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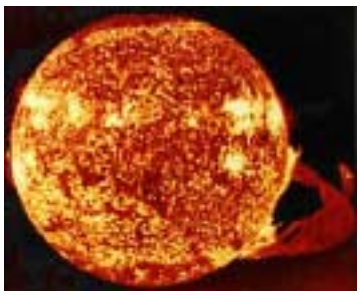
News Update

03/29/2006

US Air Force Begins Preparations for Solar Maximum

By Michael P. Kleiman, Mar 24, 2006



A recently established partnership between the Air Force Research Laboratory and the Air Force Weather Agency seeks to reduce the impact of space environmental effects on Defense Department operational assets through enhanced forecasting of violent solar storms.

Modern military operations have expanded from the traditional domains of land, sea, and air to the ultimate high ground of the cosmos.

The space-based communications, navigation, and surveillance systems can all be adversely affected by the environment in which they operate.

These impacts range from energetic particles in the Van Allen radiation belts disrupting satellite micro-electronics to turbulence in the ionosphere degrading ground-to-space communication links.

The space environment is not a static system to be measured once, corrected, and forgotten. Rather, it is a dynamic 'space weather' system driven by unruly radiation and plasma from the solar surface.

Predicting ferocious flares is unreliable at best. To improve the space weather forecast value to operational end-users, scientists with Air Force Research Laboratory's Solar Disturbance Prediction Program stationed at the National Solar Observatory's complex at Sacramento Peak, N.M., initiated a project called Solar Fusion.

It is a grand "data fusion" effort that aims to bundle state-of-the-art, research-grade solar and space environment data from a large variety of telescopes, satellites, and computer-based models, and make it available to the Air Force Weather Agency's Space Weather Operations Center, the Defense Department's only operational space weather forecast center.

" The Air Force Weather Agency relies on real-time solar measurements to allow accurate forecasting of hazardous space weather conditions," said Lt. Col. William Cade, chief of the Air Force Weather Agency's Applied Technology Division. "Air Force Research Laboratory is a perfect partner to support our space weather forecast mission."

"We need to improve the value of space weather forecasting because things like satellite operations and warfighter communication, as well as navigation on the ground are drastically affected by what the sun is doing," said Dr. Nathan Dalrymple, Solar Disturbance Prediction Program manager, Air Force Research Laboratory's Space Vehicles Directorate, Kirtland AFB, N.M.

"By enabling more accurate forecasts, Solar Fusion allows the Air Force and the Defense Department to better manage its communication networks and satellite operations," he explained.

The first fruits of Solar Fusion were realized in January 2006, when daily solar data began to pass from the Air Force Research Laboratory to the Air Force Weather Agency.

The collaboration currently consists of maps of the solar wind speed projected onto the sun and involves a three-step process.

First, ground-based facilities including the Mount Wilson Observatory, located above Pasadena, Calif., and the National Solar Observatory, Kitt Peak, Ariz., provide solar magnetic field information to the Air Force Research Laboratory facility, situated 15 miles south of Cloudcroft, N.M.

Then, program staff generates a source surface map from the submitted information and send it to the Air Force Weather Agency.

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Finally, the Air Force Weather Agency employs the source surface map to initialize the new Hakamada-Akasofu-Fry (HAF) solar wind model, which forecasts when a coronal mass ejection will strike the Earth. Other ventures between the two agencies have also been planned.

Within the next few months, project personnel will provide solar imagery taken with the Optical Solar Patrol Network to the Air Force Weather Agency, as well as solar magnetic field measurements produced by the Synoptic Optical Long-Term Investigations of the Sun facility at Kitt Peak, which is comprised of a suite of three instruments with a data handling system offering full-disk solar observations. In addition, program staff will forward to the Air Force Weather Agency long-term studies of the sun including climatological research and enhanced solar flare forecasting techniques employing statistical methods.

"We want to be the Air Force Weather Agency's research arm and the trusted source of data that they need," said Dr. Richard Radick, Section Chief, Solar Disturbance Prediction Section. "The products of Solar Fusion will allow the Air Force Research Laboratory to contribute more directly to space weather forecasting and increase our value to the warfighter."

Solar disturbances that hamper military operations include electromagnetic radiation (ultraviolet and visible light, as well as radio frequency emissions), which reaches the Earth within a few minutes; fast particles, traveling at near the speed of light, which impact the globe a few minutes to hours after the flares; and vast clouds of plasma known as the coronal mass ejections which hit the planet one to three days after erupting from the sun.

To detect these space weather storms, Air Force Weather Agency has relied on solar telescopes, satellite measurements, and the intuition of skilled human forecasters.

On the other hand, Solar Fusion has already enhanced the current forecasting process by enabling the operation of a state of the art, computer-based coronal mass ejection forecasting tool - the HAF model.

When complete, Solar Fusion will provide far-ranging upgrades to our current capabilities, by gathering environmental data from the heavens from a variety of sources including ground-based optical, radio, ionospheric and space-based observatories, as well as empirical/numerical models.

