



Universidad
Nacional
de Córdoba



DOCTORADO EN
CIENCIAS GEOLOGICAS

Curso de posgrado

LA GEOMORFOLOGÍA Y *CAMBIO CLIMATICO*

SEPTIEMBRE 2022

Docentes: ***Gabriella M. Boretto (CICTERRA-CONICET-UNC)*** ***Marcela A. Cioccale (FCEPyN-UNC)***

TEMA 5

- Sensoramiento remoto y Sistema de Información Geográfica (SIG).

La teledetección por satélite ha proporcionado importantes avances en la comprensión del sistema climático y sus cambios, al cuantificar procesos y estados espacio-temporales de la atmósfera, la tierra y los océanos.

En algunos descubrimientos importantes sobre el sistema climático que no han sido detectados por los modelos climáticos y las observaciones convencionales;

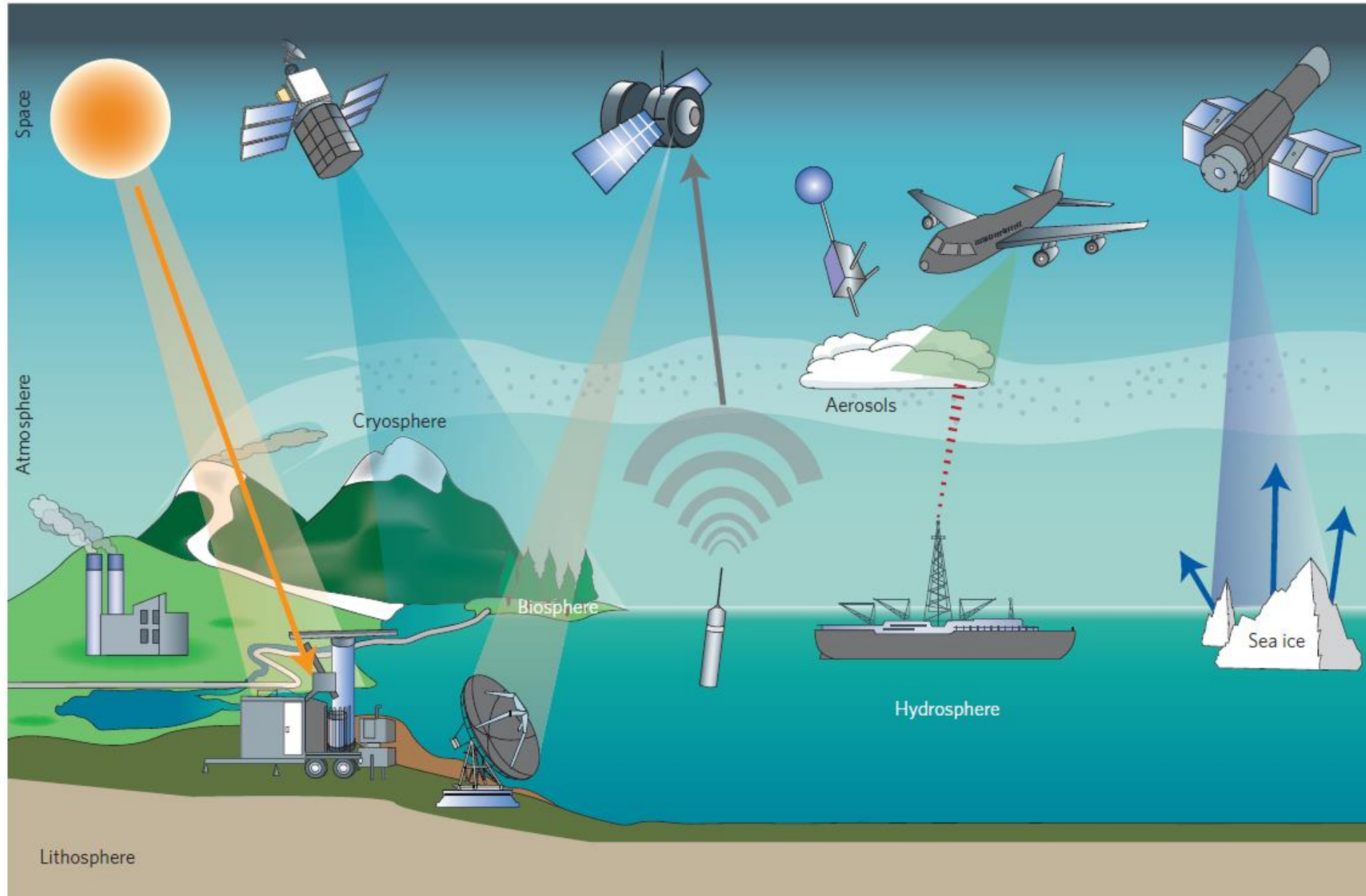
Por ejemplo, el patrón espacial de la subida del nivel del mar y los efectos de enfriamiento del aumento de los aerosoles estratosféricos. Los nuevos conocimientos son posibles gracias a la inigualable cobertura espacial a escala global de las observaciones por satélite.

Sin embargo, la corta duración de las series de observación y sus incertidumbres siguen planteando problemas para captar las tendencias sólidas a largo plazo de muchas variables climáticas. (Yang et al. 2019)

The role of satellite remote sensing in climate change studies

Jun Yang¹, Peng Gong^{1,2,3*}, Rong Fu⁴, Minghua Zhang⁵, Jingming Chen^{6,7}, Shunlin Liang^{8,9}, Bing Xu^{8,10}, Jiancheng Shi² and Robert Dickinson⁴

Satellite remote sensing has provided major advances in understanding the climate system and its changes, by quantifying processes and spatio-temporal states of the atmosphere, land and oceans. In this Review, we highlight some important discoveries about the climate system that have not been detected by climate models and conventional observations; for example, the spatial pattern of sea-level rise and the cooling effects of increased stratospheric aerosols. New insights are made feasible by the unparalleled global- and fine-scale spatial coverage of satellite observations. Nevertheless, the short duration of observation series and their uncertainties still pose challenges for capturing the robust long-term trends of many climate variables. We point out the need for future work and future systems to make better use of remote sensing in climate change studies.



