

when a pair of astronomers reported finding a KBO called 2012 VP₁₁₃. Its stretched-out orbit never came closer than 80 AU to the Sun (C. A. Trujillo and S. S. Sheppard *Nature* 507, 471–474; 2014). (Pluto, at its most distant, is 48 AU from the Sun.) VP₁₁₃ joined the dwarf planet Sedna as only the second known object with a very distant orbit. In their report, Chadwick Trujillo at the Gemini Observatory in Hilo, Hawaii, and Scott Sheppard of the Carnegie Institution for Science in Washington DC said that the orbits of these objects suggested that yet another object, a planet bigger than Earth, could exist at around 250 AU (see ‘Far afield’).

Batygin and Brown picked up the challenge. “Our main goal at that point was to show that this idea is crazy,” says Brown.

But Trujillo and Sheppard had noted that Sedna, VP₁₁₃, and several other KBOs all shared a peculiar property: their closest approach to the Sun lay in the plane of the Solar System, and they all moved from south to north when crossing that plane.

Batygin and Brown analysed the orbits further and discovered that their long axes were physically aligned, too, as if something had nudged them to occupy the same region of space around the Sun. The team concluded that a massive object must be shepherding the objects. “We have a gravitational signature of a giant planet in the outer Solar System,” Batygin says.

Planet Nine — informally known as Phattie — is probably smaller than Neptune and icy with a gassy outer layer. The gravitational effect of Uranus and Neptune would have flung it outward in the first 3 million years of the Solar System’s existence, Batygin says.

Actually spotting Planet Nine through a telescope could be difficult because it would spend most of its time very far from the Sun, making it faint and hard to see, notes Meg Schwamb, an astronomer at the Academia Sinica in Taipei. Brown and Batygin have been looking for it using the Subaru telescope in Hawaii, so far without success. The Large Synoptic Survey Telescope in Chile will have a good chance of catching it when it starts operating early next decade, Brown says.

But he and Batygin say that there are other ways to test the existence of Planet Nine. Its gravitational influence would also produce a population of KBOs with orbits at steeply inclined angles. A few of these have already been spotted, but discovering more would strengthen the statistics of the discovery and help to clarify whether Planet Nine really exists or not, says David Nesvorný, a planetary scientist at the Southwest Research Institute. So it’s back to the telescopes. “It really points to the fact that more extreme KBOs need to be found,” says Trujillo. “The location is not known well enough to just point a telescope at it and say, ‘there it is.’” ■



El Niño has sent heavy rains to California this year.

CLIMATE SCIENCE

Meteorologists probe monster El Niño

Unprecedented Pacific Ocean campaign aims to improve forecasts for strong storms.

BY RICHARD MONASTERSKY

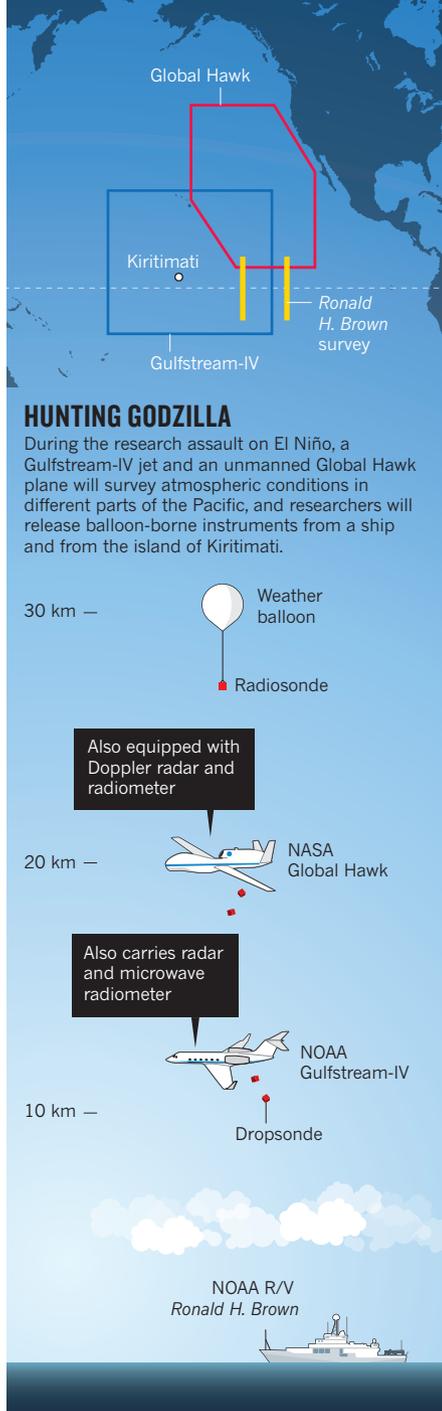
Climate scientists this week began a research blitz to study El Niño, the climate trouble-maker that disrupts weather around much of the globe. For the next two months, US researchers will use specially outfitted planes, a research ship and hundreds of weather balloons to monitor the region in the tropical Pacific Ocean where El Niño forms. Ultimately, the scientists say, their measurements could help to improve weather forecasts and unlock secrets about how powerful El Niño events evolve.

