SEVERE COASTAL STORMS AND CLIMATE CHANGE IN THE UNITED KINGDOM

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(Dated: April 30, 2007)

I. INTRODUCTION

In recent years, there has been a concerted effort to establish definitive links between large-scale meteorological events and the short-term evolution of coasts (Stone *et al*., 1997; Muller and Stone, 2001; Ranasinghe *et al*., 2004; Stone *et al*., 2004; Pepper and Stone, 2004 and Alexander *et al*., 2005). Although wind speeds in coastal storms are less than the most severe tornadoes for example, the scale and duration of these events are much larger, which are compounded by the generation of damaging waves that propagate far beyond the region of wind stress (Keim *et al*., 2004).

European storminess has been studied over various timescale and numerous data types (e.g. Beersma *et al*., 1997; Schmith *et al*., 1998; Hulme and Jenkins, 1998; Jones *et al*., 1999; Kerr, 2000; Otte, 2000; McCabe *et al*., 2001; Siegismund and Schrum, 2001; Andrade *et al*., 2004; Lozano *et al*., 2004; Pirazzoli *et al*., 2004). However, there are still significant gaps in our knowledge with regard to the frequency and intensity of these extreme events at a regional level, along with future uncertainties associated with climate change. Few attempts have been made to establish definitive links between coastal storms and their impacts along the Dorset coast, United Kingdom. No clear attempt at a thorough or holistic examination of coastal storms affecting Dorset has been performed until now.

II. PRESENTATION OF RESEARCH

Coastal storms affecting Dorset, United Kingdom, are investigated with the aid of a new metadata repository, The Dorset Coastal Storms Database. This customized database has been designed to facilitate extensive secondary data collection and provide a medium with which to analyze fundamental relationships between these data. The database presents the only county-based digital archive of coastal storm forcing and associated physical impacts (Figure 1).

FIG. 1: The Dorset Coastal Storms Database (1865-present).

A wide range of impacts, vulnerable coastal environments and specific coastal storms have been identified and analyzed for the period 1865 to present. A new intensity grading scale for coastal storm impacts has been developed in order to facilitate the identification of coastal storm types. The Coastal Impacts Intensity Scale (CIIS) provides guidance and classification on coastal storms producing physical impacts for a given range of forcing parameters and possible outcomes. Therefore, coastal storms producing physical impacts can be classified and ultimately allocated a numeric intensity value. A scale from 1-9 was developed to represent *Light Coastal Storms* (CIIS1) to *Super Coastal Storms* (CIIS9). Essentially, the CIIS is a refined grading scale based on theoretical wind speeds, storm duration, sea states, return periods and associated impacts.

III. RESULTS AND CONCLUSIONS

251 coastal storms producing physical coastal impacts have been identifed and analyzed between 1865 and 2004 inclusive. The main physical impacts relate to flooding, erosion, property and structure damage. Dorset's coastal storm season is identified as being between October and February.

Analysis of the CIIS highlighted that twelve of the fifteen most intense storms (CIIS 6/7) in the period 1865 to 2004 occurred post-1965. At present, an extreme coastal storm event for Dorset is one that rates CIIS7 in intensity. There have only been two occurrences of these in the last 140 years, on the 16th October 1987 and 3rd January 1998. Results showed that the number of coastal storms impacting Dorset have increased in intensity in more recent decades. A key turning point in coastal storm intensity was identified between 1935 and 1942. Prior to 1940 there were a greater number of less intense storms, with distinct periods of CIIS3 (1867-1894) and CIIS4 (1881-1901) events. The 'number' of events is partly explained by reporting, whereas the increase in storm 'intensity' suggests that stronger more damaging storms are affecting the coast in these years. Increased coastal storm intensity is closely linked to more recent changes in the local atmospheric pressure depth of these storms. The frequency of deeper pressure systems has increased over the last 140 years with local coastal storm systems ≤965 mb occurring for the first time in the series post-1985.

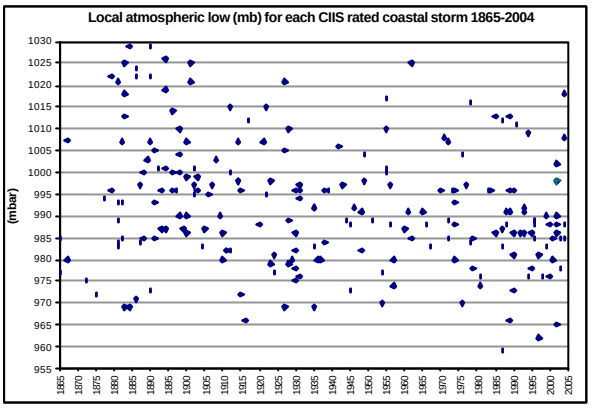

FIG. 2: Local atmospheric low (mb) for each CIIS rated coastal storm 1865-2004.

An annual average of 16 days with gale (1957-2000) along open and exposed coasts of Dorset has been established. In comparison to a Met Office (1952) calculation of 20 days (for the period 1918-1937), this indicates a decline in days with gale along the Dorset coast over the last 50 years, or indeed, a more accurate re-evaluation. Regional variability in the number of days with gale has also been identified with less than 5 days affecting inland locations. The highest number of days with gale for Dorset occurs in January.

IV. AKNOWLEDGMENTS

The authors would like to thank those data providers whom were helpful in the supply of information, data and support for this research, in particular; The British Atmospheric Data Centre, British Oceanographic Data Centre, Proudman Oceanographic Laboratory, The Environment Agency, Dorset County Council, The Met Office, Wetterzentrale, Germany and the National Centre for Atmospheric Research.

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