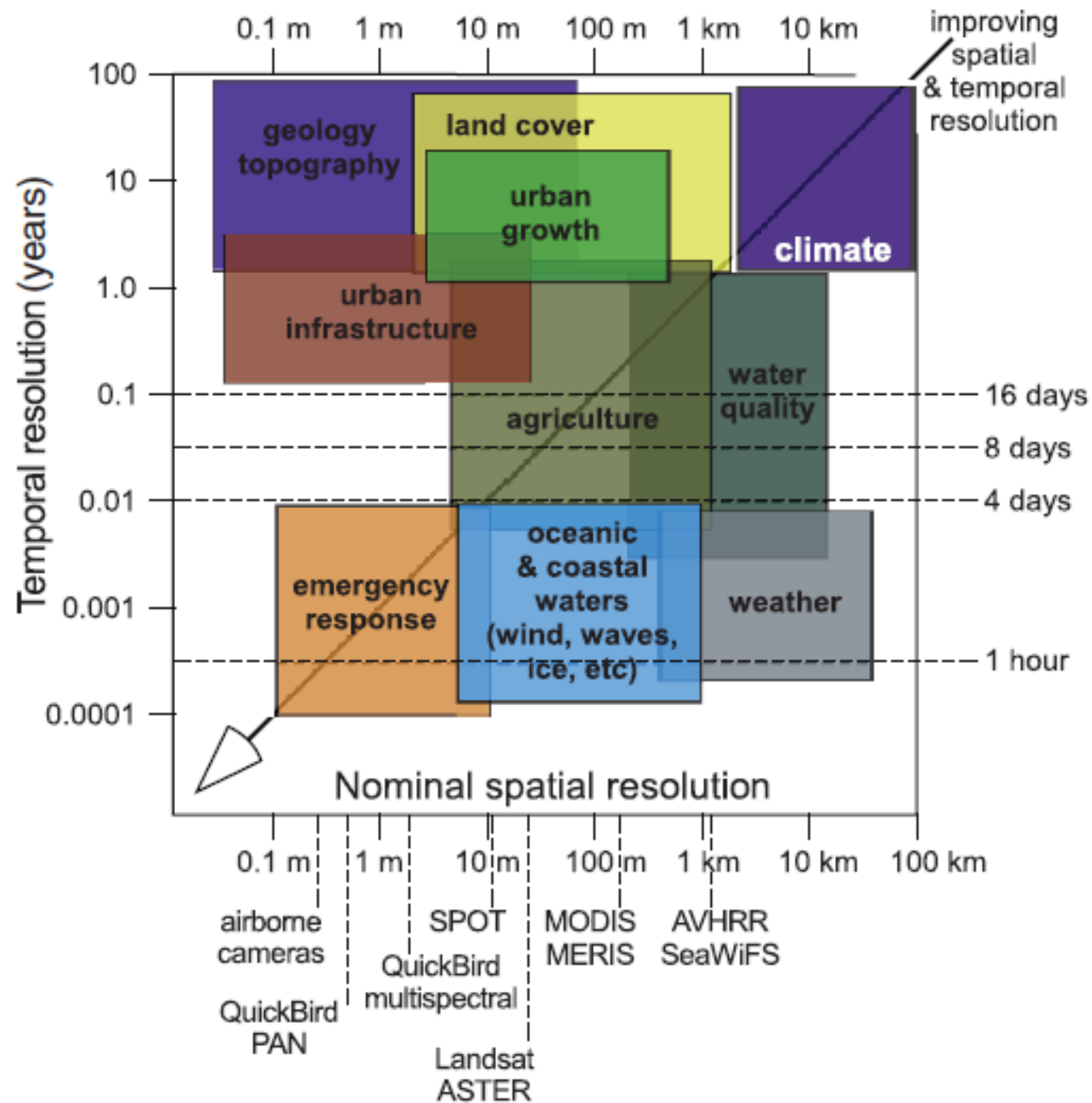


Table 3.1 Classification of remote sensors.

Classification by application	Classification by wavelength	Classification by mode
Imagers (mappers)	Visible	Active
Photographic (film)	(array or film)	LiDAR
Multispectral (array)		Radar
Radar	Near infrared	†Sonar
†Side-scan sonar	(reflected)	
		Passive
Radiometers	Thermal infrared	Visible
	(emitted)	Infrared
Spectrometers		Microwave
	Microwave	
Profilers (rangers)		
LiDAR, Radar	†Sound waves	
	†Seismic waves	

