

SPECIAL DOUBLE ISSUE

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AVIATION WEEK

& SPACE TECHNOLOGY

50

YEARS

OF SPACEFLIGHT



EART



Earth observation has made great strides since April 1960, when the Tiros 1 spacecraft (inset, above) collected this first television image of Earth in black and white. The color image of the Western Hemisphere at right is a mosaic of satellite data assembled in 2002, much of it from the Moderate Resolution Imaging Spectroradiometer (Modis), an instrument on NASA's Terra satellite flying more than 700 km. (440 mi.) above Earth. For obvious reasons, this is known as a "blue marble" image.

German-designed V-2 rocket takes first picture of Earth from space, 100 mi. over New Mexico.

Photo-mosaic of tropical storm in Gulf of Mexico assembled after first launch from Cape Canaveral, Fla., on a two-stage V-2/WAC Corporal "Bumper" rocket.

Sputnik 1 launched.

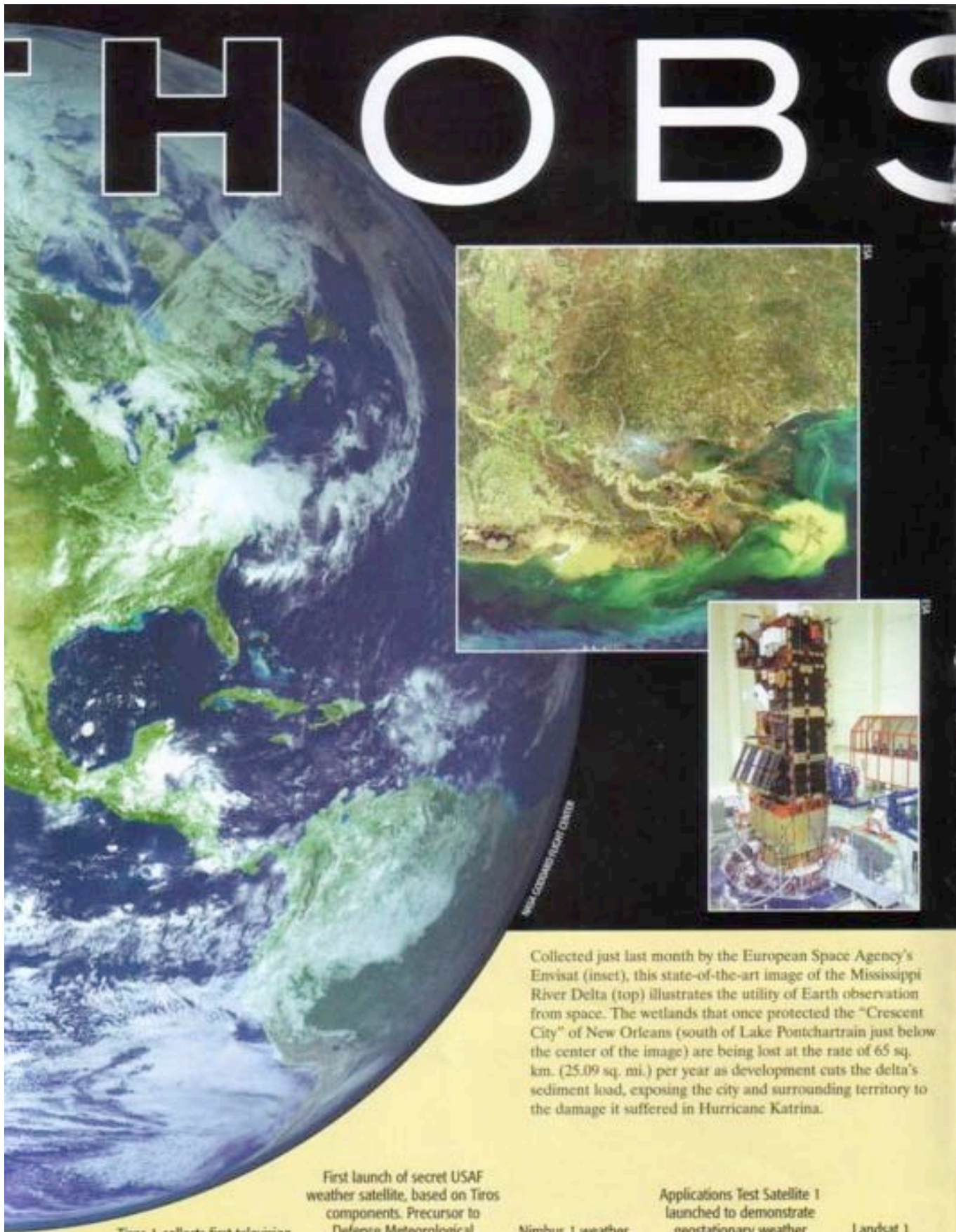
Explorer 1 detects Van Allen Belt.

