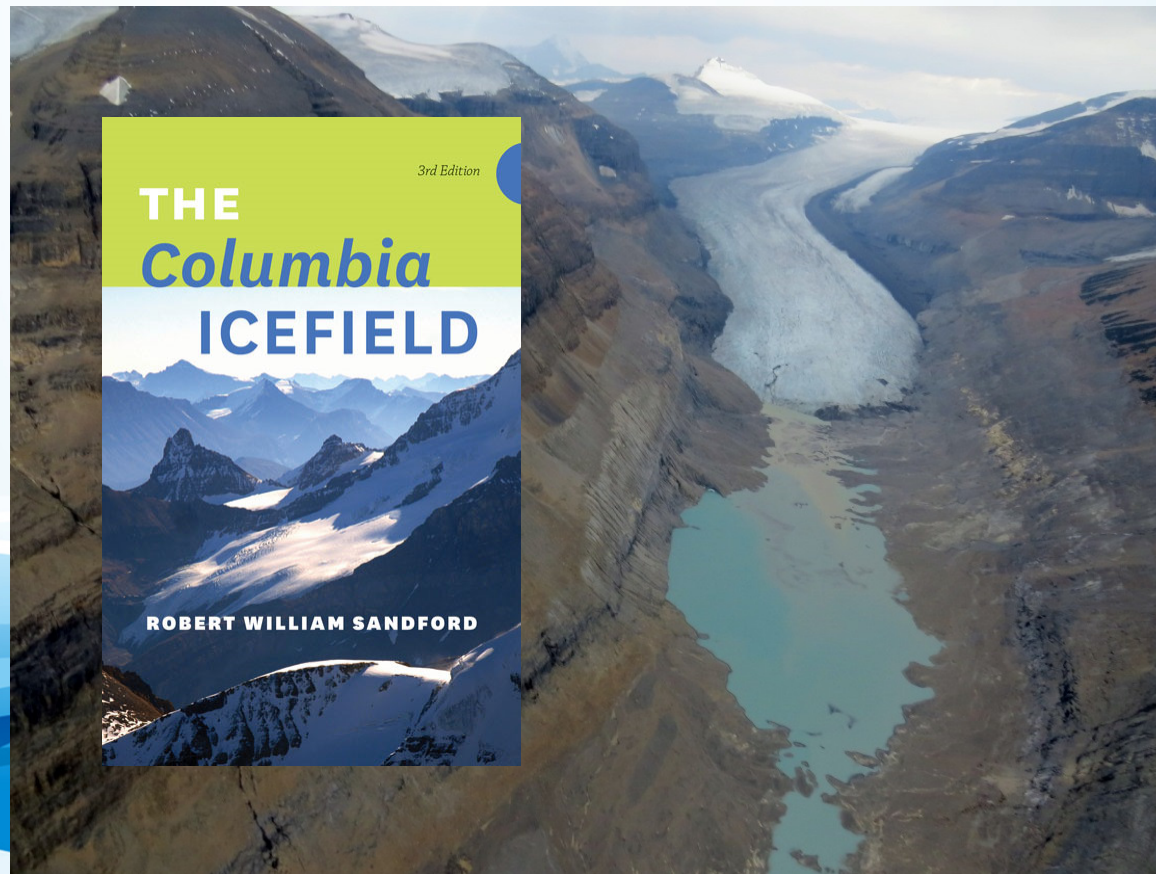


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Follow the Water: We lost 300 glaciers in the Canadian Rockies alone between 1920 and 2005.



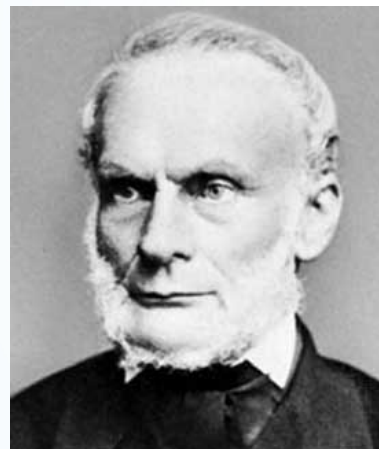


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The Clausius-Clapyron Relation

