

Interactive comment on “The historic reality of the cyclonic variability in French Antilles, 1635–2007” by E. Garnier et al.

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Received and published: 30 May 2015

I recently read “The historic reality of the cyclonic variability in French Antilles, 1635–2007” by E. Garnier, J. Desarthe and D. Moncoulon (hereafter Garnier et al) published in *Climates of the Past*. The abstract describes the construction of a new chronology of hurricanes, and their estimated intensity, in the French Lesser Antilles from French language source documents not previously used by other researchers. The authors search for, and use of, the original sources is commendable and is welcome. Such reports are important to find and track possible new historical hurricanes and to include additional details to better characterize the type of damage done by hurricanes already known to exist. In the literature cited in Garnier et al there was relatively few French language sources used. This was an excellent spur to their interest in growing our

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knowledge of historical hurricanes in the French Lesser Antilles from these previously little used sources.

The authors are probably correct that language issues and source availability account for the apparent neglect of French language reporting of historical hurricanes. I say apparent because there are actually many French reports, or reports from foreigners in French ports, that were used in Chenoweth (2006) and Chenoweth and Divine (2008, 2012). The “localities” that are referenced in Table IV in Chenoweth (2006) are of necessity only shorthand for the full range of islands that were affected by the storms listed. French newspapers are often cited in English language newspapers, sometimes even in the original French (e.g. The Dominican Chronicle of 10 August 1825, published in Roseau, Dominica, printed the Guadeloupe Gazette’s French language account of the July hurricane in Guadeloupe). There is no shortage of reporting from the French islands in non-French sources so the existence of the storms is known from these abundant records. Likewise, all available data are brought to use in evaluating the long time-series of tropical cyclones (both hurricanes and tropical storms) for the Lesser Antilles (Chenoweth and Divine, 2008, 2012).

When comparing our records there is an issue with the definition. On page 1522 of Garnier et al (2015) in section 1 they state that “. . .we are studying only the events having struck these islands directly. . .” by which I take it that they mean that hurricane force winds were felt on at least some part of the islands. In the modern scientific usage from the U.S. National Hurricane Center (see <http://www.nhc.noaa.gov/aboutgloss.shtml>), a “direct hit” is defined as occurring when the hurricane passes to within a distance equal to the cyclone’s radius of maximum wind. Such information is usually not calculable from historical data. So they should re-word to state that their reports are from reports of hurricane force winds on a portion of a given island but this does not indicate that the eye and accompanying eyewall of the hurricane passed over land in every instance.

There are hurricanes included in their Table A1 that did not make a landfall on any of the islands although hurricane force winds were apparently felt in at least some

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portion of the islands. The author's should point out that their intensity estimates from land-based damage reports may not reflect the true intensity of the storm at the time it passed through the islands since the strongest winds may not have crossed over the French islands.

In the very same sentence I partially cite above the authors say "...we are studying only the events having struck these islands directly because they have been perfectly documented in the archives for more than 300 years".

The assumption that the extensive French archives are complete in capturing all hurricanes must be questioned. While there is good reason to expect that reports of some sort would be written about damages done by hurricanes on the islands, the likelihood that such records have survived completely intact in the archives cited by the authors is questionable. Written letters had to be shipped across the Atlantic and correspondence could be lost by accident, fire, theft, destruction or seizure in war, or by the loss of ships in storms at sea. Even if they reach land they are subject to loss or theft or destruction. In the archives, the written records can be lost, stolen, mis-filed, be eaten by vermin or insects, or dispersed in periods of social unrest. For such reasons, multiple archives and multiple sources need to be used. However, the number of source records containing this information is even larger than those used by the authors. They have not used other available records and have an incomplete record. How do I know their record of hurricanes creating an impact in the French Lesser Antilles is incomplete? I know this because multiple-language source records document the existence of these storms, including those included in the French National Archives that are posted on-line (<http://anom.archivesnationales.culture.gouv.fr/ark:/61561/ka455hct>).

Garnier et al provide the hurricanes they have found from their manuscript sources cited on page 1535 and listed in their Table A1 (pp. 1539-1545). They have no hurricanes listed for the years 1714 although a hurricane is reported (FR ANOM COL B 36, fo 524 v and ANOM COL B 36, fo 557). In addition, Millas (1968) cites a letter from Governor Moyencourt to the Minister of the Navy written on 1 December 1714 which

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dates the hurricane to 13-14 August; see also Pritchard (2004).

In 1738, on August 29, Guadeloupe was devastated by a hurricane (FR ANOM COL C8A49, fo. 70; FR ANOM COL C8A49 fo. 75; FR ANOM COL C8A49 fo. 132; FR ANOM C7A13 fo. 146, 147, 149, 167 and 173). Another hurricane in July 1769 is documented having struck southern portions of Guadeloupe (FR ANOM C7A30 fo. 45 dated 28 July 1769 and FR ANOM C7A31 fo. 4 dated 28 January 1770).

In 1772, one of the great hurricanes on record for St. Martin and St. Barthelemy is not included in the author's list. These documents (St. Barthelemy C8A 71 52 and C8A 71 55) document the destruction and available online at <http://www.memoirestbarth.com/st-barts/colonisation/archives-premiere-colonise>.