Mar. 7, 1947

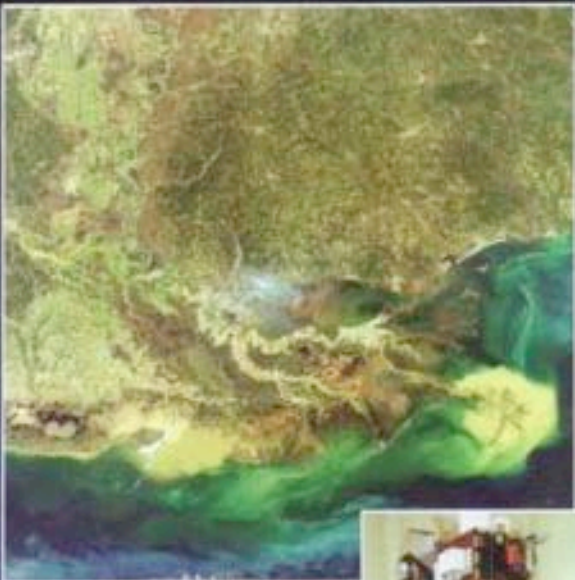
July 24, 1950

Oct. 4, 1957

January 1958



H O B S



WORLD COURTESY: NASA/ESA

Collected just last month by the European Space Agency's Envisat (inset), this state-of-the-art image of the Mississippi River Delta (top) illustrates the utility of Earth observation from space. The wetlands that once protected the "Crescent City" of New Orleans (south of Lake Pontchartrain just below the center of the image) are being lost at the rate of 65 sq. km. (25.09 sq. mi.) per year as development cuts the delta's sediment load, exposing the city and surrounding territory to the damage it suffered in Hurricane Katrina.

Tiros 1 collects first television image of Earth from orbit.

First launch of secret USAF weather satellite, based on Tiros components. Precursor to Defense Meteorological Satellite Program.

Nimbus 1 weather satellite launched.

Applications Test Satellite 1 launched to demonstrate geostationary weather observation.

Landsat 1 launched.

