22 October 2019
Issue 533

Subscribe to free weekly News Alert

Source: Marvel, K., Cook, B.I., Bonfils, C. J.W., Durack, P.J., Smerdon, J.E. Park Williams, A. (2019). Twentieth-century hydroclimate changes consistent with human influence. *Nature*, 569 (7754): 59 DOI: 10.1038/s41586-019-1149-8.

Contact:
kate.marvel@nasa.gov

Read more about:
Air pollution, Climate change and energy, Natural hazards

European Commission

Science for Environment Policy

Tree rings help reveal how humans are affecting drought patterns

A recent analysis of tree-ring data spanning the past millennium reveals drought patterns that largely align with climate model projections for the same period. This adds credibility to climate models, which project that human influences on drought patterns will become stronger over the next century.

Tree rings can provide an accurate picture of weather conditions both in past time periods and for specific locations. Trees struggle to grow during droughts; their rings from these dry periods are, therefore, much thinner than normal.

This new study used tree-ring data to build a picture of drought since the year 1900. The data were reconstructed into global 'drought atlases' covering the regions of North America, Europe and the Mediterranean basin, Mexico, Asia and Australia–New Zealand. This long-term dataset made it easier to detect potential cause-and-effect patterns, and the near-global focus allowed the researchers to see the 'big picture' of drought. The climate in individual regions can vary significantly from year to year, making it difficult to tell if a drying trend is due to human activity. However, human influence is considered more likely if droughts happen in several places at the same time.

The results reveal three distinct periods of drought pattern, which can be explained by emissions of greenhouse gases (GHGs) and air pollutants. They also show that humans have been influencing the global climate since the beginning of the twentieth century.

Between 1900 and 1949, the data show a strong change in drought patterns around the world (as compared with modelled simulations of the climate before the Industrial Revolution (1850)), with an increase in droughts in most regions. This is consistent with an increase in GHG emissions during this period.

The atmosphere became cooler and wetter between 1950 and 1975, with a decrease in droughts in all regions except Australia–New Zealand. The researchers believe this was likely due to an increased emission of aerosols — particles of air pollution that block sunlight and counteract the warming effects of GHGs.

After 1975, air pollution declined in response to legislation, and global drought patterns began to return towards earlier patterns, observed in the first half of the twentieth century, with increased drought rates. The researchers note that the patterns in the post-1975 data are not as obvious as for the first half of the twentieth century, in that the apparent link between emissions and drought patterns is not quite as clear-cut. However, they suggest that the data patterns are getting stronger and predict that the link will become more apparent over the first half of the twenty-first century.

These real-world drought-atlas data were compared with climate-model data (from the World Climate Research Programme's coupled model intercomparison project: CMIP5) for the same period. The researchers found that they closely aligned. This lends credibility to the climate model data and suggests that their future projections are reliable.

Using computer models, and assuming a 'worst-case scenario' climate pathway of RCP 8.5 (rapid economic growth, continued use of fossil fuels), the research also predicts that human influence on drought is likely to grow stronger over the next couple of decades. Droughts are expected to become more frequent and severe as temperatures rise, particularly over large parts of Europe, Asia and North America. These could potentially lead to severe consequences, such as food and water shortages, health impacts, destructive wildfires and conflicts over resources.