HISTORICAL STORM TRENDS IN FRANCE

Are they linked to global warming or are they part of natural climate variability?

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With respect to extreme weather events, Dezileau *et al*. (2011)[1] write that the major question of the day is: "are they linked to global warming or are they part of natural climate variability?" And in regard to the *significance* of this question, they say "it is essential to place such events in a broader context of time, and trace the history of climate changes over several centuries," because "these extreme events are inherently rare and therefore difficult to observe in the period of a human life." Only then, can claims of increased extreme weather events resulting from CO_2-induced global warming be properly evaluated, and several researchers have done just that. The present review examines what they have found with respect to the frequency and/or severity of storms located in and around modern-day France.

The two periods of most frequent super-storm strikes in the Aigues-Mortes Gulf (AD 455 and 1700-1900) coincide with two of the coldest periods in Europe during the late Holocene. The risk of such storms occurring during that cold period was higher than today by a factor of 10.

Continuing the work of Dezileau *et al*., the nine researchers who conducted the study, all of whom were from France, analyzed regional historical archives and sediment cores they extracted from two Gulf of Aigues-Mortes lagoons in the northwestern part of the occidental Mediterranean Sea for bio- and geo-indicators of past storm activities there, specifically assessing "the frequency and intensity of [extreme] events during the last 1500 years," as well as "links between past climatic conditions and storm activities." Accordingly, the analysis showed evidence of four "catastrophic storms of category 3 intensity or more," which occurred at approximately AD 455, 1742, 1848 and 1893. And "taking into account text description of the 1742 storm," they conclude that it was "of category more than 4 in intensity," and that all four of the storms "can be called superstorms." In addition, Dezileau *et al*. make a point of noting that "the apparent increase in intense storms around 250 years ago lasts to about AD 1900," whereupon "intense meteorological activity seems to return to a quiescent interval after (i.e. during the 20th century AD)." And they add that, "interestingly, the two periods of most frequent superstorm strikes in the Aigues-Mortes Gulf (AD 455 and 1700-1900) coincide with two of the coldest periods in Europe during the late Holocene (Bond cycle 1 and the latter half of the Little Ice Age.)" As a result, the authors suggest that "extreme storm events are associated with a large

[1] http://www.co2science.org/articles/V14/N16/C3.php.

cooling of Europe," and they calculate that the risk of such storms occurring during that cold period "was higher than today by a factor of 10," noting that "if this regime came back today, the implications would be dramatic."

In another proxy-based study of the late-Holocene, Clarke *et al*. (2002)[2] used an infra-red stimulated luminescence technique to date sands from dunes in the Aquitaine region of southwest France, finding that dune formation was generally most common during cooler climatic intervals. In the most recent of these cold periods, the authors note there is voluminous historical evidence of many severe North Atlantic wind storms in which the southward spread of sea ice and polar water during that time likely created "an increased thermal gradient between 50°N and 65°N which intensified storm activity in the North Atlantic ... which may well have mobilized sand inland from the coast." In addition, they note that sand-drift episodes across Europe "show synchroneity with sand invasion in the Aquitaine region of southwest France, implying a regional response to increased storminess." Hence, the long view of history suggests that the global warming of the past century or so has actually led to an overall *decrease* in North Atlantic storminess.

Working with historical accounts, as well as "sedimentology, granulometry and faunistic data," which they obtained from two cores of the Pierre Blanche lagoon just south of Montpellier, France, Sabatier *et al*. (2008)[3] found evidence in the form of "washover events" that allowed them "to identify the strongest storms in the Mediterranean area" over the past four centuries. The results, in the words of the eight researchers, "provided evidence of three main storms," which they identified as occurring in 1742, 1839 and 1893, *all of which were deemed to have been much stronger than any of the 20th century*. In fact, a storm that occurred in 1982, which they describe as having been "the most recent catastrophic event," was not even "registered" in the lagoon sediment cores. Such a *decline* in the occurrence of "superstorms" in the Mediterranean area -- *if not their total disappearance* -- is a significant observation running counter to the climate-alarmist claim that global warming both *intensifies* storms and *brings more of them*.

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Writing as background for their work, Sorrel *et al*. (2009)[4] say studies indicate that "estuarine systems are particularly sensitive to changing hydrological conditions," and that one of the major purposes of examining them has been to determine "the effects of past centennial- to

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2 http://www.co2science.org/articles/V5/N25/C1.php.

3 http://www.co2science.org/articles/V11/N34/C2.php.

4 http://www.co2science.org/articles/V12/N23/C2.php.

millennial-scale natural climatic fluctuations" in order to "better predict the impact of present-day and forthcoming climatic changes (and/or anthropogenic activities) on estuary infill." Of "crucial impact" in this regard, in their estimation, "is the impact of storminess within warmer and colder periods on sedimentary patterns through the climatic regulation of (i) coastal wave hydrodynamics and (ii) continental inputs from the Seine river catchment area [in the case of their specific study] during the late Holocene." Against this backdrop, Sorrel *et al*. linked high-resolution sediment and rock properties of materials found in cores collected from the Seine estuary in northwest France to climatic conditions of the past few thousand years. So what did their work reveal?

