Human Activity Changes Atmosphere Circulation

For the first time, a study has provided evidence that human activity is altering the circulation of the tropical atmosphere through global warming. The results suggest that the principal overturning of winds that drives climate and ocean behaviour across the tropical Pacific ocean is slowing down. Variations in its intensity and structure may affect climate around the globe.

The Walker circulation is an atmospheric circulation of air over the equatorial Pacific Ocean that covers almost half the circumference of the Earth, pushing the Pacific Ocean's winds from east to west. This air circulation is fundamental to climate around the globe because its variations are closely linked to those of the El Niño/Southern Oscillation and monsoonal circulations over adjacent continents. Several theoretical studies have shown that an increase in greenhouse gases could produce a weakening of the Walker circulation through global warming.

A recent study has explored the changes in tropical atmospheric circulation since the mid-nineteenth century using observations of sea level pressure over the tropical Pacific. Global climate model experiments served to explore the origin of the observed circulation changes, and to estimate the statistical significance of the observed changes. Some of the simulations included the observed increase in greenhouse gases; others included just the natural climate-altering factors of volcanic eruptions and solar variations.

The results suggest that the principal overturning of winds that drives climate and ocean behaviour across the tropical Pacific is slowing down. The researchers identified a 3.5 percent weakening that has occurred since the mid-1800s in this air system known as the Walker circulation. This study found a weakening of the Walker circulation in historical observations that corresponds closely to what theoretical and modelling studies expect from an increase in greenhouse gases. The obtained results provide increased confidence in model projections of future climate change in the tropics.

Furthermore, the authors also mention that there is evidence that this air system may weaken another 10 percent by 2100. This weakening could have implications for the frequency and intensity of future El Niño events. The climate model also indicates that this slowdown has modified the structure and circulation of the tropical Pacific Ocean, which is a source of nutrients for one of the most biologically productive regions of the world’s oceans, which could have implications for the marine ecosystems in tropical oceans.

Only the simulations that included an increase in greenhouse gases showed the Walker circulation slowing, and they did so at a rate consistent with the observations. Consequently, the study indicated that the only plausible explanation for the slowdown is human-induced climate change.

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