SPARC WEEKLY

SCIENTISTS SAY: DEEPFAKE

In 2023, deepfake images of Pope Francis wearing a white puffer jacket (one shown) went viral. While the images were created with AI, many people online were tricked into thinking the pictures were real photos.

Deepfake (noun, "DEEP fayk")
A deepfake is a realistic fake image, video or audio clip created by artificial intelligence, or AI. The term deepfake comes from "deep learning" and "fake." Deep learning is the type of AI used to make this media.

Deepfakes have some practical use. Consider someone making a sequel to a movie from many years ago. The actors might look different today. But filmmakers can use deepfake technology to show an actor today looking as they did in the first movie.

But deepfakes also cause problems. Many actors, for instance, are concerned that people could use their images to create new movies without their permission. Deepfakes also can contribute to the spread of false information.

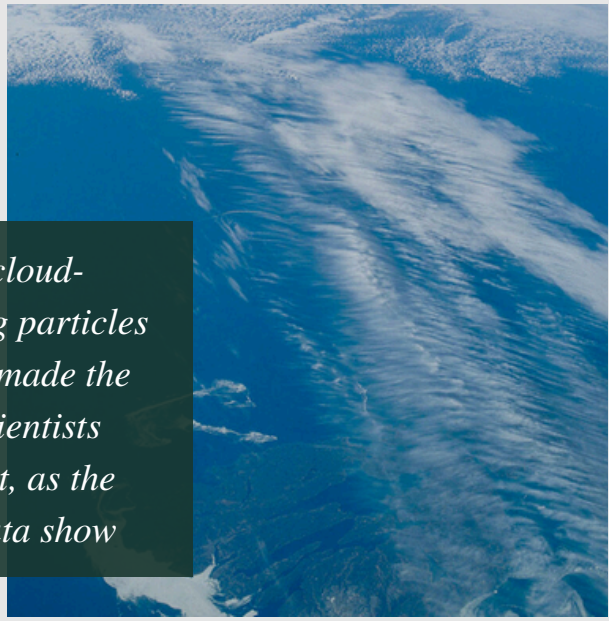
In 2024, for example, fraudsters created a deepfake of President Joe Biden's voice. The audio clip sounded like Biden asking people not to vote in New Hampshire's presidential primary elections. Some people who received phone calls with this fake voice were convinced to skip voting.

Nowadays, deepfakes represent a new kind of digital media. For one thing, rather than tweaking existing media, deepfakes are easily created from scratch. For another, AI now allows non-experts to easily make such images and audio. That makes it possible for anyone to create deepfakes of people saying or doing things they never did. And public figures aren't the only victims. People can use AI to make deepfakes of ordinary people to bully them, scam them and more.

https://www.snexplores.org/article/scientists-say-deepfake-definition-pronunciation

SURPRISE! THE JET STREAM CAN TRIGGER CLOUD FORMATION

Waviness in the high-speed flow of the jet stream (shown) can cause fingers of stratospheric air to punch down and curl into the troposphere below. This mixing of atmospheric layers spurs chemical reactions that cause new aerosol particles to form. - NASA



Many cloud-seeding particles aren't made the way scientists thought, as the new data show

Clouds form when water molecules in the air stick to certain tiny particles — think of them as seeds. Scientists have now discovered an unexpected source of those seeds.

When two layers of Earth's atmosphere overlap, chemicals in each layer can mix and react. These reactions can form the tiny new particles around which clouds begin to form. In fact, this may be the most common way that the seeds for clouds form. That's the finding of a study in the July 12 Science.

Earth's atmosphere has five layers. We live in the troposphere. It's the lowest one. It also has the densest air. The stratosphere, right above it, has thinner air. It also contains different chemicals than those in our layer.

Scientists had thought most new atmospheric particles form in the upper troposphere. Clouds would rise into this region and then shed rain. That rain would carry away the existing particles. Gases left behind would have almost no solid particles left to glom onto. So new clouds would not develop until new particles formed.