"Basic research, by itself, is not worth much, but when it is transitioned through applied research into operational products it becomes indispensable to the warfighter," said Dalrymple. "Our relationship with the Air Force Weather Agency is a two-way street that we are trying to build and foster and Solar Fusion provides a firm foundation."

Source

Mega Eruption of Yellowstone's Southern Twin

By Sciencedaily, Mar 28

North America isn't the only continent that's experienced super-colossal volcanic eruptions in the recent geologic past. The massive explosion of the almost unknown Vilama Caldera in Argentina appears to have matched Yellowstone's last continent-blanketing blast. It may, in fact, be just one of several unappreciated supervolcanoes hidden in a veritable mega-volcano nursery called the Eduardo Avaroa Caldera Complex, located in the inhospitable Puna-Altiplano region near the tri-section of Argentina, Bolivia, and Chile.

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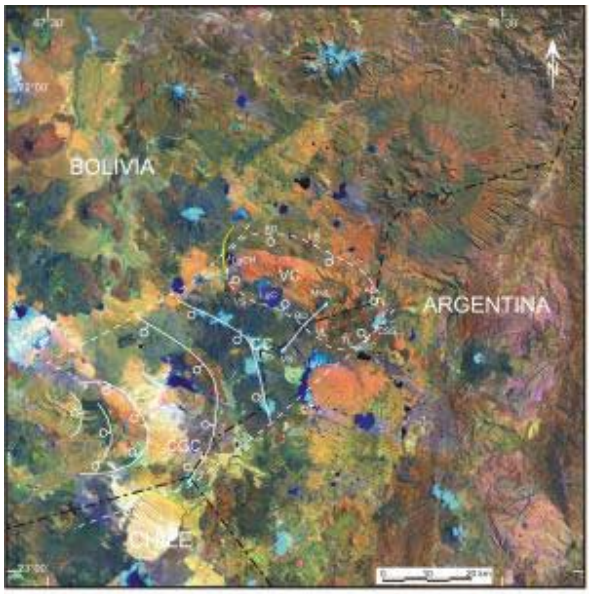
The Vilama Caldera appears to have been created when the 10 by 24-mile roof catastrophically collapsed on a chamber of molten rock, or magma, explosively venting vast amounts of ignimbrites out in various directions. That massive roof collapse is the one thing all large calderas have in common and what separates them from the exponentially smaller "single vent" volcanic eruptions like Mount St. Helens or Mount Pinatubo.



Satellite image of the study area (Landsat TM). The political boundary between Argentina, Chile and Bolivia (dashed black line), as well as the new location and main features of the Vilama caldera (yellow line: topographic rim; white line: structural rim and inferred faults) have been marked. Main collapse calderas in the proximity to the Vilama structure (white lines), and some topology of the area, have also been plotted for reference (VC: Vilama caldera; CC: Coruto caldera; CGC: Cerro Guacha calderas; KD: Khastor domes; KS: Khastor stratovolcano; AS: Alcoak stratovolcano; CSS: Cerro Salle stratovolcano; TL: Toloma lavas; VL: Vilama lavas; BD: Bayo dome; MNL: Mesada Negra lavas; VD: Vitichi domes; VS: Vilama stratovolcano; LgCH: Laguna Chojllas; LgC: Laguna Coruto; LgV: Laguna Vilama).

But that's where the similarities with Yellowstone end, says Soler. The magma under Yellowstone is thought to be created by the melting of ancient crust under North America, buoying back up and creating a hot spot. Vilama's magma was probably created by a more complex melting of the crust caused by the South American Plate colliding with and overriding the Nazca Plate to the west. The resulting kneading of the crust — the thickening and thinning, pressurizing and depressurizing — caused large pockets of rock to melt and eventually led to a series of gigantic caldera eruptions.

The trigger for the Vilama mega-eruption, says Soler, was probably the same thing that gave the caldera its football-like shape: The tectonic faults in the roof of the magma chamber which probably formed as a consequence of its own instability and/or from the significant stresses in the crust in that area. The crystal-rich nature of the ignimbrites and minimal signs of pre-eruption gases also point to an external trigger for the vast eruption, says Soler.

Much remains unknown about Vilama Caldera, says Soler, largely because it is a terribly difficult caldera to study. Unlike Yellowstone, which has the Yellowstone River cutting through it and exposing the layers of volcanic rock, called stratigraphy, for easy reading by geologists, Vilama is in one of the driest places on Earth.

"There is not much topographic relief to permit viewing of many complete columns of stratigraphy," said Soler. What's more, most of the region is more than 13,000 feet above sea level, which makes field work in the area particularly physically demanding, as well. All this also explains why Vilama is just the first of several important calderas in the region that deserve a lot more scientific attention, he said.

"Among the other calderas in the region that need to be studied in detail and which in all cases are also certainly 'supervolcanoes' are Cerro Guacha, Coruto, Pastos Grandes, and Capina," said Soler.

The study of these supervolcanoes is not an end in itself, according to Soler. Figuring out their histories and how and why they erupted will help geologists grasp the regional forces that have been at work in one of the Earth's thickest patches of crust, as well as give clues to other calderas worldwide.

Source