

# TROPICAL CYCLONE LOSSES IN THE USA AND THE IMPACT OF CLIMATE CHANGE – A TREND ANALYSIS BASED ON DATA FROM A NEW APPROACH TO ADJUSTING STORM LOSSES

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## I. INTRODUCTION

Economic losses caused by tropical cyclones have increased dramatically. Historical changes in losses are a result of meteorological factors (changes in the incidence of severe cyclones, whether due to natural climate variability or as a result of human activity) and socio-economic factors (increased prosperity and a greater tendency for people to settle in exposed areas).

This paper aims to isolate the socio-economic effects and ascertain the potential impact that climate change as a whole (due to natural and anthropogenic forcings) has on loss trends. The IPCC states that humans have, “more likely than not”, contributed to the trend towards intense tropical cyclone activity since the 1970s. Therefore, any increase in losses could, more likely than not, be partly related to anthropogenic climate change. Our initial approach was to adjust storm losses for various years to a comparable socio-economic level before subjecting them to a trend analysis.

## II. METHOD

Storm losses for the period 1950–2005 have been adjusted to the value of capital stock in 2005 so that any remaining trend cannot be ascribed to socio-economic developments. For this, we introduce a new approach to adjusting losses based on the change in capital stock at risk. Storm losses are mainly determined by the intensity of the storm and the material assets, such as property and infrastructure, located in the region affected. We therefore adjust the losses to exclude increases in the capital stock of the affected region.

## III. RESULTS AND CONCLUSIONS

We believe there is at least evidence to suggest that climatic change as a whole, due to both natural variability and anthropogenic forcings, does have an impact. For example, annual adjusted losses since the beginning of the last “cold phase” (1971) of the Atlantic Multidecadal Oscillation show a positive trend, with an average annual rise of 4% that cannot be explained by socio-economic components. This increase can at least be interpreted as a climate variability impact. There is no evidence yet of any trend in tropical cyclone losses that can be attributed directly to anthropogenic climate change. But we advance the premise that if losses are affected by natural climate fluctuations, they are also likely to be affected by additional global warming due to anthropogenic climate change.

This premise is supported by indications that the

intensity of tropical cyclones is affected by anthropogenic climate change. The destructive force of tropical cyclones has been increasing globally since the mid-1970s. This increase correlates very closely with the sea surface temperature (cf. Emanuel, 2005, Hoyos et al., 2006, Webster et al., 2005). According to Barnett et al. (2005) there is already a link between global warming and temperature increases in the uppermost levels of the ocean (see also Elsner, 2006, Mann and Emanuel, 2006). They looked at the past 40 years, in which they already found a very significant impact

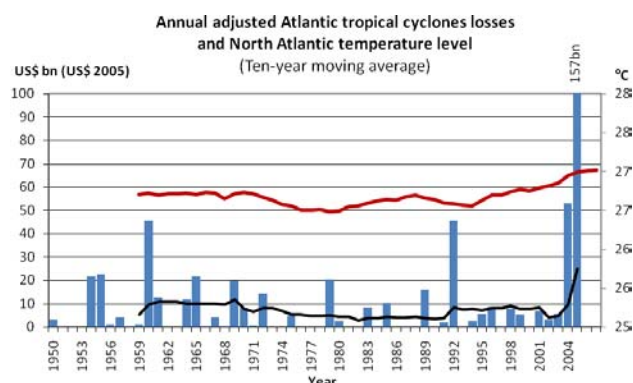


FIG. 1: Annual adjusted losses caused by Atlantic tropical cyclones that made landfall in the USA in US\$ billion (2005 values). The ten-year average broadly follows the cycle of natural climate fluctuations (AMO) (ten-year average of mean sea surface temperature) (source: Schmidt et al., 2009).

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