† Not electromagnetic waves

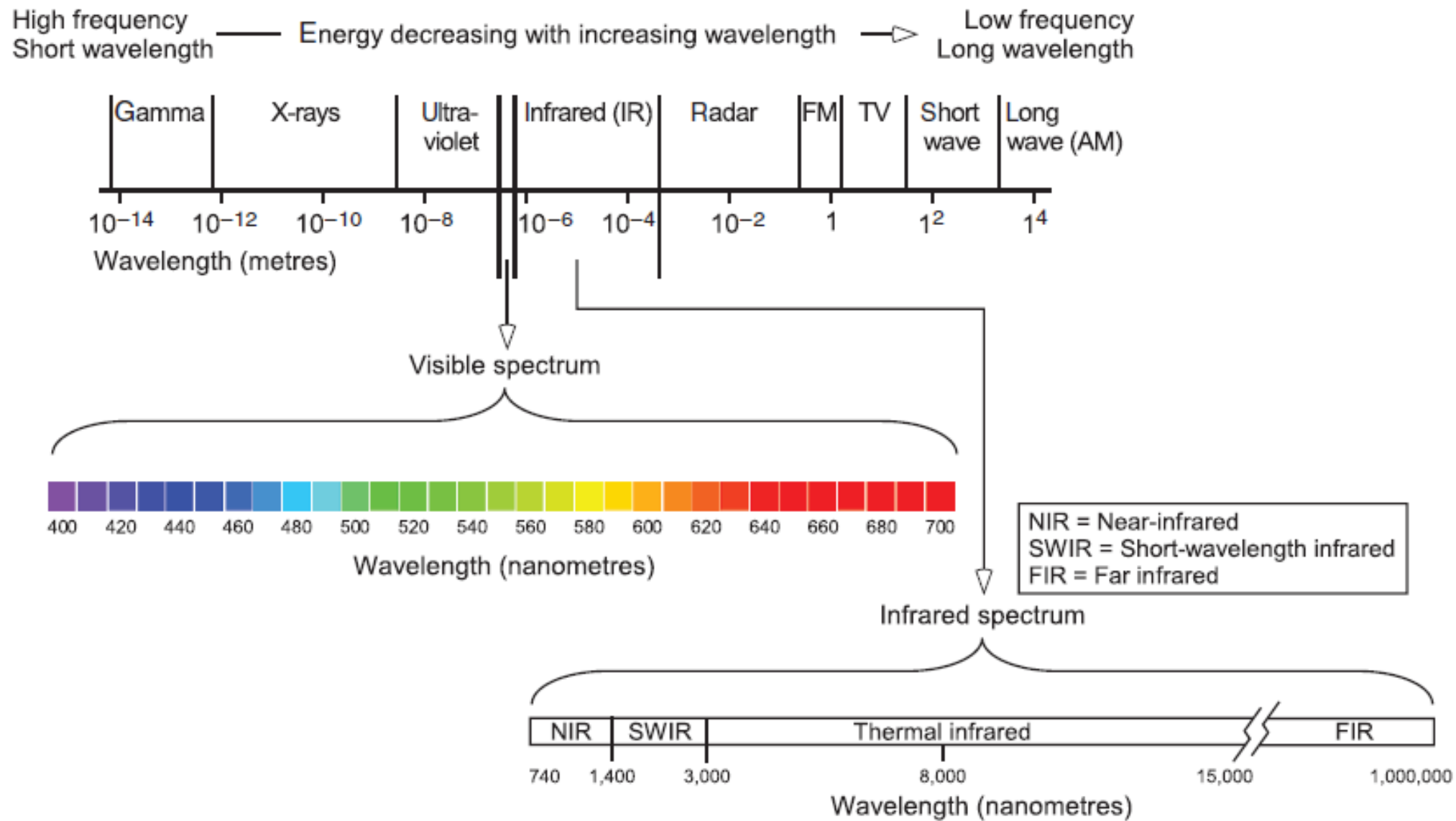
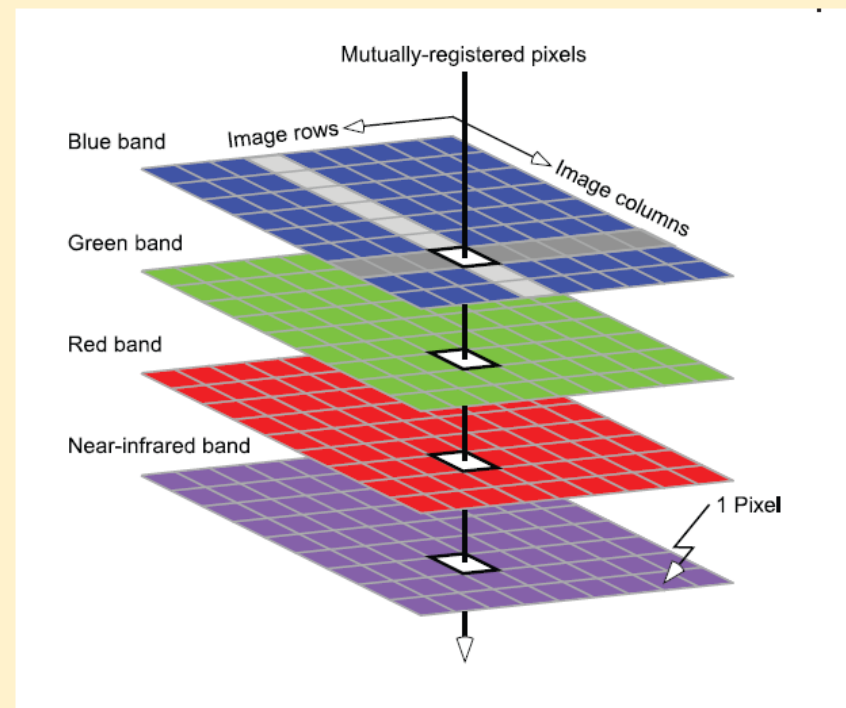
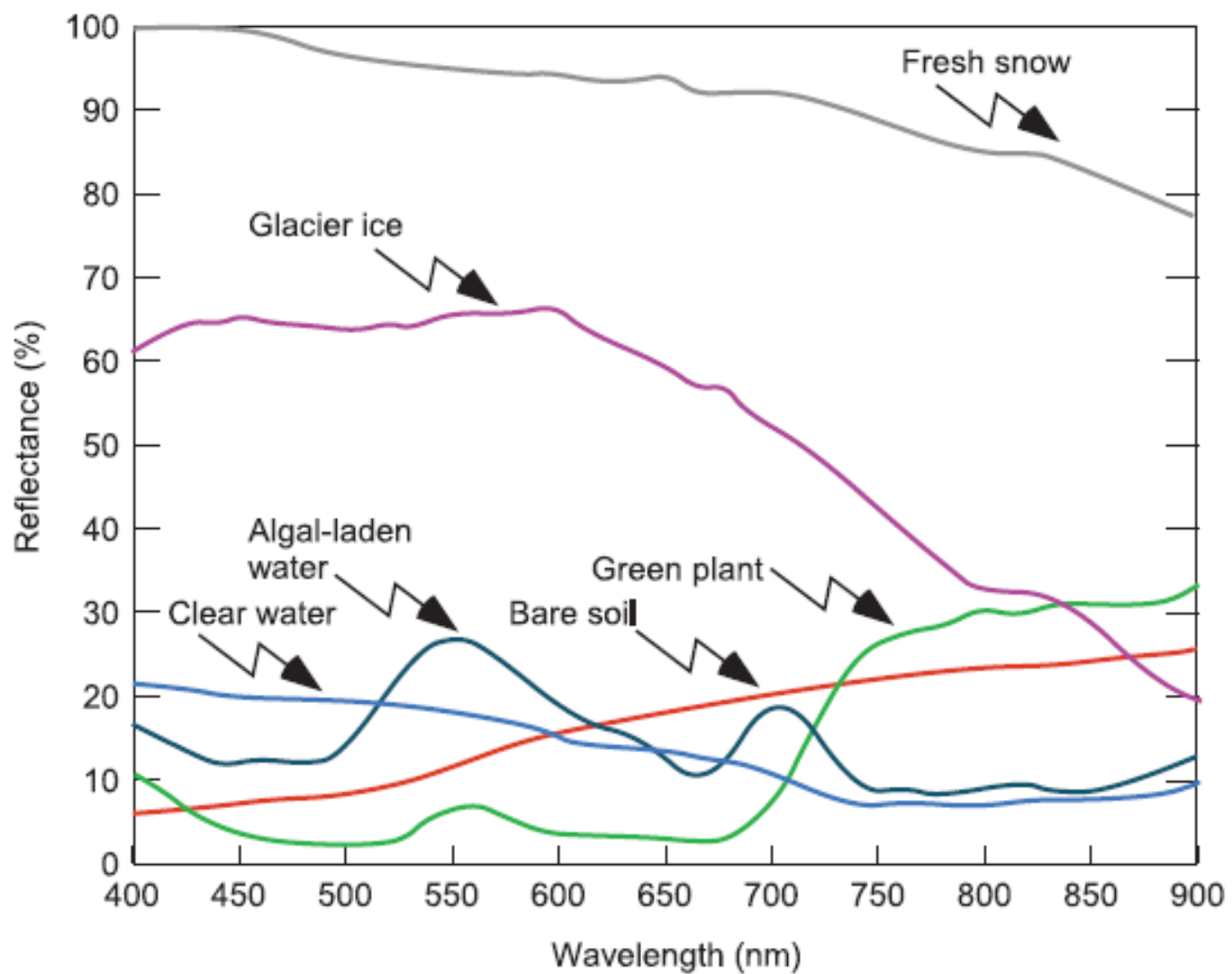


Figure 2.3 The electromagnetic spectrum.



Los satélites de observación de la Tierra de la NASA observan los cambios en todo el planeta, desde la atmósfera, la biosfera, la hidrosfera, la criosfera y la litosfera.

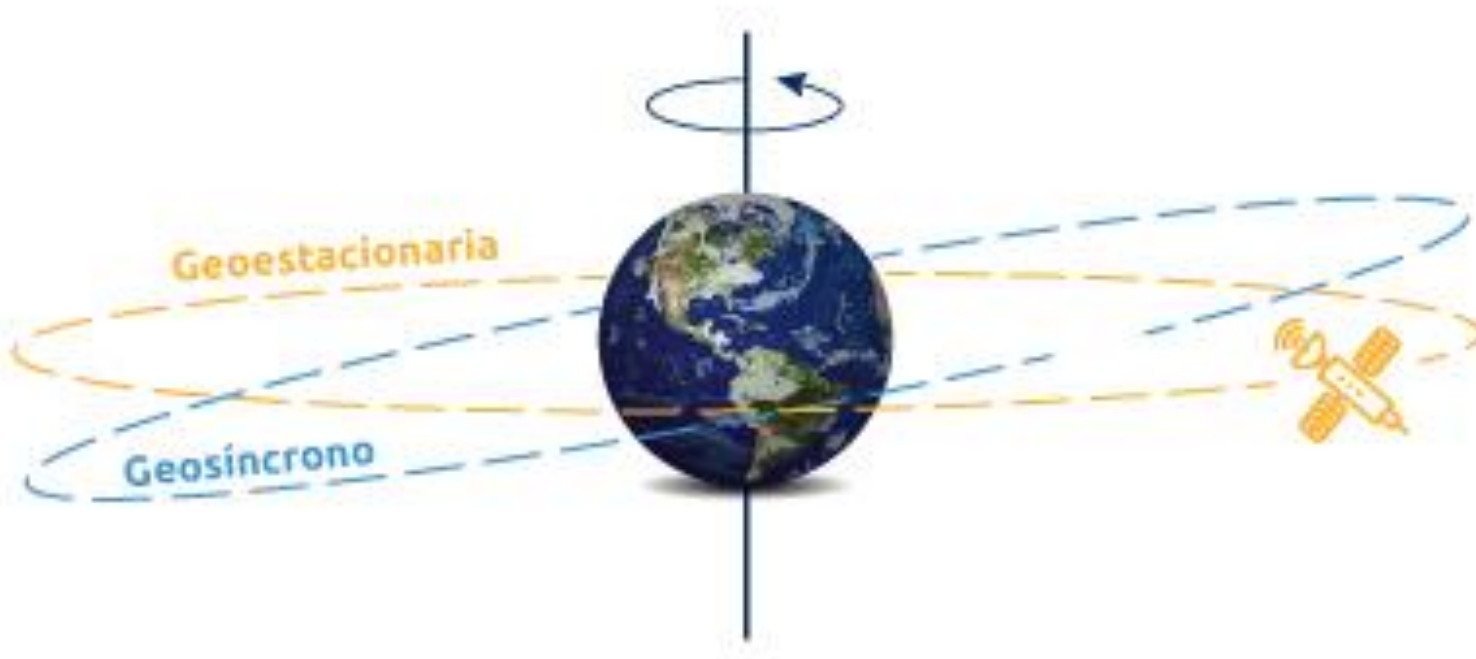
Proporcionan mediciones consistentes, oportunas, globales y precisas, desde los trópicos hasta las regiones polares.

