



WHAT'S HAPPENING TO THE WEATHER? CLIMATE CHANGE AND WEATHER EXTREMES

MORE WEATHER EXTREMES	OR	NATURAL VARIABILITY?
<p><i>"We would expect to see some sort of increase in rainfall in that area as a result of global warming"</i></p> <p>(Dr. Geoff Jenkins, Hadley Centre for Climate Prediction and Research, after heavy flooding in Central Europe. Quoted in Financial Times, 23/07/97)</p>		<p><i>"Every global weather blip, which in more reasoned times would be characterized as simple natural variability, will portend our climatic fate and be used to build the body of evidence for global action against industrialized nations".</i></p> <p>(World Climate Report, Vol.17 No.2, edited by climate sceptic Patrick Michaels)</p>

CLIMATE CHANGE AND WEATHER EXTREMES

Even the climate sceptics agree that our climate has changed over the last century. There is no disputing the fact that since the late 19th century the global mean surface temperature has increased by almost 0.7°C and that recent years have been among the warmest since 1860, when the global temperature record began [1]. Of course, climate variability is nothing new, as past ice ages and warmer periods demonstrate. However, current changes are taking place at an unprecedented rate.

The rising concentration of greenhouse gases in the atmosphere caused by fossil fuel burning is not only expected to result in global warming, but also in more frequent weather extremes such as droughts, floods or heat events. According to the Intergovernmental Panel on Climate Change (IPCC), 'small changes in the mean climate or climate variability can produce relatively large

changes in the frequency of extreme events' [2]. In recent years we have seen a large number of extreme weather events all over the world (heat waves, floods, droughts, storms etc). As one weather extreme follows the next, the question arises whether what we are seeing is simply natural variability or whether it constitutes evidence of human influence on the climate.

A number of climate models suggest that increases in the following types of weather extremes can be expected:

- extremely high temperature events;
- intense precipitation;
- long dry spells;
- frequency of hurricanes [2].

Furthermore, there is the possibility of unpleasant surprises, as the response of the climate system to radiative forcings could be non-linear, with quite irregular changes such as

fluctuations in the behaviour of ElNiño, one of the main drivers of climate variability.

Obviously, there are many uncertainties associated with climate modelling. But as weather extremes pose real risks to human life and economic well-being, the predictions should not be taken lightly. Cuts in greenhouse gas emissions to reduce such risks are needed urgently.

IS IT ALREADY HAPPENING?

Data and analyses on weather extremes are poor and not comprehensive, hence it is difficult to make definite assessments about the frequency of extreme weather events or climate variability on a global scale. However, according to the IPCC, on regional scales there is clear evidence of changes in some weather extremes and climate variability [2]. Some changes have been towards greater variability and frequency.

For the US, this has been confirmed by the US National Oceanic and Atmospheric Administration (NOAA), who reported that the number of 'extreme precipitation events' (blizzards and heavy rainstorms) in the US has increased by 20% since 1990 [3]. Heavier storm activity is likewise occurring in Australia and South Africa. Also notable was the very persistent warm-phase of the El Niño Southern Oscillation, which lasted from 1990 to mid-1995, and the occurrence of yet another El Niño phase which started in May 1997 (see page 3).

The heat is on:

The 15 hottest years on global records (i.e. from 1860 onwards) have occurred since 1980. The top ten, starting with the hottest, were: 1998, 1997, 1995, 1990, 1999, 1991, 1994, 1983, 1988 and 1987. In the UK, since records began in 1659, four out of the five hottest years occurred in the 1990s and 1999 was the hottest year ever. [4]

Weather extremes have high economic and human costs. An appalling series of weather-related catastrophes in 1998 cost more than the sum of all such catastrophes in the 1980's [5].

The insurance industry is worried about the soaring costs of severe weather damage and is already refusing cover for various weather events in certain regions. According to one of the largest

reinsurance companies, Munich Re, 'the dramatic increase in the frequency and intensity of natural catastrophes that has been observed in recent decades is leading to a greater demand for insurance protection' [6]. During the 1990s there were three times as many natural catastrophes as during the 1960s [7].

The waters are rising:

Although it is difficult to detect trends in floods, of the major floods over the last 50 years:

- 15% occurred between 1991 and 1996*
- 5% occurred in the early 1980's*
- 5% occurred in the early 1970's*
- 2.5% occurred in the 1960's*
- 2.5% occurred in the 1950's [1]*

1997 TO 1999 - 3 MORE YEARS OF RECORD-BREAKING WEATHER

1997 was the second hottest year of the last millennium. The most notable events were severe flooding, particularly in Central Europe, Kenya, Somalia, the US and along the Pacific coast of Latin America [8].

Central Europe suffered economic losses of US\$5.3bn as a result of floods. However, there was also extremely dry weather with innumerable forest fires in Indonesia and Australia due to the effects of a particularly strong El Niño in the equatorial Pacific [9]. And Vietnam experienced some of the worst humanitarian losses of the year with 3,900 dead or missing after Typhoon Linda [10].

