Reduced Caribbean Hurricane Activity during the Maunder Solar Minimum

Valerie Trouet

Sun Climate Symposium
29 January 2020
A.E. Douglass (1867-1962)
Founder of Modern Dendrochronology
&
Laboratory of Tree-Ring Research (1937)
Tree-ring data are available on time-scales that are linked to human history (~2K years)
Tree-ring data allow us to study natural climate variability on time-scales that are relevant to policy and to human history (~2K years)
NH temperature over the past 2,000 years

Medieval Warm Period (~900-1300)

Late Antique Little Ice Age (~500-700)

Little Ice Age (~1500-1850)

IPCC 2013
During the **Little Ice Age**, average temperatures were up to 0.7°C **colder** than “today”.

Little Ice Age (~1500-1850)

Frank et al. (2010) *Nature*
In particular during the Maunder solar Minimum (1645-1715 CE)

Louis XIV “The Sun King” of France (1643-1715 CE)
TREE STORY
The History of the World Written in Rings  Valerie Trouet

Johns Hopkins University Press
April 2020
Tree-ring based reconstruction of extreme events

- Human Societies
- Forest Ecosystems
- Climate Change
- Extreme events
- Atmospheric Circulation Patterns
- Climate Reconstruction
- Carbon Cycle & disturbance
21st century model simulations generally agree that globally:
Higher Tropical Cyclone intensity and lower frequency*

*but large uncertainties exist
“We find that for North Atlantic Tropical Cyclone frequency … the largest uncertainties are driven by the chaotic nature of the climate system and by the climate response to radiative forcing*”

*e.g. CO$_2$, the sun

Villarini and Vecchi (2012) Nature Climate Change
Can we use paleoclimate records to reconstruct Caribbean hurricanes back to the Maunder Minimum?
First Spanish West Indies voyage in 1492
Tropical storms were the primary cause of shipwrecks in the 16th through 18th centuries.
Can Spanish shipwreck rates be used as a proxy for Caribbean hurricane activity?
# Spanish shipwrecks/year (1495-1825 CE)

Trouet et al. (2016) PNAS
DATA

- instrumental
- tree rings
- shipwrecks
Tree-ring sample collection on Big Pine Key
Slash pines on Florida Keys show suppressed growth in years following storms

Trouet et al. (2016) PNAS
% suppressed trees per year on Florida Keys (1707-2009 CE)
Tropical storms result in tree growth suppression in year of storm + year after
High shipwreck years result in tree growth suppression (t0 and t+1)
Decadal-scale variability
Reconstruction of Caribbean tropical cyclones (1495-2010)
We find **75% less** Caribbean tropical cyclones during the Maunder Minimum.
Less Caribbean tropical cyclones during Maunder Minimum linked to lower sea surface temperatures

Trouet et al. (2016) PNAS
Our results can help improve models of future tropical cyclone activity by serving as a benchmark and thus reducing their uncertainty.
"Golden Age of Piracy"
1650-1680 CE
Thank you

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BLACKBEARD'S SHIP,
THE QUEEN ANNE'S REVENGE
The History of the World Written in Rings  Valerie Trouet

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April 2020
SHIPWRECKS IN THE AMERICAS

A complete guide to every major shipwreck in the Western Hemisphere.

ROBERT F. MARX
Environmentally stressful year

Environmentally beneficial years

Environmentally stressful year
Sea level rise will increase storm surge
Increasing population in coastal communities