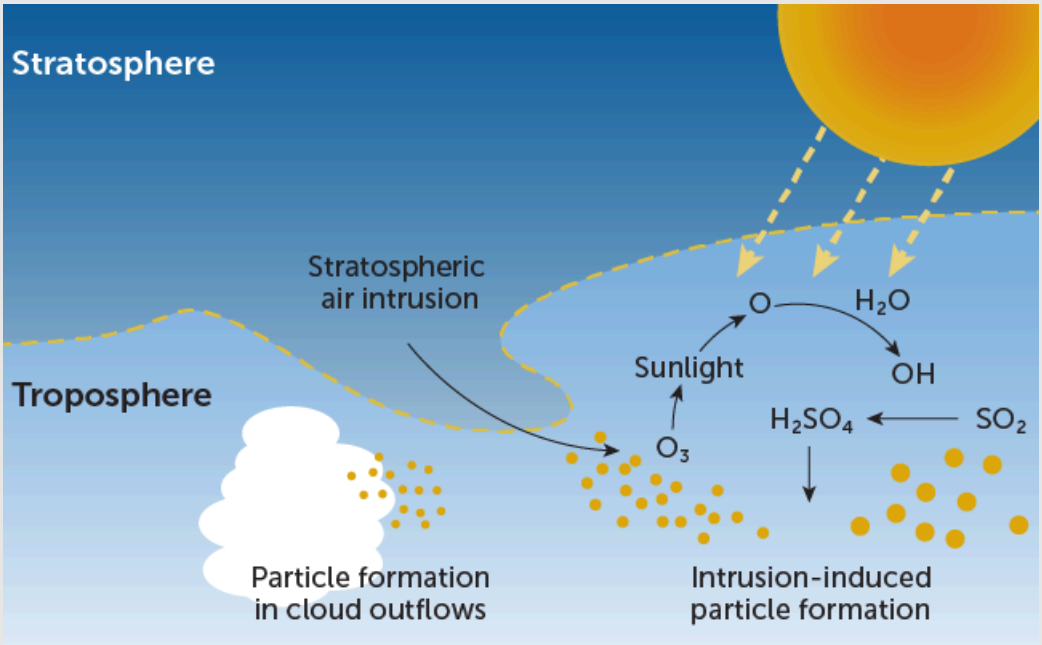
It all starts when the gases mix

The stratosphere is cold and enriched with a type of oxygen known as ozone. The troposphere is warmer. It's moister and contains a variety of other gases. Sunlight and water cause molecules in these air masses to react chemically. This can generate different types of tiny particles, explains study coauthor Jian Wang.

The newly made particles include sulfate (SO4), which seeds clouds.

However, "We don't really understand the mechanisms in detail," Wang says. "We know from the data that … you need sunshine, high ozone and moisture" to produce molecules known as hydroxyl (OH) radicals. These gas molecules eagerly react with other gases high above Earth. So there are probably many different chemical reactions going on up there. And they'll produce a variety of new gases and particles. Exactly which and how many particles are being formed is a question for future research, Wang says.

ANATOMY OF AEROSOL FORMATION



Stratospheric intrusions may be an especially big source of such new particles in Earth's midlatitudes. Those are regions such as the continental United States — ones that are not close to either the poles or the Equator.

Waviness of the jet stream can lead the stratosphere — rich in ozone (O3) — to dip into the troposphere, which is rich in water (H2O). The troposphere also contains molecules such as sulfur dioxide (SO2), emitted by fossil fuels and volcanoes. Sunlight and water vapor cause these chemicals to react in ways that generate chemicals such as sulfuric acid (H2SO4), a building block of tiny aerosol particles. Previous research had suggested that the main way new particles formed were instead "cloud outflows" — regions where high troposphere clouds break up.

Climate change is expected to speed up stratospheric circulation. In the future, that could cause the stratosphere to poke into the troposphere more frequently. If it does, stratospheric intrusion may become even more important in forming new particles, Wang says.

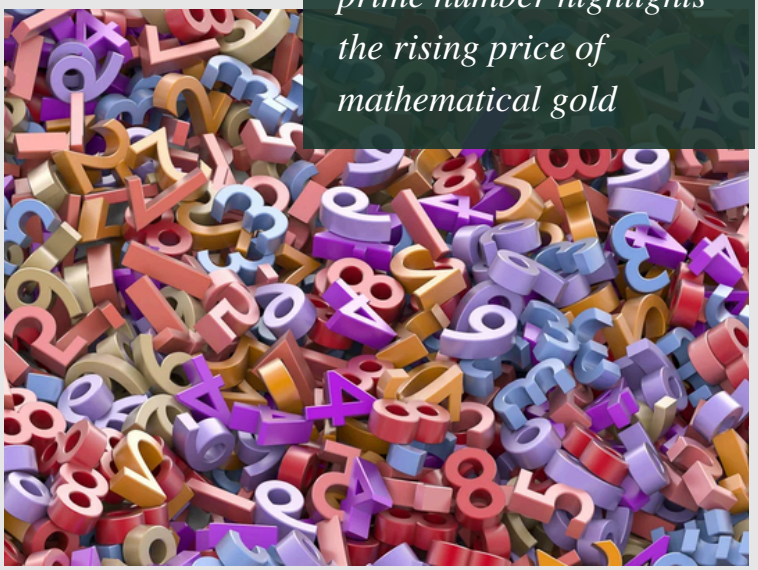
This newly reported role for jet streams in particle formation has been long overlooked, says Yuanlong Huang.