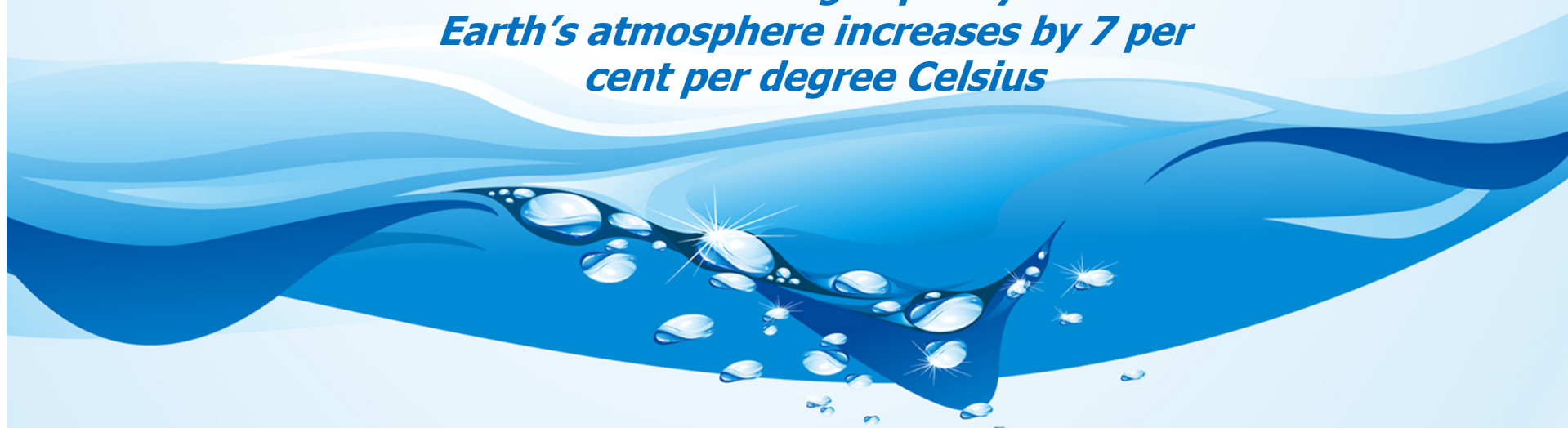


Rudolf Clausius



Benoit Clapeyron

***The water-holding capacity of the
Earth's atmosphere increases by 7 per
cent per degree Celsius***



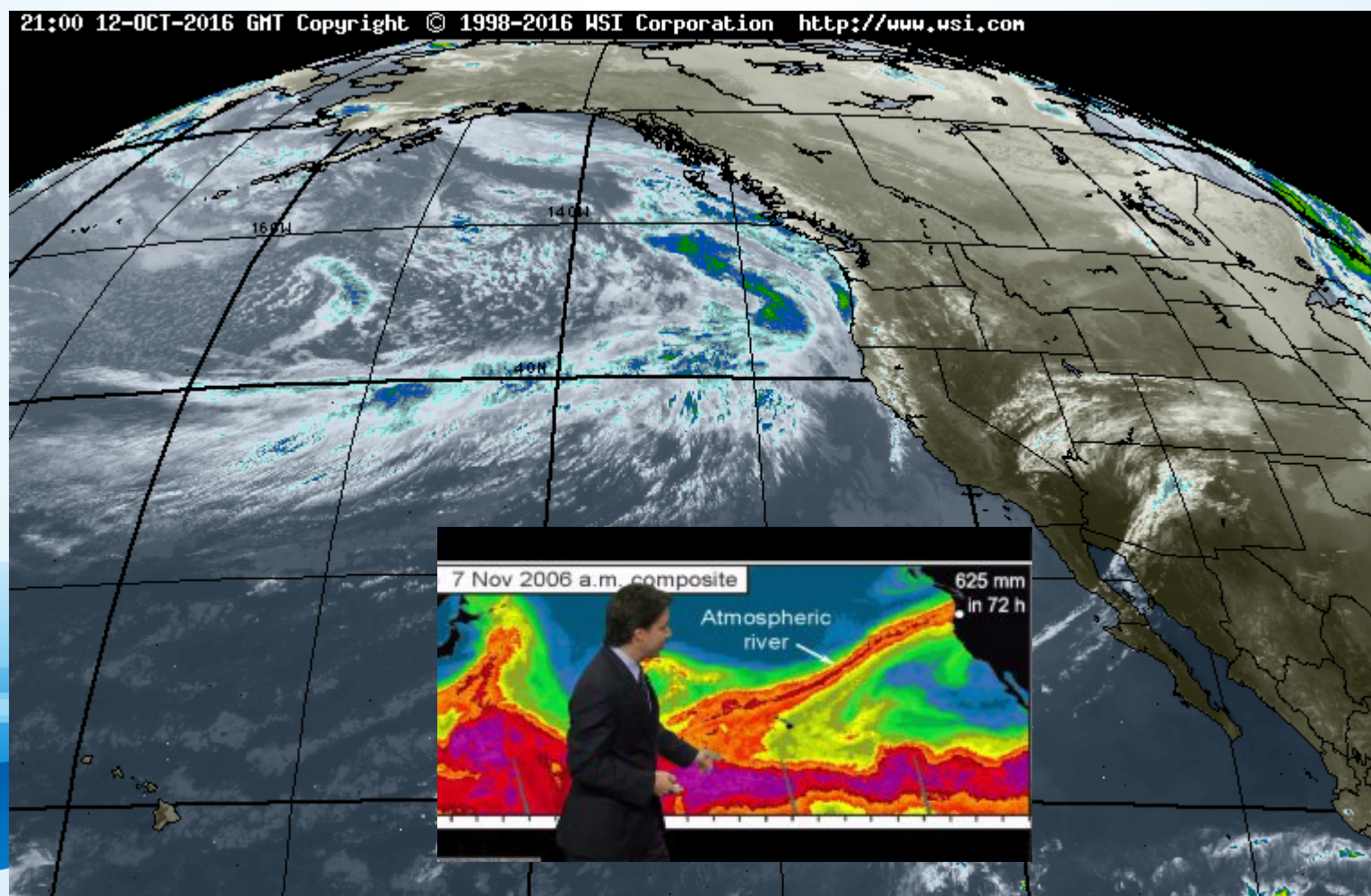


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Atmospheric Rivers



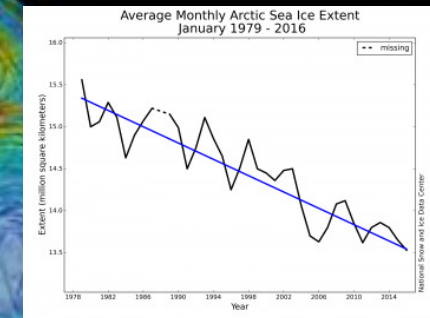
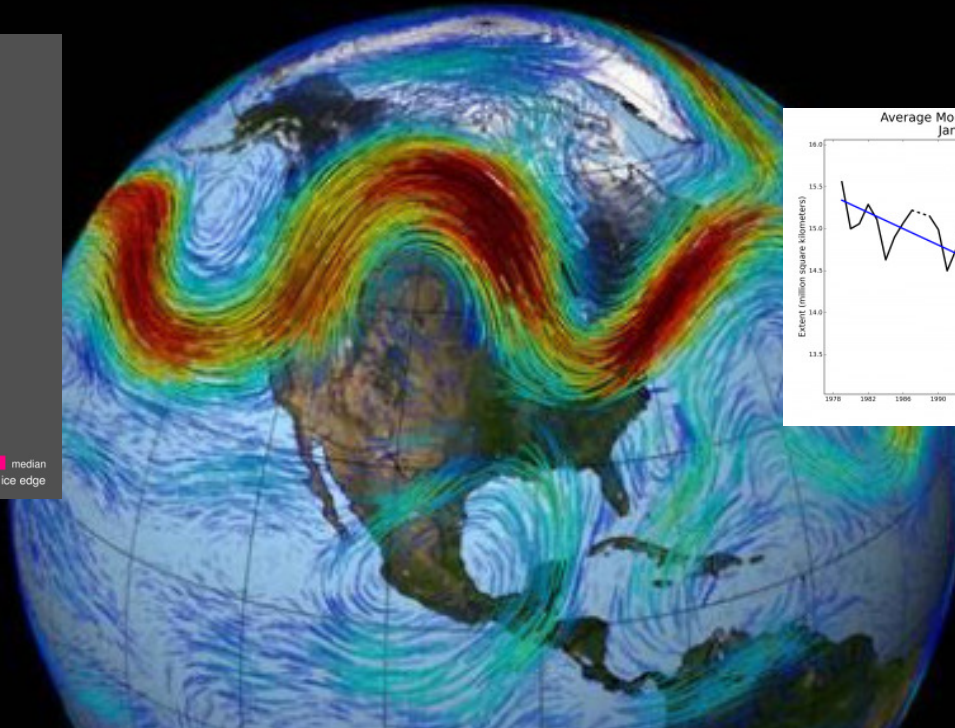
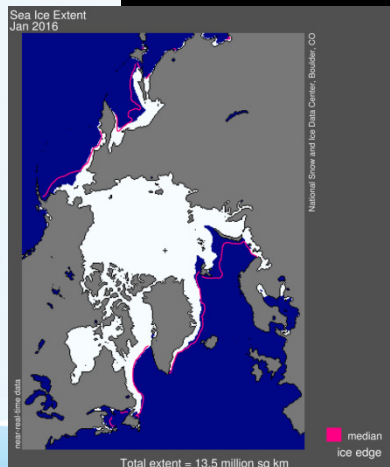