La NASA lleva a cabo un programa de investigación de vanguardia sobre la ciencia del clima, mejorando la capacidad de la comunidad científica internacional para avanzar en la ciencia del sistema terrestre integrado a nivel mundial.



Hay varios tipos básicos de satélites artificiales que orbitan sobre la Tierra: satélites geoestacionarios y satélites polares.

Geoestacionarios: son aquellos que se mueven en dirección este-oeste por encima del Ecuador. Siguen la dirección y velocidad de la rotación de la Tierra



Los satélites geosincrónicos pueden tener cualquier inclinación, la diferencia clave con la órbita geoestacionaria es el hecho de que se encuentran en el mismo plano que el Ecuador.

Las órbitas geoestacionarias caen en la misma categoría que las órbitas geosincrónicas, pero están estacionadas sobre el Ecuador. Esta cualidad especial

Table 3.2 Characteristics of some current and scheduled remote sensing systems. SAV denotes Submerged Aquatic Vegetation. Modified from Donato & Klemas (2001).

Satellite/sensor	Spectral range	Bands	Spatial resolution	Revisit time	Swath-width	Applications
AVHRR NOAA 15/16	580–12,500 nm	6	1.1 km	< 12 h	2,400 km	SST, turbidity, circulation
SeaWiFS	402–885 nm	8	1.1 km	daily	2,800 km	Ocean colour, red products
MODIS Terra/Aqua	620–14,385 nm	16 VNIR	variable	daily	2,330 km	SST, turbidity, circulation
		4 SWIR	250 m			Ocean colour
		16 TIR	1 km	< 12 h		
MISR Terra (9 camera angles)	425–886 nm	4	275 m	9d	360 km	Ocean colour, circulation
ASTER Terra	520–11,650 nm	3 VNIR	15 m	16 d	60 km	Coral reef, SAV, vegetation
		6 SWIR	30 m			Land use, change detection
		5 TIR	90 m			Circulation, geomorphology
LANDSAT-7	450–20,80 nm	6 VNIR	30 m	16 d	180 km	Coral reef, SAV, vegetation
	10,420 nm	1 TIR	60 m			Land use, change detection
		1 Pan	15 m	16 d		Geomorphology, circulation
SPOT 1-2-4-5	500-890 nm	3 MS	20 m	26 d	60km	Coral reef, SAV, vegetation
		1 Pan	10 m	daily		Land use, change detection
						Geomorphology, circulation
IKONOS	450–750 nm	4 MS	4 m	1–3 d	13 km	Coral reef, SAV, vegetation
		1 Pan	1 m			Littoral processes, digital elevation models
QuickBird-2	450–900 nm	4 MS	2.4 m	1 d	16.4 km	Coral reef, SAV, vegetation
		1 Pan	0.61 m			Littoral processes, digital elevation models
WorldView-2	400–1,040 nm	8 MS	1.8 m	≈ 2 d	16.4 km	Coral reef, SAV, vegetation
		1 Pan	0.46 m			Littoral processes, digital elevation models
Orbview 3	450–900 nm	4 MS	4 m	< 3 d	8 km	Coral reef, SAV, vegetation
		1 Pan	1 m			Littoral processes, digital elevation models
Orbview 4	450–2,500 nm	200 HS	8 m	< 3 d	5 km	Coral reef, SAV, vegetation
	450–900 nm	4 MS	4 m		8 km	Littoral processes
		1 Pan	1 m			Digital elevation models
ALIEO-1	400–2,400 nm	9 MS	30 m	19 d	37 km	Coral reef, SAV, vegetation
		1 Pan	10 m			Land use, change detection, geomorphology, circulation
Hyperion EO-1	400–2,400 nm	220	30 m	16 d	8 km	Coral reef, SAV, vegetation, littoral processes
NEMO/COIS	400–2,500 nm	210	30 m			Coral reef, SAV, vegetation, littoral processes
MERIS ENVISAT-1	290–1,040 nm	15	300 m	< 3 d	1,150 km	Ocean colour, circulation
ASAR ENVISAT-1	C-band 4 pol	2	30 m	< 3 d	50–100 km	Circulation, waves
AMI ERS-2(SAR)	C-band V pol	1	25 m	28 d	100 km	Circulation, waves
RADARSAT-1(SAR)	C-band H pol	1	6–100 m	1–4 d	20–500 km	Circulation, waves
RADARSAT-2(SAR)	C-band HV pol	1	3–100 m	Quick	20–500 km	Circulation, waves

Table 3.4 Typical Remote sensing requirements.

	Open ocean	Coasts/estuaries	Land
Spatial resolution	1–10 km	20–200 m	1–30 m
Extent (coverage)	2,000 km	200 km	20–200 km
Frequency of coverage	1–6 days	0.5–6 hours	0.5–5 years
Dynamic range	Narrow	Wide	Wide
Radiometric resolution	10–12 bits	10–12 bits	8–10 bits
Spectral resolution	Multispectral	Hyperspectral	Multispectral (hyperspectral)