► total economic losses due to extreme weather events 1997: US\$ 30 billion [9]

1998 has been declared the hottest year of the last millennium. It was also a particularly severe year in terms of catastrophes with many record-breaking events ranging from ice-storms, floods and hurricanes to heat waves, forest fires and cyclones.

- An ice storm in Canada resulted in economic losses of US\$2.5 billion [7]
- A cyclone in the Indian province of Gujarat killed more than 10,000 people [8].
- Hurricane George caused damage estimated at US\$10 million in the Caribbean [8].
- Hurricane Mitch claimed over 9,000 lives in Honduras and Nicaragua [8].
- Mudslides caused major destruction in many towns and villages in central Italy [8].
- Intense drought and fires burnt 370,000 acres of forest in Greece [11].
- China's Yangtze floods led to 3,600 deaths and cost US\$30 billion, making it the most expensive event of the year [12].

► **total economic losses due to extreme weather events 1998: US\$ 93 billion** [12]

1999, the fifth hottest year of the last millennium, drew to a close with catastrophic weather events worldwide. Winds of up to 120 miles an hour battered France, Germany and Switzerland, killing more than 120 people, damaging a million homes and leaving many without power. Damage from the storms was estimated at more than \$4 billion, making it Europe's all-time largest insurance catastrophe. In Venezuela 50,000 people died and 150,000 were left homeless after floods that were declared the country's worst natural disaster in the 20th Century [13].

- Extreme floods also occurred in the following countries: France, UK, Vietnam, Fiji, Brazil, Australia, Nepal, China, Romania, Hungary, Bangladesh, the Philippines, South Korea, North Korea, Cambodia, Thailand, USA, India, Colombia, Ethiopia and Somalia [13].
- The worst drought in China since the 1980s left 19 million people short of drinking water. In some parts of the country rainfall was more than 70% lower than normal [13].
- The area around Moscow suffered an average of 50 forest fires a day during the hottest June in 118 years [13].
- The US had a record-breaking hurricane season with 17 disasters. September's Hurricane Floyd resulted in the biggest

- peacetime disaster evacuation in the US [14].
- The strongest ever recorded tornado at 318 mph devastated Oklahoma City [13].

WHAT ABOUT EL NIÑO AND LA NIÑA?

One of the biggest players in the game of natural climate variability is the El Niño Southern Oscillation (ENSO) phenomenon. El Niño periods normally occur every three to five years. Weakening easterly trade winds result in higher sea temperatures in the tropical Pacific, causing major changes in global weather patterns [8].

During the 1982/83 El Niño, droughts, floods and hurricanes caused \$8 billion worth of damage and killed 2,000 people [15]. Peru, one of the countries most affected, was hit with the heaviest rainfall recorded in history in the North, while the South suffered from a severe drought. Although El Niño is a natural phenomenon, it is not clear what triggers it or influences its strength. Additionally, its occurrence has become more frequent since 1976. The 97/98 El Niño was the fourth in the 1990s (in fact, some scientists count the three El Niños of 90/91, 92/93, and 94/95 as just one event, the longest in history). This departure from the norm has been linked to climate change [16].

Scientists vary in their assessment about the interaction between ENSO and climate change. Several models indicate that there could be enhanced precipitation variability associated with ENSO events in the increased CO₂ climate, especially over the tropical continents [2]. It is thus possible that the effects of El Niño will be exacerbated by climate change.

The extreme El Niño event between March 1997 and June 1998 attracted considerable public attention, and the insurance industry also followed the natural events connected with the phenomenon very closely. Altogether there were about 80 catastrophes in 1997-98 that can be attributed definitely to the El Niño phenomenon, causing economic losses amounting to just under US\$ 14bn and insured losses of approximately US\$2bn. The indications are that in the future El Niños will be frequent and strong [7].

El Niño was followed closely by La Niña, its “cool sister”. Strong trade winds caused a rapid reversal of the temperature conditions in the equatorial Pacific. The west warmed up and the east cooled down. This weather pattern has been blamed for the drought experienced in most of the southern United States in 1999 and the increase in hurricanes, including two that caused serious flooding in North Carolina, also in 1999 [17].

CONCLUSION

Recent years have seen many extreme weather events, including a number of ‘floods of the century’ and the hottest year on record. While climate variability is a natural phenomenon, there are indications that the human footprint on the climate system is becoming increasingly visible.

According to the IPCC ‘the balance of evidence suggests a discernible human influence on global climate’ [2].

- ▶ In the short-term it is difficult to distinguish between natural variability and climate change, so it is not possible to definitely link a specific weather event (or sequence of events) to climate change. However, many climate scientists think that recent weather extremes are consistent with climate change predictions.
- ▶ The insurance industry has few doubts that the frequency and intensity of natural catastrophes have increased. Costs to the insurance industry between 1987-1996 were 15 times those incurred during the 1960s [9].
- ▶ The human suffering and economic damage caused by recent extremes demonstrates that the risks associated with climate change are great. Precautionary action is needed sooner rather than later.
- ▶ The year 2000 marks a critical moment for international negotiations to protect the climate. Governments at the sixth meeting of the Conference of Parties in the Hague this November must ensure a strong and effective Kyoto Protocol is upheld.

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