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What we know scientifically: The loss of Arctic sea ice appears to be causing the jet stream to meander.



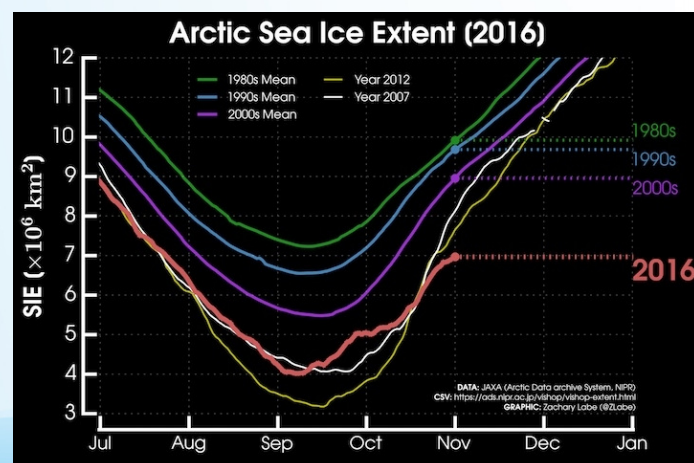


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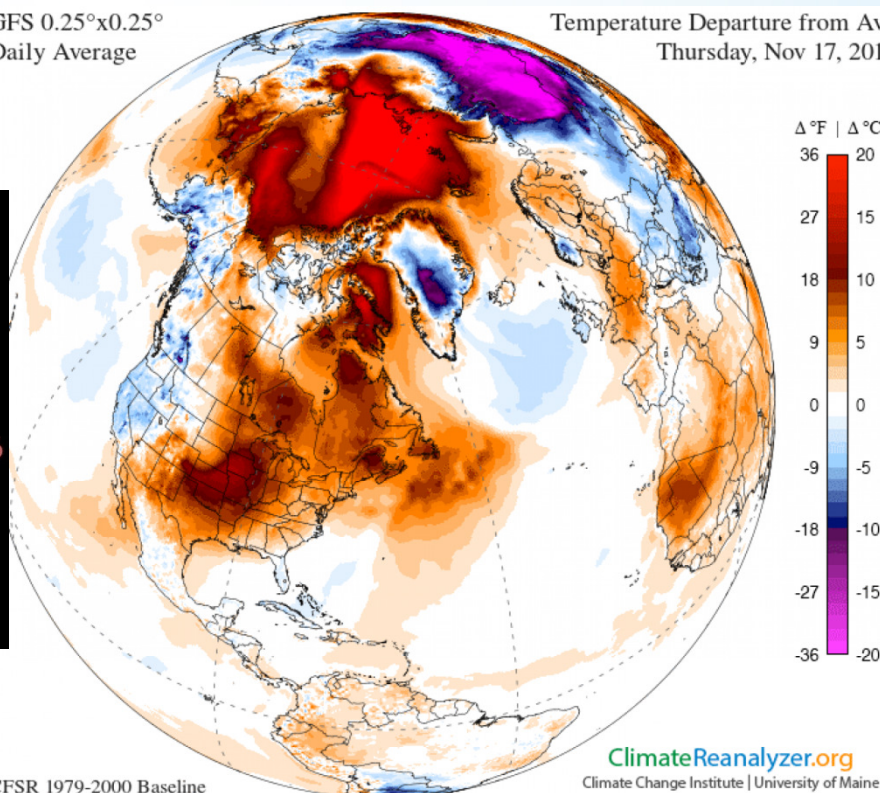
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Follow the Water: *Arctic sea ice extent in 2016.*



