



CLIMATE CHANGE AND EXTREME WEATHER EVENTS IN EUROPE Summer 2005

Many parts of Europe are now suffering from extreme weather events. Increased rainfall has led to extreme flooding in parts of Switzerland, Austria, Germany, and Bulgaria, killing an estimated 70 people so far. At the same time Spain, Portugal and France have been experiencing a long drought which reduced the countries' agricultural output and food resources considerably and in some places caused severe fires. Countries and communities are crying out for help. Is this the Europe of the future, or are these just one-off events?

Climate change has warmed Europe by almost 1°C over the last century. Current extreme weather events on the Iberian Peninsula and in the Alps are part of the picture – they are consistent with the scenarios that climatologists have made for a warmer Europe.

Unless Europe increases its efforts to curb climate change, Europeans will have to get used to many more catastrophic impacts on people and nature. Summer 2005 should serve as a strong call to European leaders that the best way to ensure that disasters become less frequent and less extreme in the future is to cut greenhouse gas emissions.

WWF's PowerSwitch! Campaign in Europe is calling for leaders to clean up the power sector, the greatest contributor to climate change by strengthening legislation. Now is the key time to do so.

The background:

The concentration of carbon dioxide (CO₂) in atmosphere has increased 36% since pre-industrialization and is at the highest level in the last 420,000 years. Largely due to human-caused CO₂ increase, the climate in most parts of the world, including Europe, is warming.

The global average temperature has increased by about 0.6°C and the European average temperature by 0.95 °C in the last hundred years (EEA 2004). The eight warmest years in Europe's history have been during the last 14 years. Similar to the global trend, European winters have warmed more than summers, resulting in milder winters and a decreased seasonal variation (Jones and Moberg 2003). It is projected that temperatures will further increase by 1.4–5.8 °C globally (IPCC 2001) and 2.0–6.3°C in Europe (Parry 2000) by the year 2100.

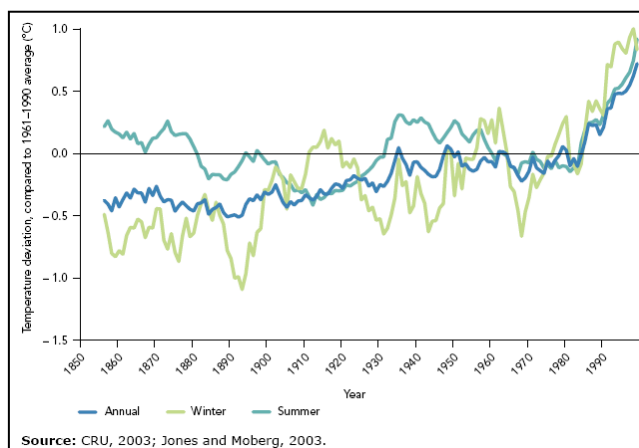


Figure 1. Observed annual, winter, and summer temperature deviations in Europe 1850-2000

The estimated warming within Europe is likely to be the greatest over southern countries (Spain, Portugal, Italy, and Greece) and less along the Atlantic coastline. As a consequence, the European Environment Agency (EEA) predicts that southern Europe will experience extreme weather events such as increased drought stress, more frequent forest fires, increased heat stress and risks for human health.

Are these events climate change at work?

Yes. Temperatures have risen, precipitation patterns have changed, and frequency of extreme weather events have increased. All of these factors influence both nature and human systems.

Heatwaves, droughts, forest fires, and flooding are not isolated events. In 2003 much of southern Europe experienced a substantial drop in crop yields because of the 2003 heatwave and drought, which was attributed, in part, to human-induced climate change. The 2003 drop in crop yields was the strongest negative deviation from the long-term trend in Europe in the last 43 years (FAO, 2004). The consequences of this year's drought and the 2003 heatwave are especially relevant because they are examples of what could be the average climate in the future (Beniston, 2004).

While there will never be 100% certainty of these events being directly attributable to climate change, they are key examples of the scenarios and predictions that climate scientists have been making for the last few years. These events – and their increase in intensity and frequency – fit precisely with scientific climate change scenarios. It is more than likely that these types of extreme events (heatwaves, droughts, forest fires, and flooding) will occur more frequently in the future as humans continue to dump billions of tones of CO₂ into the atmosphere.

Is climate change the only cause?