April 1960

Aug. 23, 1962

Aug. 28, 1964

Dec. 7, 1966

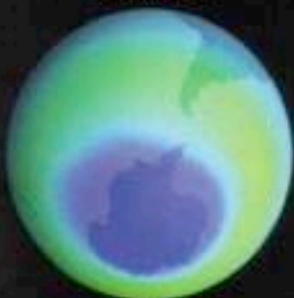
July 23, 1972

SERVA



SEPTEMBER 1980

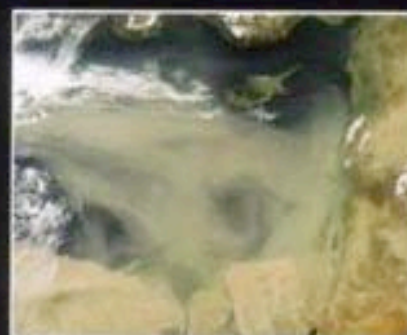
SEPTEMBER 1987



SEPTEMBER 1993



SEPTEMBER 1999



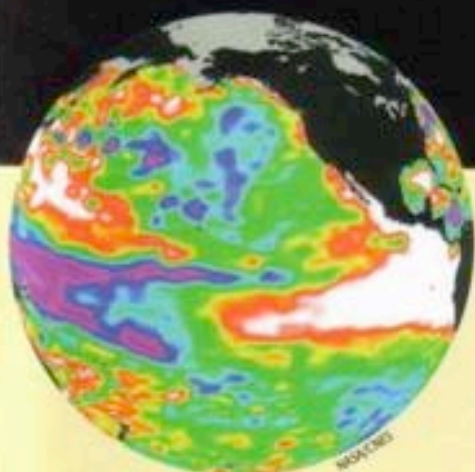
NASA Aqua/COR



NASA



NASA



NOAA/CIRES

Satellite observations provide scientists with valuable information about changes in the atmosphere and oceans. The Total Ozone Mapping Spectrometer (TOMS) instruments flown on four different orbiting spacecraft since 1978 have traced the shifting hole in the protective ozone layer over Earth's poles (Antarctica is shown at left above). The change is attributed to the human release of chlorofluorocarbons into the atmosphere. Ocean-surface topography measurements from space allow researchers to trace the huge currents that shape continental weather, like El Niño depicted as white in the Pacific Ocean image at left. On a faster scale, satellites can give forecasters real-time views of weather events like the Sahara sandstorm sweeping across the Eastern Mediterranean at top, collected Feb. 24 by the Modis instrument on NASA's Aqua satellite.

Synchronous Meteorological Satellite 1 launched – first operational geostationary weather satellite.

May 17, 1974

Launch of NASA's Seasat, first ocean-monitoring spacecraft using synthetic aperture radar (SAR).

June 27, 1978

Nimbus 7 launched with first TOMS instrument.

Oct. 24, 1978

Launch of Almaz 1, quasi-commercial radar-imaging satellite based on Soviet-era military space station.

Mar. 31, 1991

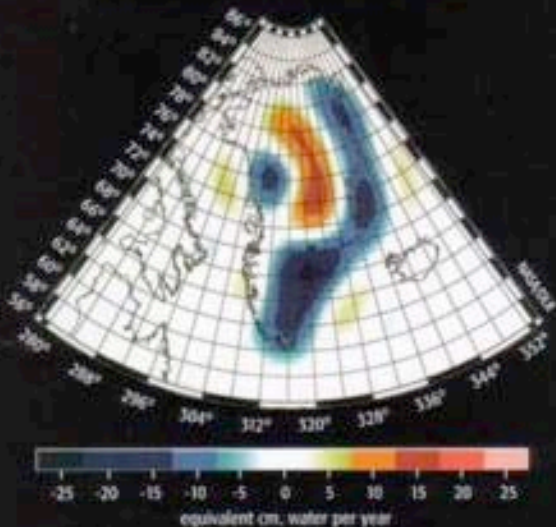
Canada's Radarsat-1 commercial SAR Earth-observing spacecraft launched.

Nov. 4, 1995

ATION



GREENLAND MASS TREND FROM GRACE



Precise data on the distance separating the twin Gravity Recovery and Climate Experiment (Grace) satellites allows scientists to calculate the mass of the terrain below them, producing gravity maps like the one above. It shows that the summertime ice loss in coastal regions of Greenland (blue) exceeds the wintertime gain in the island's interior (orange) by a factor of three. Composite satellite data from the same region (left) provide more evidence that global warming is causing a dramatic decline in the sea ice surrounding the North Pole.

The images at top from U.S. Landsats 2, 4 and 7 show deforestation in the tropical dry forest east of Santa Cruz de la Sierra, Bolivia, from 1975 to 2000. Continuity of the Landsat data is imperiled by technical and management problems, and a gap is expected at the end of this decade. The Advanced Spaceborne Thermal Emission and Reflection Radiometer (Aster) instrument on NASA's Terra satellite provides scientists detailed maps of land-surface temperature, reflectance and elevation, as in the above image of snowcapped Himalayan peaks and ridges in southwestern China. It also allows us to witness Earth's beauty from orbit.

U.S./Japanese Tropical Rainfall Measuring Mission (TRMM) launched.

Launch of Ikonos, the first high-resolution commercial imagery satellite.

Terra (EOS AM-1) launched - first in Earth Observing System series.

Europe's Envisat launched.

Twin Gravity Recovery and Climate Experiment (Grace) satellites launched.

Nov. 28, 1997

Sept. 24, 1999

Dec. 18, 1999

Mar. 1, 2002

Mar. 17, 2002