GFS 0.25°x0.25°
Daily Average

Temperature Departure from Avg
Thursday, Nov 17, 2016



World
+ 0.55 °C

Northern Hemisphere
+ 0.94 °C

Arctic
+ 6.42 °C

Tropics
+ 0.31 °C

Southern Hemisphere
+ 0.15 °C

Antarctic
+ 0.92 °C

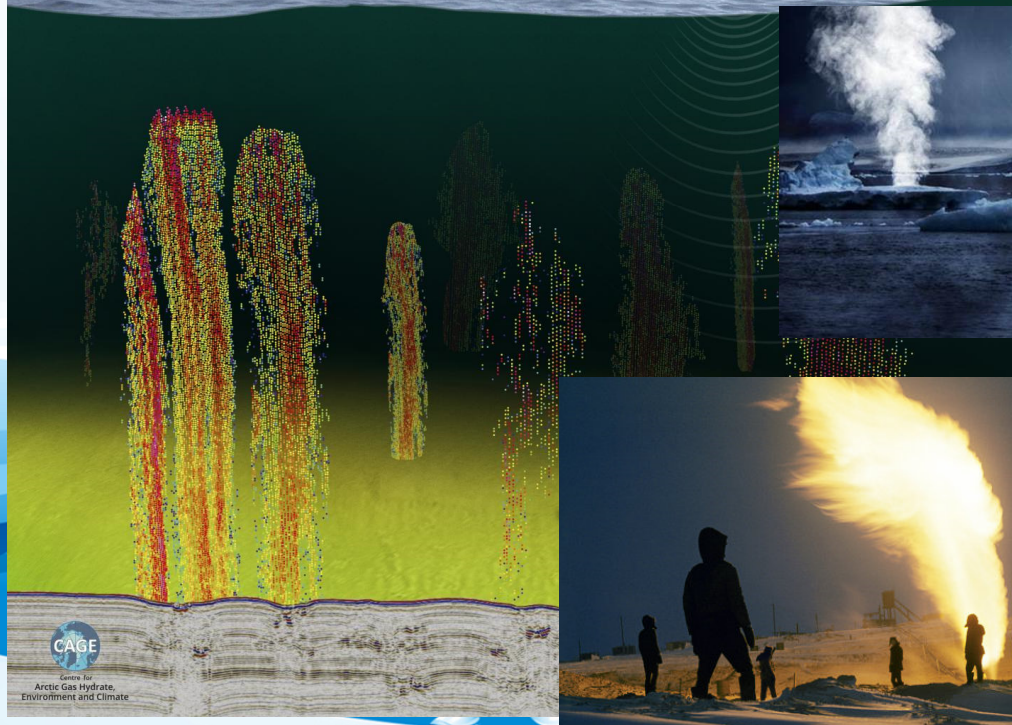
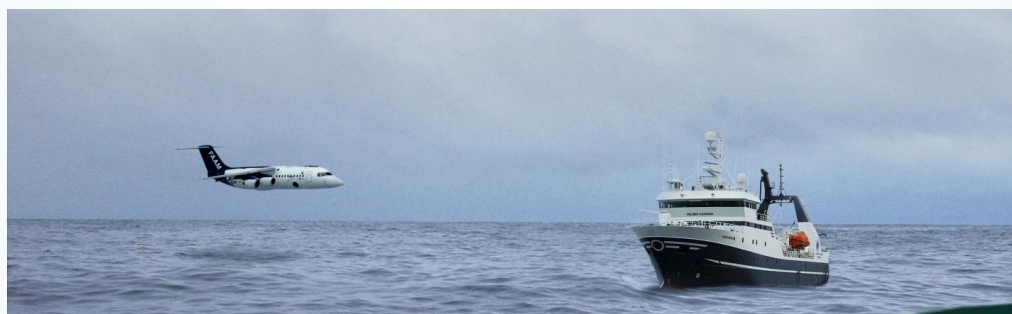