No, floods, droughts and fire have occurred throughout history because of natural causes. However, climate change is now a huge global driver which will cause extreme events to occur more often, and with increased intensity. In addition to human-induced climate change, the current catastrophes in Europe have other man-made causes which exacerbate the catastrophes:

Floods often become disasters because of human mismanagement of the environment. Intensive agriculture, deforestation, and destruction of wetlands for urban development destroy the hydrological balance of rivers and increase flood risk. In many parts of the world, river courses have been straightened– and constricted into artificially narrow channels by the construction of dykes to use floodplains for farming, urban development and transportation routes. All this straightening and narrowing makes rivers flow faster over a much smaller area. Floodwaters have nowhere to go, since the floodplains that would normally store the excess flow safely have been cut off from their rivers.

Fires in the Mediterranean are often lit by people, be it for illegal land clearing or by neglect. Inappropriate land use planning or agriculture policies can also lead to damaging fires. Improved enforcement and better fire control systems may help Portugal to combat the fires more effectively.

While all such steps are necessary also as preparation for a warmer world it remains imperative to cut CO₂ emissions now to make sure we remain at a level of global warming in which the impacts can still be managed.

More rain in the North and less in the South

Annual precipitation trends in Europe are much more varied than temperature trends. However, patterns exist: for example, northern Europe has become wetter over the last century (10-40% wetter), where as southern Europe has become up to 20% drier (Klein Tank et al. 2002, NOAA 2001).

Future projections of precipitation across Europe show a 1-2% increase per decade in annual precipitation in northern Europe and an up to 1% per decade decrease in southern Europe (in summer, decreases of 5% per decade may occur). Winters are expected to become wetter in most of Europe, (1-4% per decade) with some exceptions, especially the Balkans and Turkey (Parry 2000). These expected changes, most notably the reduction in precipitation in southern Europe, will have severe effects including more frequent droughts and fires, with considerable impacts on agriculture and water resources and river flows. In fact, the EEA (2004) suggests that changes in precipitation patterns over the year can lead to more flooding in

some regions or seasons and more droughts in other, more frequent land slides and soil erosion. Floods and droughts can even occur in the same region in different seasons of the same year (e.g. a region may be exposed to drought in spring and summer then is flooded in the autumn).

Temperatures are up, and it's getting wetter

The EEA (2004) reports that during the past three decades summer days (days with temperatures above 25°C) and heatwaves have become more frequent. The most severe changes have been observed in western and southern Europe. At the same time, the number of frost days has decreased even more, due to a greater warming in winter than in summer (Jones et al., 1999; Klein Tank et al., 2002). The tendency towards milder winters in Europe in the last 10–20 years is partly caused by stronger westerly circulation in winters, consistent with a positive phase of the North Atlantic Oscillation (NAO) (Hurrell, 1996). It is scientifically uncertain whether the current trend towards the positive phase of the NAO is part of the human-induced climate change signal or is natural climate variability. It is likely to be a combination of both (Gillett et al., 2003).

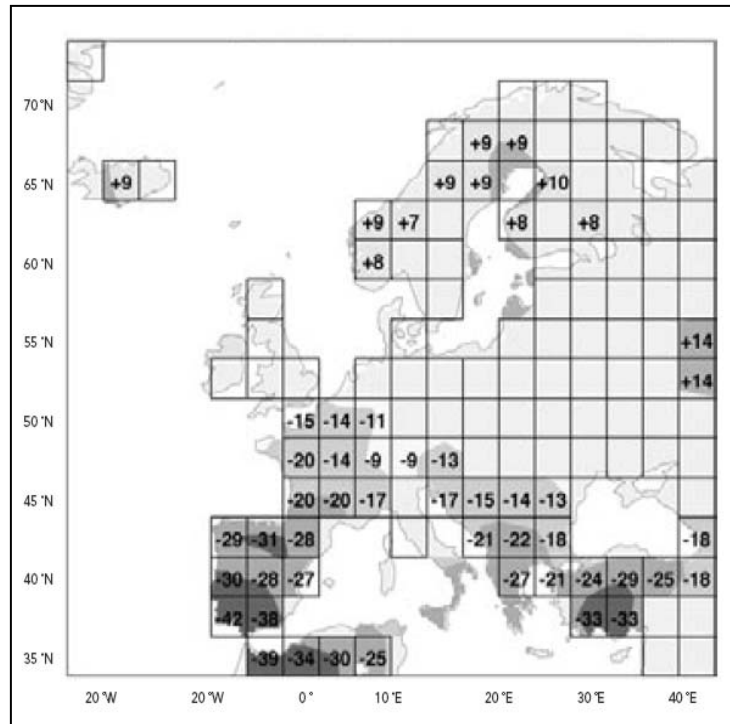


Figure 2. Projected change in summer precipitation (%) in Europe up to 2080 (IPCC 2000b; Parry 2000)

The number of wet extremes has also increased in Europe in recent decades (Klein Tank et al., 2002). In many regions the trend in extreme precipitation events is more pronounced than the trend in average precipitation. The number of observed very wet days in central and northern Europe has increased, whereas the number has decreased in parts of southern Europe (EEA 2004).