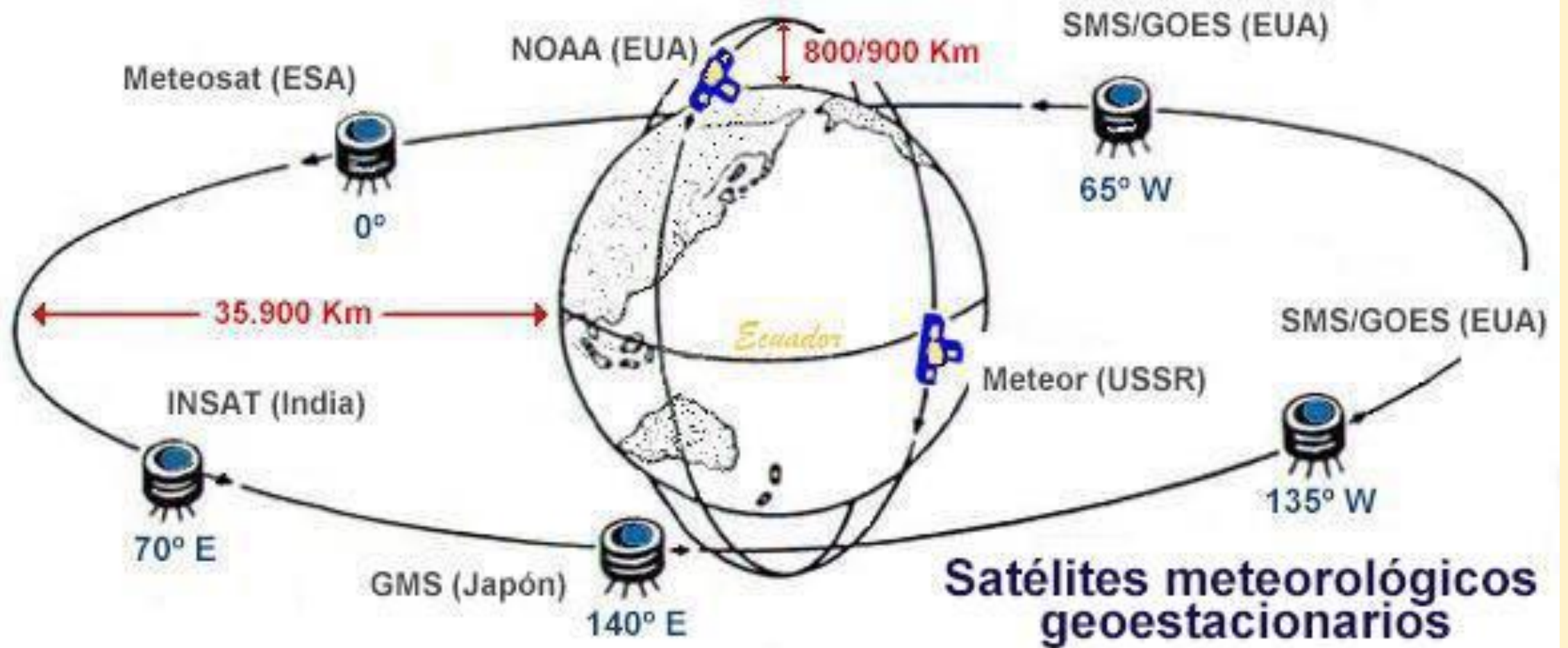
Table 3.6 High-resolution satellite parameters and spectral bands (Space Imaging, 2003; DigitalGlobe, 2003; Orbimage, 2003; Parkinson, 2003).

		IKONOS	QuickBird	OrbView-3	WorldView-1	GeoEye-1	WorldView-2
Sponsor		Space Imaging	DigitalGlobe	Orbimage	DigitalGlobe	GeoEye	DigitalGlobe
Launched		Sep 1999	Oct 2001	Jun 2003	Sep 2007	Sep 2008	Oct 2009
Spatial resolution (m)	Panchromatic	1.0	0.61	1.0	0.5	0.41	0.5
	Multispectral	4.0	2.44	4.0	n/a	1.65	2
Spectral range (nm)	Panchromatic	525–928	450–900	450–900	400–900	450–800	450–800
	Coastal blue	n/a	n/a	n/a	n/a	n/a	400–450
	Blue	450–520	450–520	450–520	n/a	450–510	450–510
	Green	510–600	520–600	520–600	n/a	510–580	510–580
	Yellow	n/a	n/a	n/a	n/a	n/a	585–625
	Red	630–690	630–690	625–695	n/a	655–690	630–690
	Red edge	n/a	n/a	n/a	n/a	n/a	705–745
	Near-infrared	760–850	760–890	760–900	n/a	780–920	770–1,040
Swath width (km)		11.3	16.5	8	17.6	15.2	16.4
Off nadir pointing		±26°	±30°	±45°	±45°	±30°	±45°
Revisit time (days)		2.3–3.4	1.0–3.5	1.5–3	1.7–3.8	2.1–8.3	1.1–2.7
Orbital altitude (km)		681	450	470	496	681	770

Table 4.2 Landsat Thematic Mapper bands (Lachowski *et al.*, 1995).

Band	Wavelength (nm)	Application
1	450–520 Blue band	Coastal water mapping, bathymetric mapping of shallow water, soil/vegetation differentiation, deciduous/conifer difference, cultural feature identification
2	520–600 Green band	Green reflectance by healthy vegetation, vigour assessment and cultural feature identification; important for discriminating vegetation types
3	630–690 Red band	Chlorophyll absorption for plant species differentiation
4	760–900 Near infrared	Biomass surveys, water delineation, vegetation types, vigour, soil moisture
5	1,550–1,750 Mid-infrared	Vegetation moisture measurement, snow/ cloud difference, soil moisture measurement
6	10,400–12,500 Thermal infrared	Vegetation heat stress analysis, soil moisture, urban heat island and water surface temperature mapping applications
7	2,080–2,350 Mid-infrared	Hydrothermal mapping, mineral and rock type, vegetation moisture content

Los satélites geoestacionarios están ubicados en un punto fijo de la "órbita geoestacionaria", situada a una distancia cercana a los 35800 Km. del ecuador terrestre. Permiten la observación continua de una área geográfica las 24 horas del día, ya que completan en este tiempo una órbita alrededor de la Tierra.