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Arctic Methane Plumes



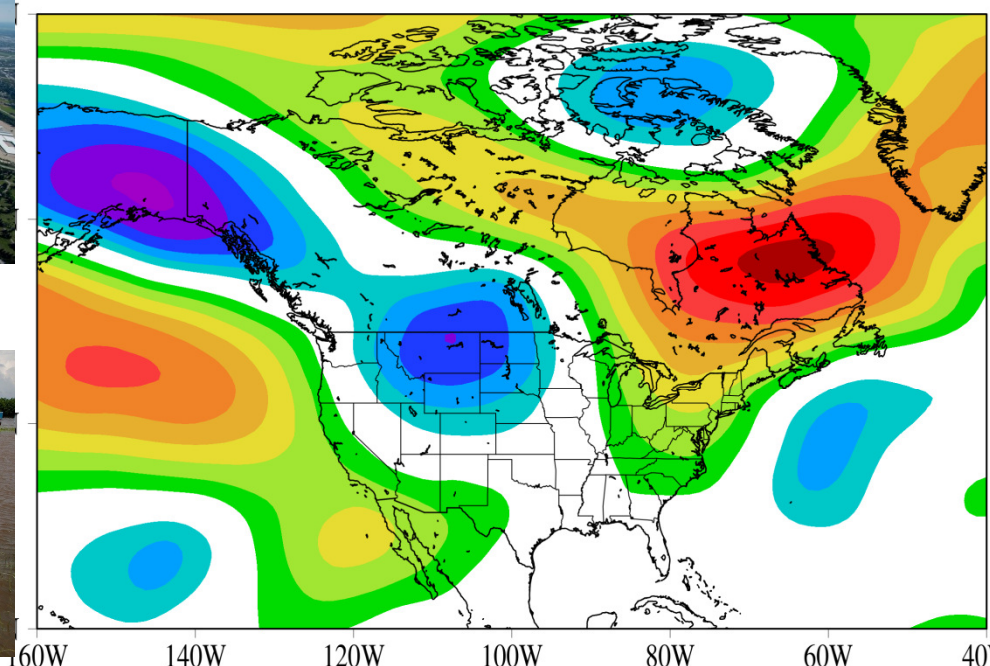


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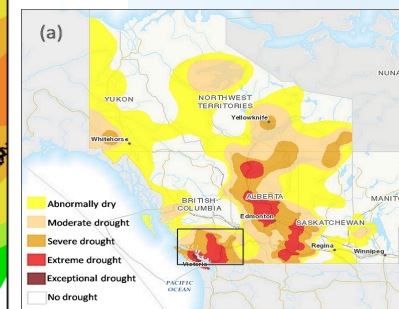
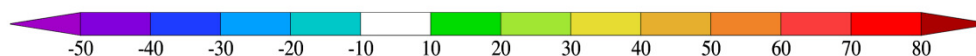
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Arctic Sea Ice Loss: Possible new climate links



June 2014 500mb Geopotential Height Anomaly (m)
(1980-2010 climatology)





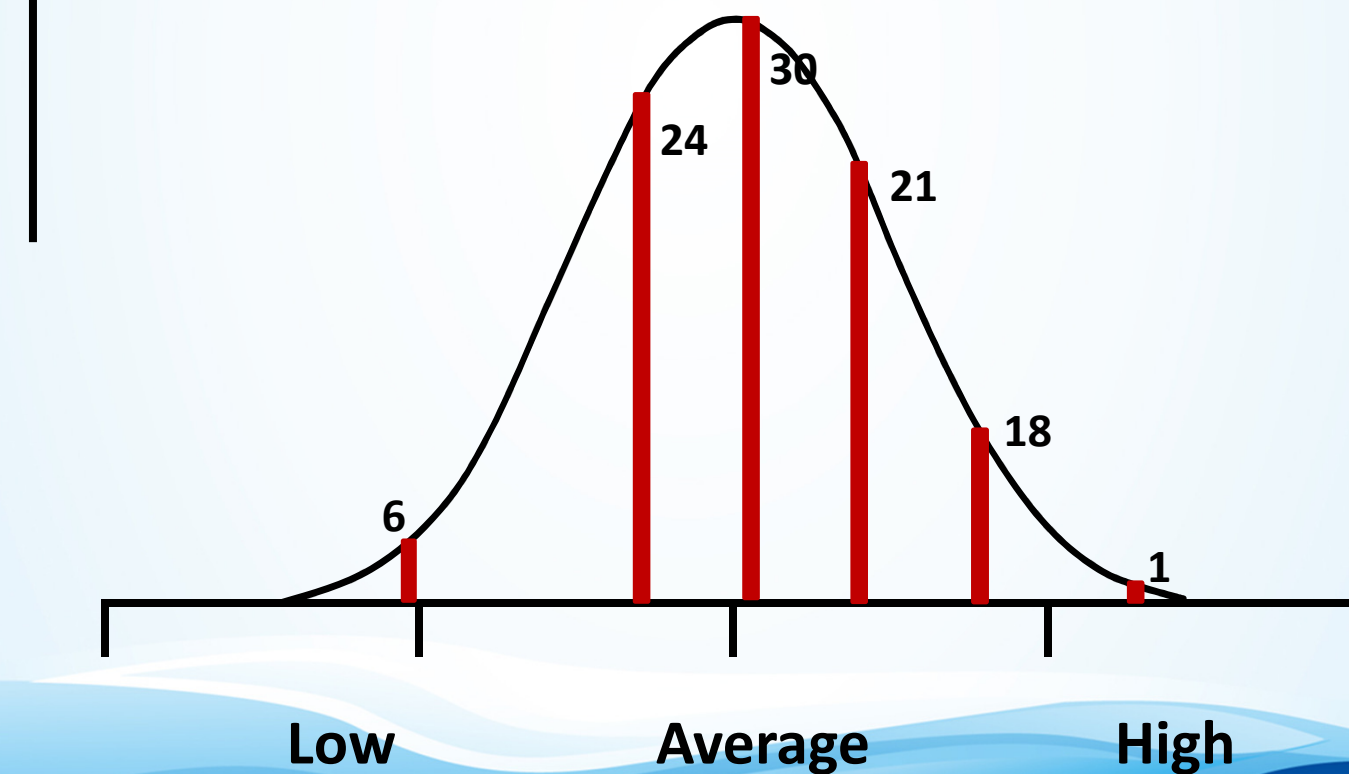
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Probability of
occurrence