Recent developments fit the scenarios – a case study in the Mediterranean

A WWF climate scenario for the Mediterranean confirms that summers with extreme heat, which still seem exceptional to us, might become the norm if we do not manage to keep average global warming below that dangerous threshold of 2°C compared to pre-industrial levels (Giannakopoulos et al., 2005).

The WWF climate scenario shows that average annual temperatures would go up by 1 to 2°C, but in inland locations temperature increases could exceed 5°C. Heatwaves and extremely hot days are expected to become more common, with up to 6 weeks per year of days over 35°C. The scenario also shows that rain would decrease by as much as 30% in the Northern Mediterranean, while droughts would become longer (fitting in with other climate scenarios by the IPCC and EEA). The scenario also predicts that future rain would come in shorter periods and be more intense, causing more catastrophic floods and landslides.

The WWF climate scenario also predicts a higher risk of forest fires because of associated drought, which would mean longer periods of extreme fire risk (a month longer in the Iberian Peninsula) and all year fire risk in the Maghreb. It might not be a coincidence that Portugal has been experiencing widespread drought, which has lead to the worst forest fires on record, resulting in 14 deaths this year and millions of dollars of damage. Portugal has recently asked for international support to put out the fires.

Drought, Rain and Floods - extreme events get even more frequent and more extreme

Weather extremes are becoming more frequent in Europe; e.g. the summers of 1995 and 2003 were extremely hot throughout most parts of Europe, whereas 2002 was very wet and saw extreme flooding in central Europe. When compared with their historical frequency, the accumulation of such extreme weather events in recent decades seems uncommon (IPCC, 2001a; Schär et al., 2004). There is now evidence that the frequency and extent of climate extremes have been caused by a shift of the average climate to more extreme conditions (IPCC 2001a). Schär et al. (2004) showed that the extremely hot summer of 2003, which killed about 40,000 people, could be explained only by including human-induced climatic change.

The EEA climate models project that cold winters, which occurred once every 10 years from 1961 to 1990, are likely to become rare and will almost entirely disappear by 2080 (EEA 2004). In contrast by 2080 nearly every summer in many parts of Europe is projected to be hotter than the 10% hottest summers in the current climate. Under high emission scenarios every second summer in Europe will be as hot or even hotter than 2003 by the end of the twenty-first century (Luterbacher et al., 2004). In southern Europe, these changes are projected to occur even earlier (in Spain by the 2020s) (Parry, 2000). Changes are also projected for precipitation extremes in Europe, but the uncertainties remain high. It is likely that the frequency of both intense precipitation events and summer droughts will increase (Parry, 2000; Klein Tank et al., 2002). Increased rain could lead to more flood events while drought will likely have severe consequences for agriculture, water resources and forest fires in southern Europe.

How to prevent dangerous climate change? Strong caps on CO₂ emissions!

The world is warming, but the rate of warming can be slowed down significantly if CO₂ emissions are cut now.

The solutions already exist but need to be implemented with a much greater sense of urgency. Politicians, businesses and the public must each take action. WWF is focusing on the power sector, the single largest source of man-made CO₂.

Europe will suffer unless Europe takes a clear lead in fighting climate change. European governments have a vital role to play by enforcing strict pollution limits under the European Emissions Trading Scheme (ETS).

Since January 2005, the ETS has placed CO₂ limits on the chimney stacks of big companies: companies that exceed their emission limits have to pay the penalty by being forced to buy unused pollution allowances from cleaner companies. Tough pollution limits combined with a powerful financial incentive to invest in cleaner, more efficient technologies would transform the power sector and automatically reduce its CO₂ emissions.

Unfortunately, EU governments agreed to weak limits and weak financial incentives. Now the ETS is being reviewed, opening up a big opportunity to get it right next time.

**Help WWF to campaign for tougher emission limits in Europe – go
www.panda.org/powerswitch**