The five French researchers found that "increased removal and transport of estuarine sediments occurred when winter storm activity greatly intensified over northwestern France," and they report on "four prominent centennial-scale periods of stronger storminess, occurring with a pacing of ~1500 years," which they say are "likely to be related to the last four [of] Bond's [1997, 2001] Holocene cold events," the most recent of which was the Little Ice Age, when Sorrel *et al*. say that tidal and open marine hydrodynamics exerted "primary control on the sedimentary evolution of the system during 1200-2003 AD." In contrast, they found that "the preservation of sedimentary successions in the outer Seine estuary was *maximal* [italics added] during ca. 800-1200 AD," which time period they identify as the Medieval Warm Period, when they say that "sediment reworking by waves was considerably reduced."

A similar approach to investigating historical storm records was conducted one year later by Sorrel *et al*. (2010)[5] for the macrotidal Bay of Vilaine (47°20'-47°35'N, 2°50'-2°30'W). Their results indicated that "the late Holocene component (i.e., the last 2000 years) is best recorded in the most internal sedimentary archives," where the authors found that "an increase in the contribution of riverine inputs occurred during the MWP [Medieval Warm Period]" at "times of strong fluvial influences in the estuary during ca. 880-1050 AD." They also report that "preservation of medieval estuarine flood deposits implies that sediment remobilization by swells considerably waned at that time, and thus that the influence of winter storminess was minimal," in accordance with the findings of Proctor *et al*. (2000) and Meeker and Mayewski (2002). Furthermore, they state that the preservation of fine-grained sediments during the Middle Ages has been reported in other coastal settings, citing the studies of Chaumillon *et al*. (2004) and Billeaud *et al*. (2005). In fact, they indicate that "all sedimentary records from the French and Spanish Atlantic coasts" suggest that "the MWP appears to correspond to a period of marked and recurrent increases in soil erosion with enhanced transport of suspended matter to the shelf as a result of a likely accelerated human land-use development," adding that "milder climatic conditions during ca. 880-1050 AD may have favored the preservation of estuarine flood deposits in estuarine sediments through a waning of winter storminess, and, thus, reduced coastal hydrodynamics at subtidal depths."

Sorrell *et al*. (2010) also note that the upper successions of the sediment cores "mark the return to more energetic conditions in the Bay of Vilaine, with coarse sands and shelly sediments sealing the medieval clay intervals," while observing that "this shift most probably documents the transition from the MWP to the Little Ice Age," which led to the "increased storminess both

[5] http://www.co2science.org/articles/V13/N45/C3.php.

in the marine and continental ecosystems (Lamb, 1979; Clarke and Rendell, 2009)" that was associated with "the formation of dune systems over a great variety of coastal environments in northern Europe: Denmark (Aagaard *et al*., 2007; Clemmensen *et al*., 2007, 2009; Matthews and Briffa, 2005), France (Meurisse *et al*., 2005), Netherlands (Jelgersma *et al*., 1995) and Scotland (Dawson *et al*., 2004)." And in what they call an even "wider perspective," they note that the Medieval Warm Period "is recognized as the warmest period of the last two millennia (Mayewski *et al*., 2004; Moberg *et al*., 2005)."

The French scientists ultimately concluded their study by stating that "the preservation of medieval estuarine flood deposits implies that sediment reworking by marine dynamics was considerably reduced between 880 and 1050 AD," implying that during that considerably warmer period than most (if not all) of what followed it, "climatic conditions were probably mild enough to prevent coastal erosion in northwestern France."

There appears to have been no significant increase in either the frequency or intensity of stormy weather in the European region around France as the Earth recovered from the global chill of the Little Ice Age. In fact, most studies suggest just the opposite.

In one final study, Pirazzoli (2000)[6] analyzed tide-gauge, wind and atmospheric pressure data over the period 1951-1997 for the northern portion of the Atlantic coast of France. This work indicated that the number of atmospheric depressions (storms) and strong surge winds for this region, in the words of the author, "are becoming less frequent" and that "ongoing trends of climate variability show a decrease in the frequency and hence the gravity of coastal flooding" over the period of study. Such findings, to once again quote the author, should be "reassuring," especially for those concerned about coastal flooding.

In conclusion, as the studies above attest, there appears to have been no significant increase in either the frequency or intensity of stormy weather in the European region around France as the Earth recovered from the global chill of the Little Ice Age. In fact, most studies suggest just the *opposite*. These observations - coupled with the fact that storminess in most other parts of the planet *also* decreased over this period (see the other regions of the Earth treated under Storms[7] in our Subject Index) - suggest there is no real-world/data-driven reason to believe that storms would necessarily get any worse or become more frequent if the Earth were to warm somewhat more in the future.

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[6] http://www.co2science.org/articles/V4/N13/C3.php.
[7] http://www.co2science.org/subject/s/subject_s.php.

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