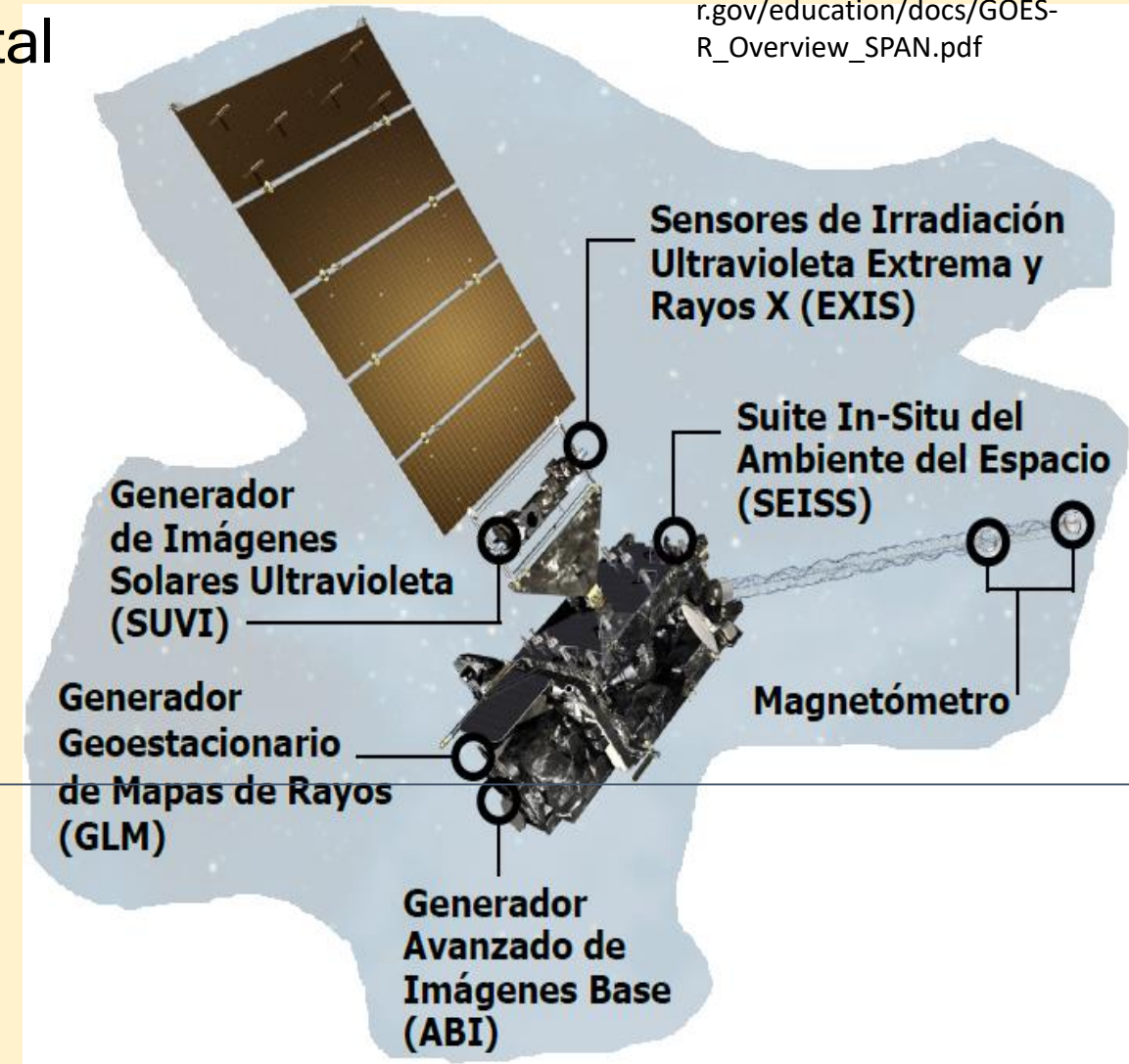
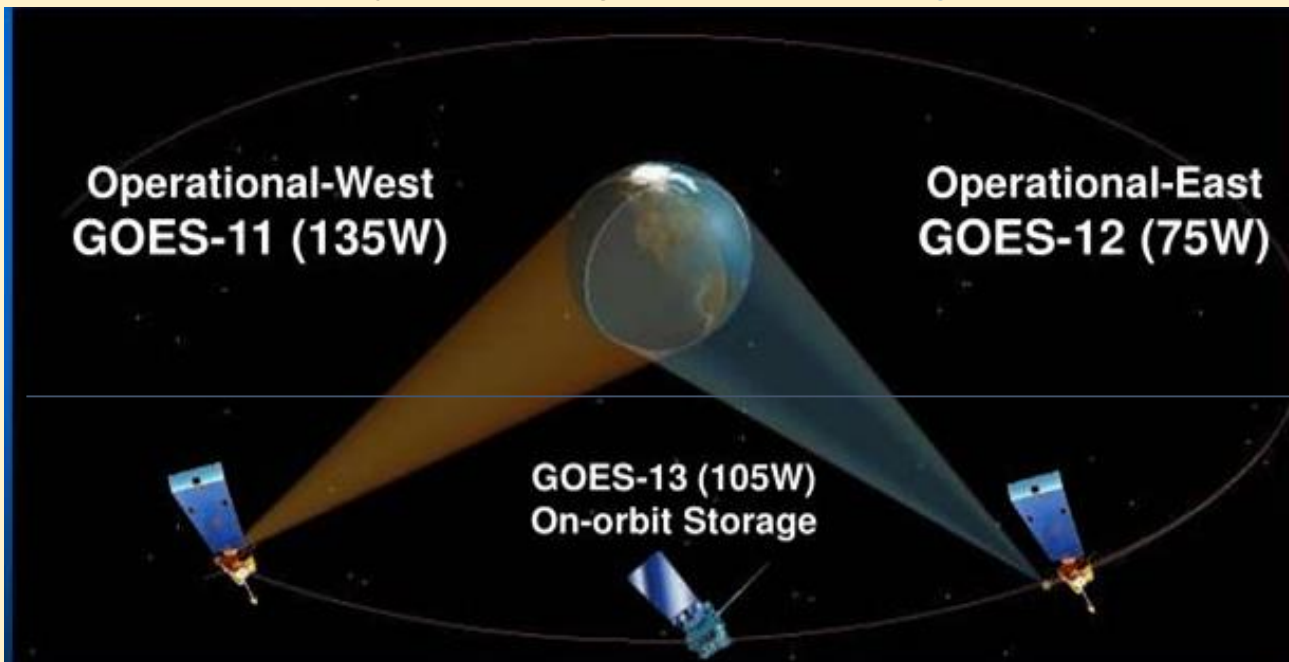


Geostationary Operational Environmental Satellite (GOES)

Satelite Operacional Geoestacionario Ambiental

GOES es una de las claves del programa estadounidense del National Weather Service "NWS" de la NOAA. Los datos de imágenes y de sonda del GOES son continuos y proveen una corriente de información ambiental para soportar el [pronóstico del tiempo](#), el seguimiento de tormentas severas, y para investigación de [meteorología](#).