The Bell Curve



CRC

Probability of
occurrence

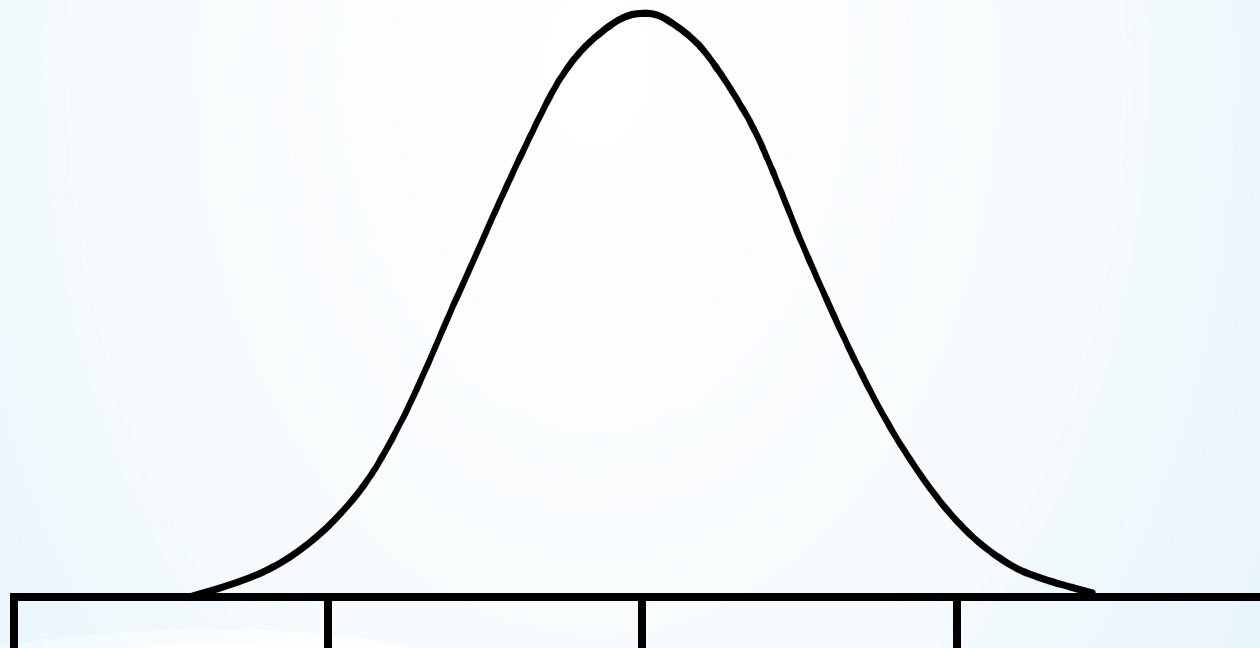
Mean Annual Temperature



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Cold

Average

Hot

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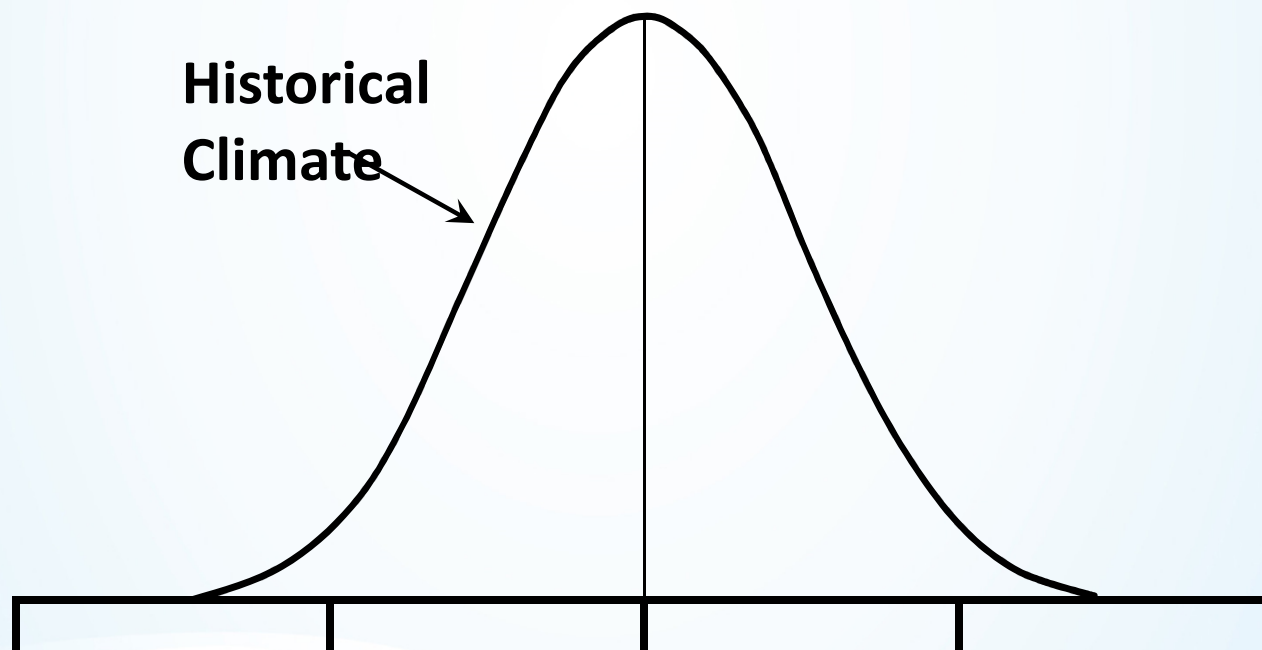
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Probability of
occurrence