Right now, he notes, stratospheric intrusion is not yet accounted for in computer models that simulate weather and climate. In other words, these particles may play a bigger role than scientists once thought in how incoming sunlight is distributed on Earth. That includes how much of the sun's rays reach the planet's surface. It also includes how much of the sun's energy aerosols and clouds absorb high in the atmosphere.

https://www.snexplores.org/article/jet-stream-seeds-cloud-formation

RECORD-BREAKING PRIME NUMBER, 41 MILLION DIGITS LONG, BLOWS MATHEMATICIANS' MINDS

The discovery of a new prime number highlights the rising price of mathematical gold



Thousands of computers across the world are currently scouring the number line in a scavenger hunt for rare mathematical gems. Prime number enthusiasts, looking for larger and larger numbers that are divisible only by 1 and themselves, muster vast amounts of computing power and algorithmic ingenuity in hopes of etching their name into the scrolls of math history.

The latest entry comes from Luke Durant, a researcher in San Jose, Calif. Durant's discovery overturned the former record holder, which sat uncontested for nearly six years, an unprecedentedly long reign in the modern search for ever larger prime numbers. The gap makes sense: as primes grow, they spread further apart, making each new find harder than the last.

The new prime contains a mind-boggling 41,024,320 digits. To put that in perspective, the estimated number of atoms in the observable universe clocks in at around 80 digits. Every additional digit increases a number by 10 times, so the size of the new prime lives far beyond human intelligibility. Primes play a major role in pure math, where they're main characters in a field called number theory, and in practice, where, for example, they underlie widely used encryption algorithms. A prime with 41 million digits won't immediately join the ranks of useful numbers, but for now, it adds a feather in the cap of a community that longs to apprehend the colossal.

Durant's success stems in part from new clever software from the Great Internet Mersenne Prime Search and in part from heavy-duty hardware and computational muscle that he personally mobilized for the pursuit. By assembling a "cloud supercomputer" spanning 17 countries, he ended a long tradition of personal computers discovering primes.

Prime numbers are often called the "building blocks of math" because every whole number greater than 1 has a fingerprint as the product of a unique collection of primes. For example, 15 is the product of the primes 5 and 3, whereas 13 cannot be subdivided like this because 13 is prime. The study of these numbers dates back at least to the ancient Greeks. In 300 B.C.E. Euclid proved in his textbook Elements that infinitely many primes exist, and mathematicians, both professional and amateur, have relished the hunt for them ever since.

https://www.scientificamerican.com/article/new-prime-number-41-million-digits-long-breaks-math-records/

WHO ARE WE?

SPARC Robotics Team's mission and vision is to make our environment the best it can be. On a volunteer basis, we look at the problems that are happening around us and make them our problems, both as SPARC and individually, and help as much as we can with appropriate projects.

NASA ACCP (Astro Camp Community Partners) was only in the US until four years ago. This year they came to Turkey with us after four years of traveling to many countries. ACCP educates school-age children from kindergarten to high school on science-related topics of interest with practical knowledge and application, while also supporting children's craft development, general culture and questioning skills.

As SPARC, we have brought this training provided by NASA to our country in the most comprehensive way and our continuous communication with NASA not only enables us to improve our trainings day by day, but also gives us the opportunity to learn about the innovations in the field of STEM instantly, from the most accurate source and to spread the knowledge we have around us.

EDITOR

These newsletters are prepared by Defne Şehidoğlu and Defne Ulu;

Hello, I’m Defne Ulu and I am the editor of this edition.
I hope you learned new and interesting facts from these articles and I hope it has helped you to keep your mind out of your problems while reading it.

Have a good day.
See you next week!!