https://www.goes-r.gov/education/docs/GOES-R_Overview_SPAN.pdf



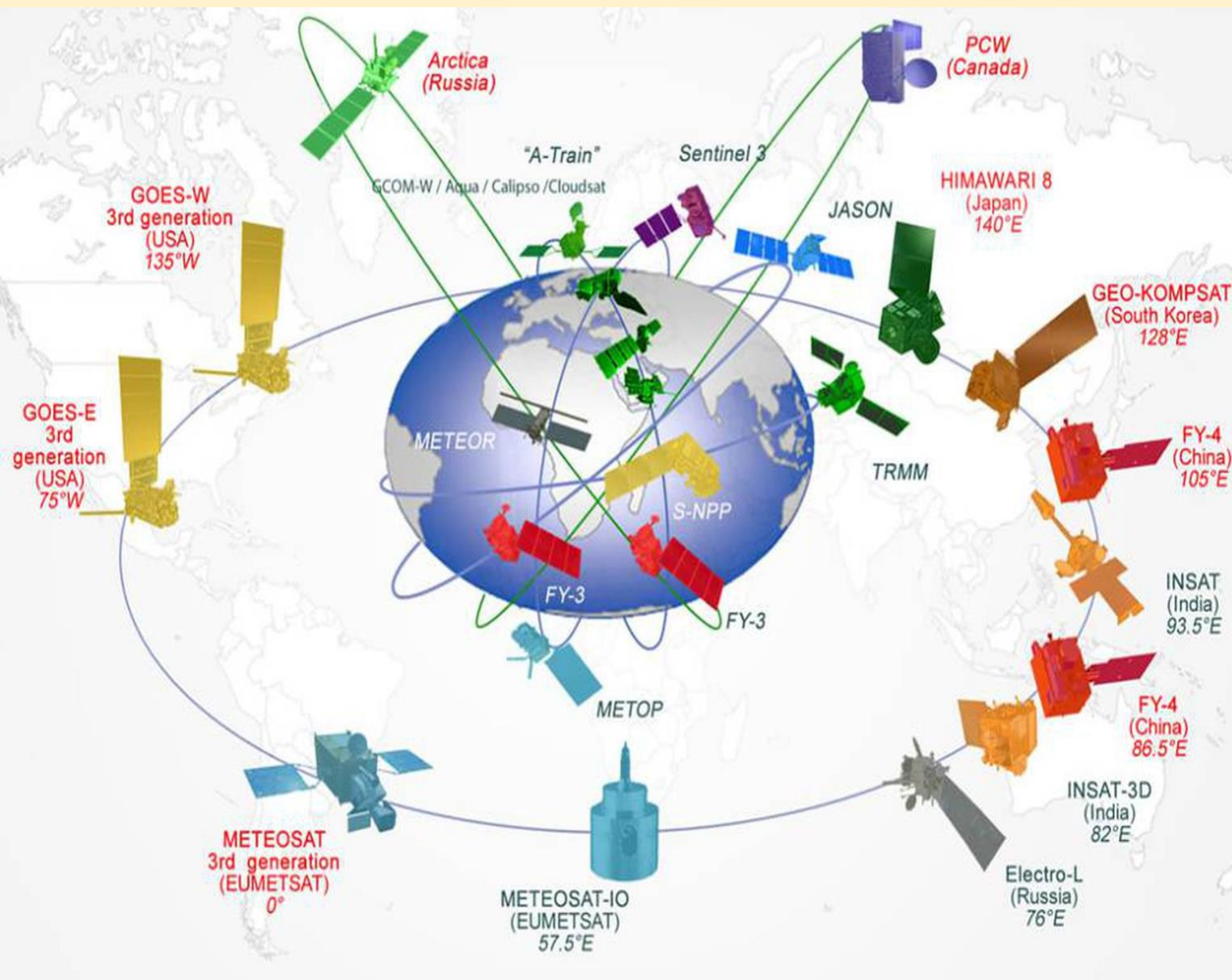


GOES-R ABI Bands and Bandwidths

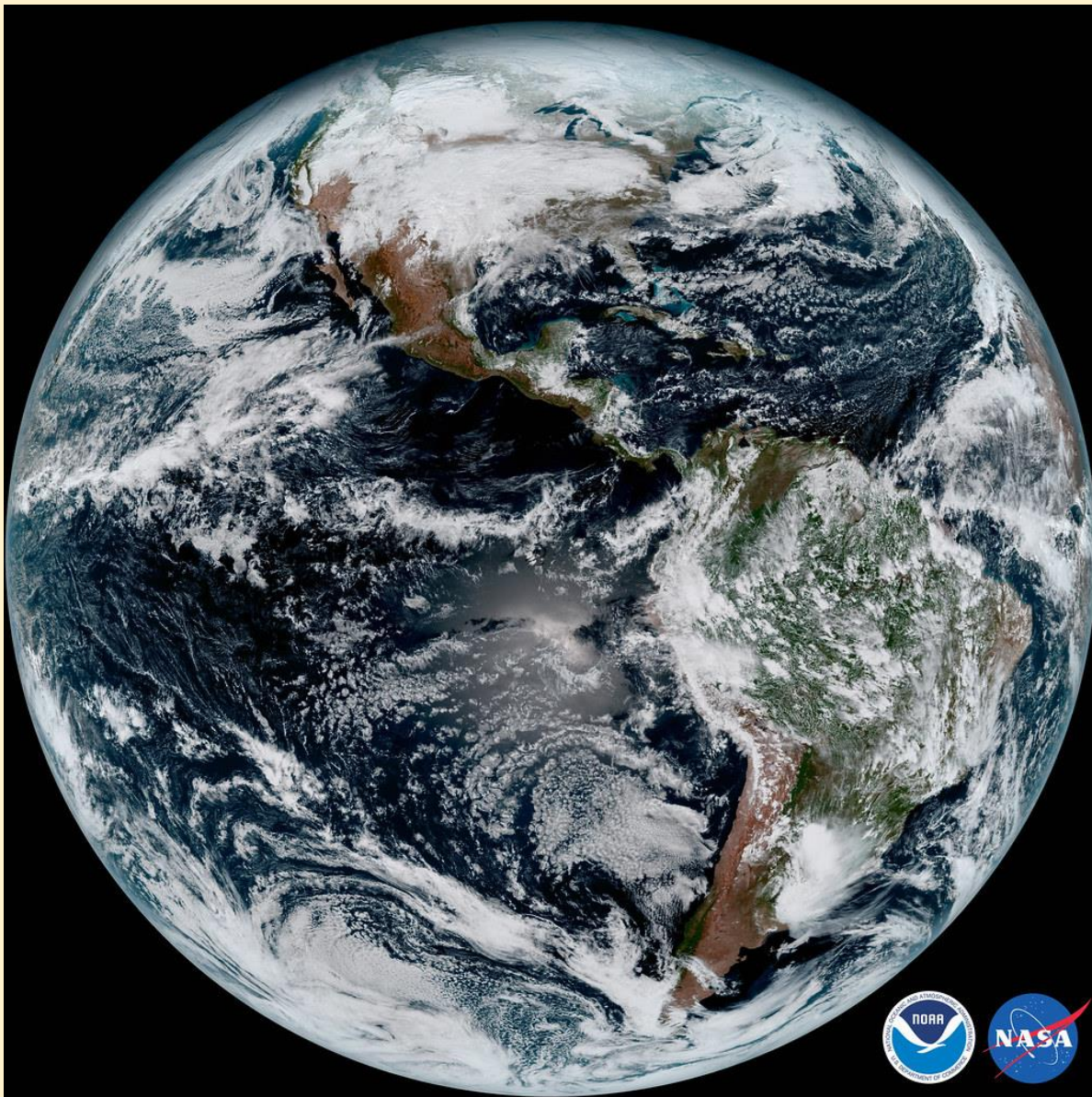
ADVANCED BASELINE IMAGER (ABI)

https://rammb.cira.colostate.edu/research/goes-r/goes-r_abi_bands_and_bandwidths.asp

ABI Band	Central Wavelength (μm)	Wavelength Range (μm)	Band Explanation	Spatial Resolution (km) @ nadir
1 (blue)	0.47	0.45 - 0.49	Visible/reflective	1
2 (red)	0.64	0.59 - 0.69	Visible/reflective	0.5
3	0.865	0.846 - 0.885	Reflective	1
4	1.378	1.371 - 1.386	Cirrus	2
5	1.61	1.58 - 1.64	Snow/ice	1
6	2.25	2.225 - 2.275	Particle size	2
7	3.9	3.80 - 4.00	Shortwave IR window	2
8	6.19	5.77 - 6.6	Water vapor	2
9	6.95	6.75 - 7.15	Water vapor	2
10	7.34	7.24 - 7.44	Water vapor	2
11	8.5	8.3 - 8.7	Water vapor, SO ₂	2
12	9.61	9.42 - 9.8	Ozone	2
13	10.35	10.1 - 10.6	Longwave IR window	2
14	11.2	10.8 - 11.6	Longwave IR window	2
15	12.3	11.8 - 12.8	Longwave IR	2
16	13.3	13.0 - 13.6	Longwave IR	2



En la actualidad hay activos cinco satélites meteorológicos situados en esta órbita geoestacionaria: el INSAT indio, los americanos GOES E y W (Geostationary Operational Meteorological Satellite), el GMS (Geostationary Environmental Satellite) japonés, el METEOSAT (European Geostationary Meteorological Satellite) y el GOMS (Geostationary Operational Environmental Satellite) de la URSS.



GOES R

- ✓ Pronósticos mejorados de trayectoria e intensidad de huracanes
- ✓ Más pronto avisos de tronadas y tornados
- ✓ Más pronto avisos de peligros de rayos
- ✓ Mejor detección de lluvia intensa y riesgos de inundaciones repentinas
- ✓ Mejoras en la seguridad en el transporte y planificación de rutas aéreas
- ✓ Mejoras en avisos de interrupciones en comunicación y navegación y apagones eléctricos
- ✓ Monitoreo más preciso de partículas energéticas responsables de peligros de radiación

Galería de imágenes ABI

[GOES-16 Galería de datos e imágenes](#)

[GOES-17 Galería de datos e imágenes](#)

star.nesdis.noaa.gov/goes/sector.php?sat=G16§or=ssa

Aplicaciones ISBN ARGENTINA AFIP - ADMINISTRA... Lab Seven: Digital T... Boletín de la Socied... Manual de Aprendi... Sentinel Data Hub earth :: a global ma...