“We’re seeing an extreme climate state — one that we know tends to produce extreme climate conditions worldwide,” says Randall Dole, lead scientist on the project and a meteorologist with the US National Oceanic and Atmospheric Administration (NOAA) in Boulder, Colorado. “We’re going

right into the heart of that.”

The El Niño warming that has bloomed in the equatorial Pacific is one of the strongest on record, with ocean temperatures reaching as much as 3°C above normal across the central and eastern parts of the ocean basin. That heat triggers convection in the atmosphere that re-routes major air currents, often sending strong storms towards California while drying out parts of southeast Asia, Australia and eastern South America. But researchers have few data on the atmospheric changes in the core of the El Niño region because the remote equatorial Pacific is essentially a meteorological black hole.

To begin the campaign, NOAA sent its Gulfstream-IV research jet to Hawaii, its base for about 20 flights south towards the Equator. Using onboard remote-sensing equipment and dropsondes — packages of instruments released from the plane — the team will measure winds, temperature, ►



HUNTING GODZILLA

During the research assault on El Niño, a Gulfstream-IV jet and an unmanned Global Hawk plane will survey atmospheric conditions in different parts of the Pacific, and researchers will release balloon-borne instruments from a ship and from the island of Kiritimati.

► air pressure and moisture from a height of 12–14 kilometres down to the ocean surface (see ‘Hunting Godzilla’).

In February, NASA’s unmanned Global Hawk aircraft will join the effort, prowling the eastern part of the Pacific in 4 flights lasting up to 24 hours each. At the same time, NOAA will launch instrument packages on weather balloons from Kiritimati, or Christmas Island, an atoll near the Equator in the heart of the region in which El Niño forms. And researchers will also release balloon-borne instruments from the NOAA research ship *Ronald H. Brown* as it conducts a previously planned cruise in the central Pacific.

SEIZING THE MOMENT

The idea for the roughly US\$3-million campaign developed as the warming gathered strength last year; Dole and his colleagues realized that they had a rare opportunity to collect the first detailed atmospheric measurements of a monster El Niño. NOAA scrambled to pull the campaign together in a few months — rather than the usual two to three years that it usually takes to mount a major meteorological field project.

The agency had some resources to spare: thanks to the way El Niño alters conditions over the Atlantic, there were relatively few tropical storms there last year. That meant that NOAA did not use all of the flying time budgeted for the Gulfstream-IV hurricane hunter, which flies over storms to collect data useful for forecasters. The quiet hurricane season also meant that the Global Hawk did not make as many research flights in the Atlantic as planned last year.

“We’ve done this largely by reallocating,” says Dole. “We’re working within the existing budget and shifting everything around.”

Alexey Fedorov, a climate modeller at Yale University in New Haven, Connecticut, says that because extreme El Niño events are so rare, “it is important to use any opportunity to

gather as much data as possible”. Fedorov, who is not part of the campaign, says that researchers lack a full understanding of the way that strong El Niños evolve and alter global weather patterns.

The information gathered over the next few months could yield long-term dividends for El Niño researchers, says Dole. “If we do this well, it will impact our community for the next 10 or 20 years.”

But the project’s immediate goal is to help forecasters to understand how the unruly atmosphere will affect weather now. By gathering direct measurements from this data-poor zone, leaders of the NOAA campaign hope to improve weather forecasts and allow researchers to test weather models to better understand the source of errors in those models.

Data from the Global Hawk will also aid meteorologists tracking El Niño-spawned storms as they barrel down on the western

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United States, says Dole. Over the past few weeks, coastal California has been pummeled by such storms, and more are expected. As part of the El Niño

campaign, NOAA has installed a scanning X-band radar south of San Francisco Bay that will measure precipitation in approaching storms.

The agency will upload data from the field campaign to the World Meteorological Organization’s Global Telecommunications System, so that forecasters around the globe can access the observations. Peter Bauer, an atmospheric modeller at the European Centre for Medium-Range Weather Forecasts in Reading, UK, says that he plans to feed the data into model experiments with the aim of improving forecasts for Europe. The campaign, he says, “has potentially a very big impact”. ■

RESEARCH INTEGRITY

GM-crop papers spark probe

Work describing harm from genetically modified crops was cited in Italian Senate hearing.

BY ALISON ABBOTT

Papers that describe harmful effects to animals fed on genetically modified (GM) crops are under scrutiny for alleged data manipulation. The leaked findings of an ongoing investigation at the University of Naples in Italy suggest that images in the papers may have been intentionally altered.

The leader of the lab that carried out the work says that there is no substance to this claim.

The papers’ findings run counter to those of numerous safety tests carried out by food and drug agencies around the world, which indicate that there are no dangers associated with eating GM food. But the work has been widely cited on anti-GM websites — and results of the experiments that the papers describe were

referenced in an Italian Senate hearing last July on whether the country should allow cultivation of safety-approved GM crops.

“The case is very important also because these papers have been used politically in the debate on GM crops,” says Italian senator Elena Cattaneo, a neuroscientist at the University of Milan whose concerns about the work triggered the investigation.