I have other storms in the French Lesser Antilles in 1784, 1785, 1792, 1793 and 1804 which are either listed in the French National Archives online or in English language sources.

If the authors or their assistants have not consulted the online version of the documents, or the originals in the archive itself, then we can be certain that they have not made use of sufficient French sources to produce a comprehensive and complete time series.

I will also comment that their Table A1 lists a number of hurricanes that affected the French Lesser Antilles. One column provides years of such storms taken from Chenoweth (2006). My final list of storms, Table IV of Chenoweth (2006) does not have any such storms affecting the French Lesser Antilles in 1705, 1716, 1720, 1722, 1736, 1743, 1744, 1759, 1760, 1761, 1762, 1763, 1764, 1769, 1771, 1774, 1777, 1782, 1783, 1791, 1794, 1796, 1797, 1802, 1808, 1811, 1812, 1823, 1836, 1845, 1849, 1851. None of these storms are near the Lesser Antilles. There are other years that are included such as 1773 where the hurricane which passed from Tobago westward to the islands on the north coast of Venezuela is included without any reasoning as to why Martinique (the closest of the French Lesser Antilles)

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would have been affected by hurricane force winds (it was not). This is a complete mis-reading of the table of Chenoweth (2006). Even with their own series of records, they fail to cite the hurricane damage done by Hurricane Lenny in St. Martin (see http://www.aoml.noaa.gov/hrd/hurdat/International_Hurricanes_2014_feb14.html) and include 1997's Hurricane Erika which is not indicated as having produced hurricane force winds in any of the islands of the Lesser Antilles (Rappaport 1999); see also: http://www.aoml.noaa.gov/hrd/hurdat/International_Hurricanes_2014_feb14.html). Therefore, a reader can have no confidence in the accuracy, completeness or coherency of the hurricanes listed in Table A1.

Hurricane Intensity

The author's cite work from Boose (2004) and Chenoweth and Divine (2012) to comment about the use of the Fujita Scale to estimate wind speed from damage to natural and manmade structures. In fact, both of these cited papers use a modified version of the Fujita Scale (see Boose et al 2001) and Chenoweth (2007)). Garnier et al cite their reason not to use the Fujita Scale in their hurricane reconstruction being due to the original Fujita scale was designed to measure the intensity of tornados. They consider it inappropriate to apply this to hurricanes because of the space and time scale differences in the two phenomena. This was not how Dr. Fujita saw it. The seminal paper that he wrote on the topic is entitled "Proposed characterization of tornadoes and hurricanes by area and intensity" (see https://archive.org/stream/nasa_techdoc_19720008829/19720008829_djvu.txt).

Having made their choice to forego a version of the Fujita Scale they instead use the Saffir-Simpson Wind Scale and adapt to their own Historical Hurricane Wind Scale. They then state that additional parameters are used in later years, such as storm surges and indicate that its application may be different after the 1880s due to changes in source types and content. Other than a reference to a brief 1672 description of a hurricane at Martinique (more completely translated in Saffache et al (2002)) they do not provide a sufficient range of examples to show how they fit the historical de-

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scriptors into their wind scale. It is also remarkable that their scale fits exactly with the modern definition of hurricane intensity categories 1 through 5. There is always uncertainty in such data categorization and there is no hint of how often this may have occurred since they did not test their methods on an independent set of data. In this instance, they would learn much from reading Boose et al (2001) – available at http://isites.harvard.edu/fs/docs/icb.topic281447.files/Hurricanes_NE.pdf - and Boose et al (2004) on their construction of a modified Fujita Scale.

The authors characterize the Martinique hurricane of 1891 as a Category 5 major hurricane. The eye of the hurricane passed over Fort-de-France and a minimum pressure of 710mm (946.5 millibars) was recorded. This equates to a maximum wind speed of about 113 knots, rounded up to 115 knots, based on the wind-pressure relationship from Landsea et al (2004). Due to the apparent small diameter of the storm an additional five knots is added giving an estimated maximum intensity of 120 knots (~221km h⁻¹) which is a low end Category 4 hurricane. Likewise, in the 1865 hurricane which the authors have as a category 5 hurricane, the central pressure in the eye of the storm was 717.3mm (956 millibars) which gives an estimated maximum wind speed of 115 knots (~213 km h⁻¹) which just puts the storm at the bottom end of Category 4 intensity. The other Category 5 hurricane they claim for the 19th century is the 1825 hurricane at Guadeloupe. In this instance, we do not have a pressure reading in the eye of the hurricane but only a peripheral pressure reading consistent with a wind speed of about 95 knots. Damage reports are consistent with those of the 1865 and 1891 hurricane so we can assume only a low end category 4 intensity in this instance as well.

The failure to characterize the uncertainty in their wind speed estimates, and the above examples of the strongest hurricanes of the 19th century, casts considerable doubt as to the accuracy of their wind speed reconstructions. It would appear that there is a significant over-estimation in the wind speeds, and therefore the assigned category of intensity for the storms. A more rigorous methodology is needed before the results of their study can be considered reliable.

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