Key messages

The global mean temperature for 2019 was 1.1±0.1 °C above pre-industrial levels. The year 2019 is likely to have been the second warmest in instrumental records. The past five years are the five warmest on record, and the past decade, 2010–2019, is also the warmest on record. Since the 1980s, each successive decade has been warmer than any preceding one since 1850.

Global atmospheric mole fractions of greenhouse gases reached record levels in 2018 with carbon dioxide (CO_2) at 407.8±0.1 parts per million (ppm), methane (CH_4) at 1869±2 parts per billion (ppb) and nitrous oxide (N_2O) at 331.1±0.1 ppb. These values constitute, respectively, 147%, 259% and 123% of pre-industrial levels. Early indications show that the rise in all three – CO_2, CH_4 and N_2O – continued in 2019.

The year 2019 saw low sea-ice extent in both the Arctic and the Antarctic. The daily Arctic sea-ice extent minimum in September 2019 was the second lowest in the satellite record. In Antarctica, variability in recent years has been high with the long-term increase offset by a large drop in extent in late 2016. Extents have since remained low, and 2019 saw record-low extents in some months.

The ocean absorbs around 90% of the heat that is trapped in the Earth system by rising concentrations of greenhouse gases. Ocean heat content, which is a measure of this heat accumulation, reached record-high levels again in 2019.

Over the decade 2009–2018, the ocean absorbed around 23% of the annual CO_2 emissions, lessening the increase in atmospheric concentrations. However, CO_2 absorbed in sea water decreases its pH, a process called ocean acidification. Observations from open-ocean sources over the last 20 to 30 years show a clear decrease in average pH at a rate of 0.017–0.027 pH units per decade since the late 1980s.

As the ocean warms it expands and sea levels rise. This rise is further increased by the melting of ice on land, which then flows into the sea. Sea level has increased throughout the altimeter record, but recently sea level has risen at a higher rate due partly to increased melting of ice sheets in Greenland and Antarctica. In 2019, the global mean sea level reached its highest value since the beginning of the high-precision altimetry record (January 1993).