Increase in Mean Annual Temperature



Historical
Climate



Cold

Average

Hot

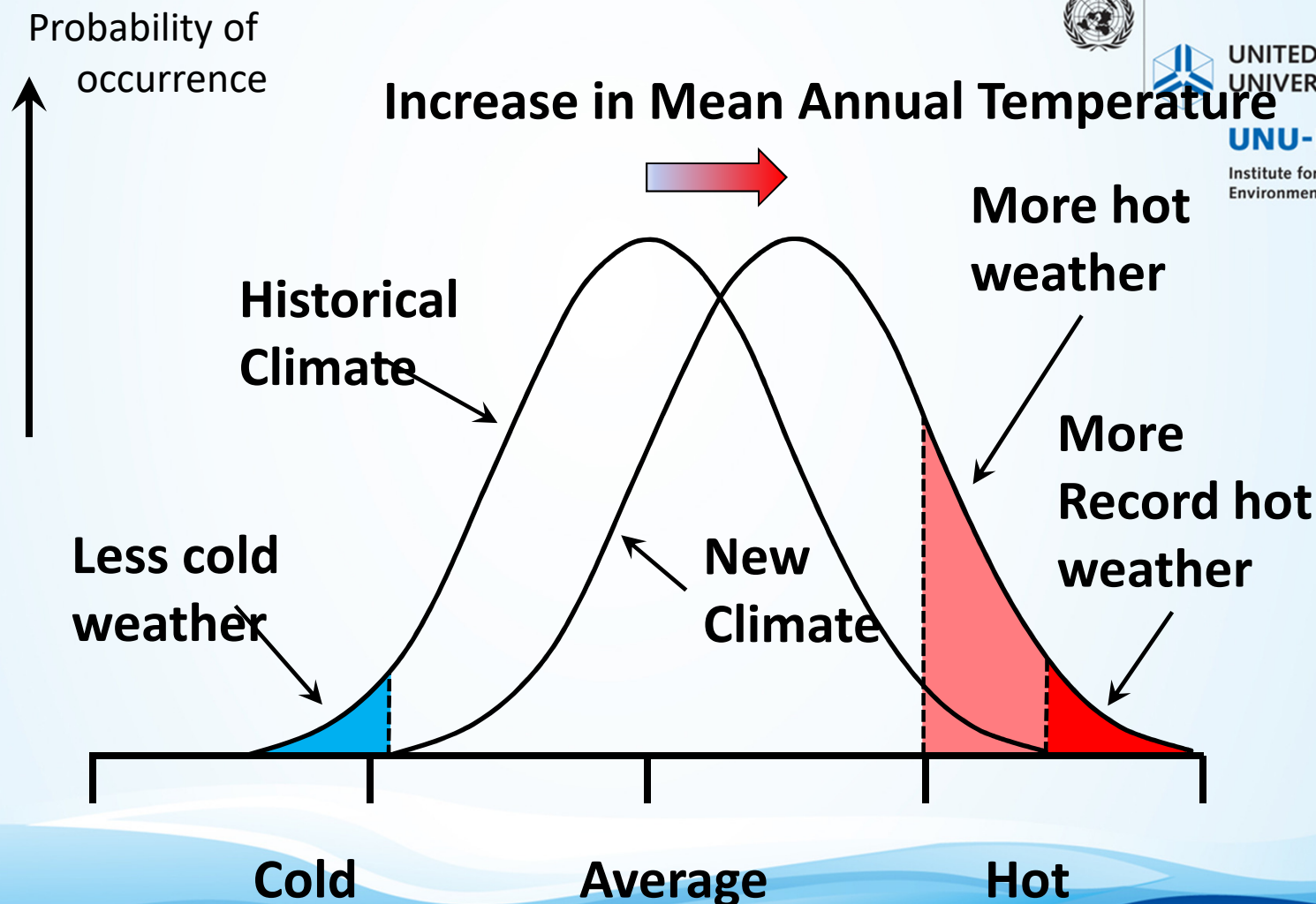
CRC



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CRC

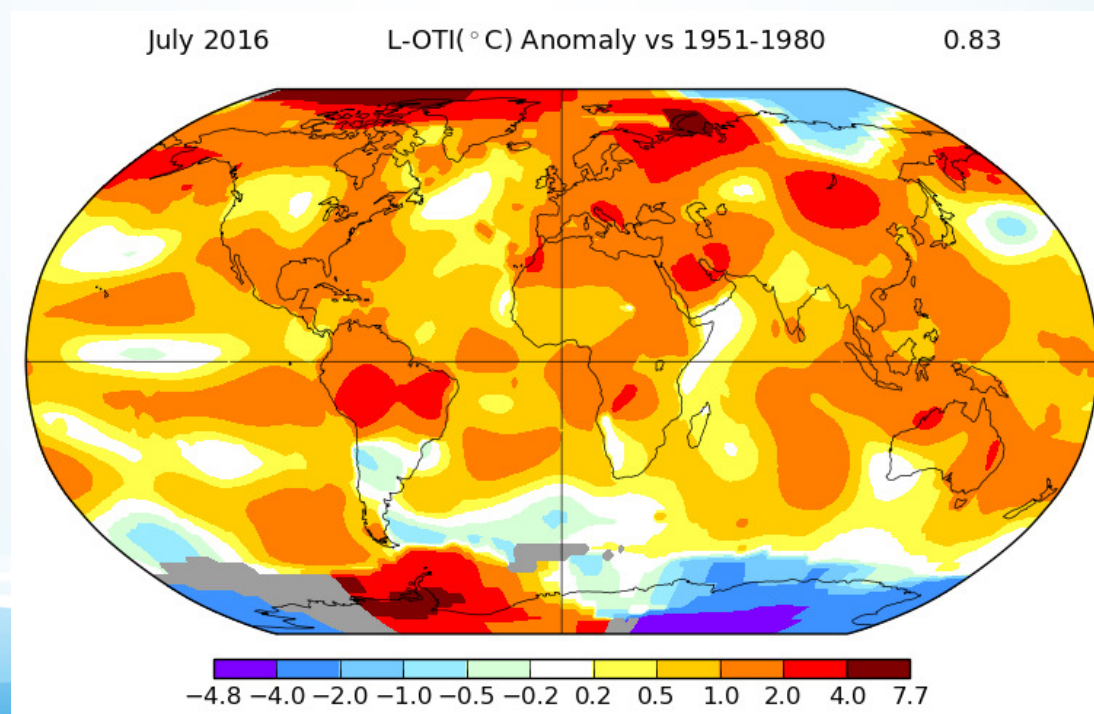


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Global Temperatures, July, 2016





