The heat was on in 2005

As 2005 draws to a close, climate scientists are making their annual pronouncements on how its temperatures compare to historical records. And although this year is among the warmest ever recorded, small differences in the claims highlight the uncertainty of such rankings.

Depending on whom one believes, 2005 will end up just above or below 1998 as the hottest year on record. Most significant, climate scientists say, is that this year's readings occurred without the help of a major El Niño event. "In just seven years, the background global temperature has increased to a level equal to the peak in the 1997–98 El Niño," says James Hansen, a researcher at NASA's Goddard Institute for Space Studies in New York City.

That record-breaking El Niño slathered the tropical Pacific with anomalously warm sea water. There was no such event this year, but many other regions were notably warm — including the North Atlantic, where an unprecedented number of tropical cyclones formed.

Hansen says that NASA is likely to dub 2005 as the warmest year on record, but a team at the University of East Anglia in Norwich, UK, is poised to rate it as number two, behind 1998. And a preliminary report from the National Oceanic and Atmospheric Administration (NOAA) shows a photo finish between the two years, with 1998 ahead by a nose (see 'Sources of disagreement'). Final rankings will be released over the next few weeks.

This year's heat was not a total surprise — NASA predicted early in 2005 that it would be one of the warmest years on record. Over the past century, says NASA, Earth's average surface temperature has risen 0.8 °C, with three-quarters of that occurring since the 1970s.

M. KHURSHEED/REUTERS

This year's record-breaking temperatures included a devastating heatwave in Pakistan.

Nine of the ten warmest years on record have occurred since 1995.

Hansen, who compiles the annual rankings for NASA, says the recent warming is consistent with the increase in heat-trapping greenhouse gases in the atmosphere. "Climate change is real and should begin to be noticed by real people," he says.

Although differing rankings for 2005 might puzzle the public, it is less of an issue for the scientists who compile them. Most of the time, the ratings agree. "People sometimes make too much of whether a year is ranked warmest or second warmest," says Jay Lawrimore, who oversees month-to-month tracking for NOAA.

Scientists hope to put the rankings in better perspective by pointing out uncertainties in them. In 2006, NOAA will shift to an analysis technique that will include uncertainty ranges for the first time. This may reduce the drama of the year-end rankings, but it could also accentuate just how many of the past few years lie at the top of the temperature heap. ■

Robert Henson

Sources of disagreement

There are three teams that rank global temperatures. Their results vary mainly because of differences in how they combine data sets.

Each group draws on a different mix of the planet's land-based temperature stations to construct a temperature record. The University of East Anglia's Climatic Research Unit (CRU) uses about 4,200 stations worldwide; the National Oceanic and Atmospheric Administration (NOAA) uses 7,200 and NASA uses 6,000.

They also differ in how they analyse this information. NASA and NOAA pool their data, weighted by area, across the globe. But the Northern Hemisphere has much more land than the Southern: "We think this adds a northern bias," says Philip Jones of the CRU. His team averages the data for each hemisphere, then combines them. Another difference is that NASA calculates its temperature differences using a 1951–80 base period; the others use 1961–90.

But overall, the results are more alike than they are different. The three groups report similar rates of warming over land in the past century, according to a recent analysis by NOAA's Russell Vose.

Adding measurements from the ocean brings more uncertainty. For decades, scientists relied on fairly crude sea-surface-temperature measurements collected by ships through buckets and engine intakes. But by the early 1990s, sea-surface data from ships and buoys became more widely available, as did air temperatures construed from satellite data.

NOAA and NASA use an index that includes all these ocean sources; the CRU and the Hadley Centre for Climate Prediction and Research in Exeter, UK, rely on ship and buoy data. There is no consistent difference in the results, says Hadley's John Kennedy, but this year the CRU/Hadley index pegs ocean temperatures as being cooler than they were in 1998. That may be why that team seems likely to place global air temperatures short of the 1998 record. **R.H.**