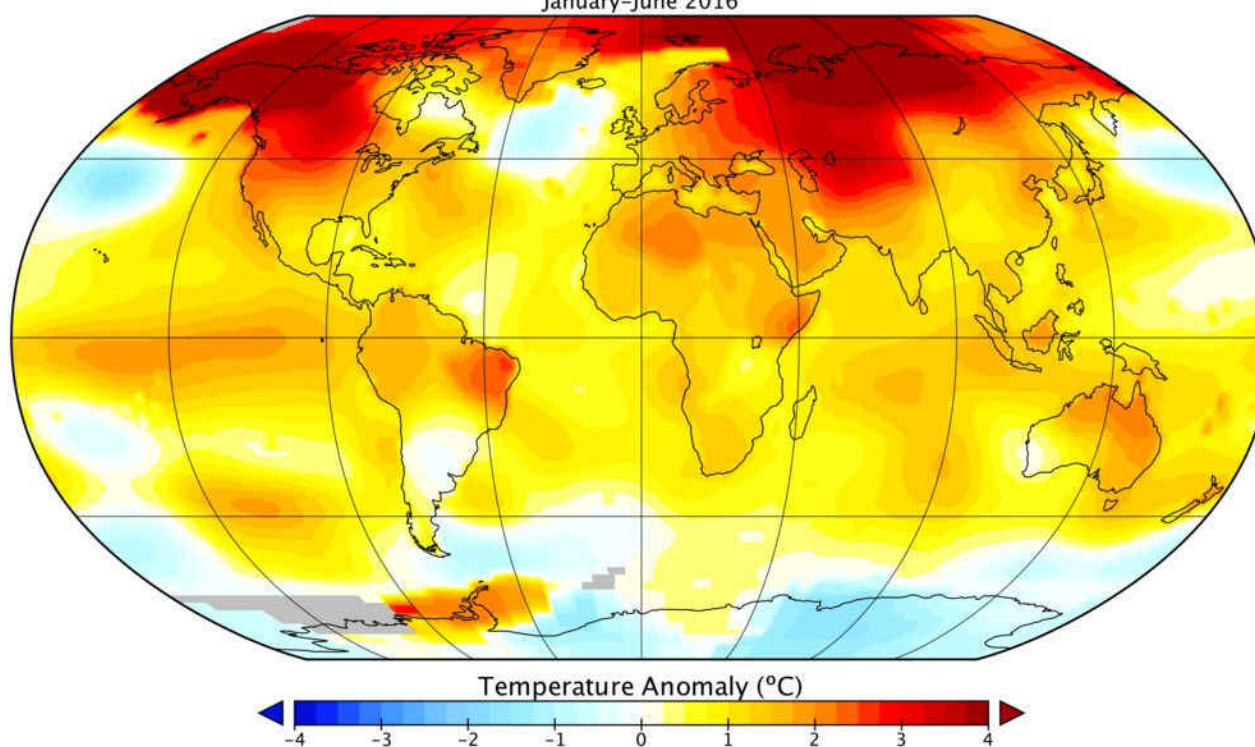
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Global Temperatures, Jan – June, 2016

Global Mean Surface Temperature(GISS)
January-June 2016





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Mobilizing Action for Impact: Follow the Water





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