GOES Image Viewer

Home CONUS Full Disk North America Caribbean Pacific South America Mesoscale Storms Support

GOES-East - Sector view: South America - Southern

Images updated every 10 minutes.

GeoColor

True Color daytime, multispectral IR at night
6 Jun 2022 - 20:40 UTC

- Animation loops
- Download images
- 450 x 270 px, (JPG, 122 KB)
- 900 x 540 px, (JPG, 414 KB)
- 1800 x 1080 px, (JPG, 1.43 MB)
- 3600 x 2160 px, (JPG, 4.77 MB)
- 7200 x 4320 px, (JPG, 15.71 MB)
- Animated GIF, (GIF, 15.56 MB)
- Product documentation

GLM FED3+GeoColor

Lightning flash extent density over GeoColor
6 Jun 2022 - 20:46 UTC

- Animation loops
- Download images
- 450 x 270 px, (JPG, 109 KB)
- 900 x 540 px, (JPG, 399 KB)
- 1800 x 1080 px, (JPG, 1.46 MB)
- 3600 x 2160 px, (JPG, 5.12 MB)
- 7200 x 4320 px, (JPG, 17.14 MB)
- Animated GIF, (GIF, 15.22 MB)
- Product documentation

AirMass RGB

RGB based on data from IR & water vapor
6 Jun 2022 - 20:50 UTC

- Animation loops
- Download images
- 450 x 270 px, (JPG, 32 KB)
- 900 x 540 px, (JPG, 90 KB)
- 1800 x 1080 px, (JPG, 269 KB)
- 3600 x 2160 px, (JPG, 794 KB)
- 7200 x 4320 px, (JPG, 2.31 MB)
- Animated GIF, (GIF, 11.63 MB)
- Product documentation

Sandwich RGB

Blend combines IR band 13 with visual band 3
6 Jun 2022 - 20:50 UTC

- Animation loops
- Download images
- 450 x 270 px, (JPG, 41 KB)
- 900 x 540 px, (JPG, 125 KB)
- 1800 x 1080 px, (JPG, 395 KB)
- 3600 x 2160 px, (JPG, 1.24 MB)
- 7200 x 4320 px, (JPG, 3.98 MB)
- Animated GIF, (GIF, 12.61 MB)
- Product documentation

Day Cloud Phase RGB

RGB for evaluating phase of

Nighttime Microphysics

Fire Temperature

Dust RGB

RGB for identifying

El Advanced Baseline Imager es el instrumento principal de la serie GOES-R para obtener imágenes del clima, los océanos y el medio ambiente de la Tierra. ABI ve la Tierra con 16 bandas espectrales diferentes (en comparación con las cinco de la generación anterior de GOES), incluidos dos canales visibles, cuatro canales de infrarrojo cercano y diez canales de infrarrojo. Estos diferentes canales (longitudes de onda) son utilizados por modelos y herramientas para indicar varios elementos en la superficie de la Tierra o en la atmósfera, como árboles, agua, nubes, humedad o humo.

<https://www.goes-r.gov/mission/ABI-bands-quick-info.html>

<https://www.star.nesdis.noaa.gov/goes/sector.php?sat=G16§or=ssa>

https://www.meted.ucar.edu/satmet/goes_resources/index_es.html

The screenshot shows a web browser with multiple tabs open. The active tab displays the URL [meted.ucar.edu/satmet/goes_resources/index_es.html](https://www.meted.ucar.edu/satmet/goes_resources/index_es.html). The page features a large header image of Earth from space. The main title is "Recursos de formación multilingües para los satélites de la serie GOES-R". Below the title, there is a text box explaining that the list contains training materials for GOES-R satellites, including lessons and guides created by various groups at the request of the National Weather Service (NWS) and the National Environmental Satellite Data and Information Service (NESDIS) of the United States. It notes that these materials are now available in multiple languages. Another text box mentions that these materials were originally created in English by COMET, RAMMB/CIRA, CIMSS, and SPoRT, and are now available in Spanish, Portuguese, or both, thanks to the participation of the National Meteorological Service (SMN) of Argentina and the University of São Paulo in Brazil.

English Español Português

Recursos de formación multilingües para los satélites de la serie GOES-R

Este listado reúne en un solo lugar algunos materiales de formación sobre los satélites de la serie GOES-R —lecciones preparatorias y guías rápidas creadas por distintos grupos a petición del Servicio Nacional de Meteorología (*National Weather Service*, NWS) y del Servicio Nacional de Datos e Información de Satélites Ambientales (*National Environmental Satellite Data and Information Service*, NESDIS) de los EE.UU.— que ahora están disponibles en más de un idioma. Muchos de estos materiales forman parte de cursos o catálogos de formación más amplios.

Estos materiales, que originalmente fueron creados en inglés por COMET, RAMMB/CIRA, CIMSS y SPoRT, ahora también están disponibles en español, portugués o ambos. El Servicio Meteorológico Nacional (SMN) de Argentina y la Universidad de São Paulo en Brasil participaron en la traducción o revisión de los materiales en español y en portugués, respectivamente.

Lecciones del curso fundamental sobre el GOES-R disponibles en MetEd

Estas lecciones forman parte del curso preparatorio sobre satélites para GOES-R (*Satellite Foundational Course for GOES-R*, SatFC-G) que CIRA distribuye a través de su sitio.

SatFC-G: Principios básicos de radiación

SatFC-G: Bandas en el visible e IR cercano

SatFC-G: Bandas en el IR cercano

SatFC-G: Bandas IR, excepto las de vapor de agua

GOES-16/JPSS Case Exercise: Monitoring the Rhea Oklahoma Grassland Fire

GOES-16/JPSS Case Exercise: Monitoring the Rhea Oklahoma Grassland Fire

CIRA/RAMMB/NOAA

Languages: English
Publish Date: 2019-06-26

Skill Level: 2
Completion Time: .75 - 1.00 h
Includes Audio: no
Required Plugins: none
Topics:
Fire Weather, Satellite Meteorology

BEGIN LESSON

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Overall Rating:

★★★★★ (17 ratings)

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Keywords

Media Gallery

Reviews (0)

The current GOES-R and JPSS meteorological satellites have improved capabilities for enhanced fire detection that include more effective monitoring of fire starts, evolution, and smoke. This lesson provides forecasters and others with the opportunity to become more familiar with both GOES-R and JPSS satellite products (including the longwave-shortwave IR difference, Fire Temperature RGB, GeoColor, GOES-R Fire Mask, JPSS Active Fire, and others) during the onset of a large grassland fire event, known as the Rhea Fire, that affected western Oklahoma from April 12-18, 2018.

Interactions and questions provide opportunities for practice using satellite products to analyze different phases of a grassland fire cycle, and feedback reinforces product strengths and limitations as well as best practices.

GOES-16 and S-NPP/JPSS Case Exercise: Hurricane Harvey Surface Flooding

GOES-16 and S-NPP/JPSS Case Exercise: Hurricane Harvey Surface Flooding

Creative Commons: Jill Carlson (jillcarlson.org)

Languages: English
Publish Date: 2018-07-03

Skill Level: 1
Completion Time: .50 - .75 h
Includes Audio: no
Required Plugins: none
Topics:
Emergency Management, Hydrology/Flooding, Satellite Meteorology

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Overall Rating:

★★★★★ (91 ratings)

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Media Gallery

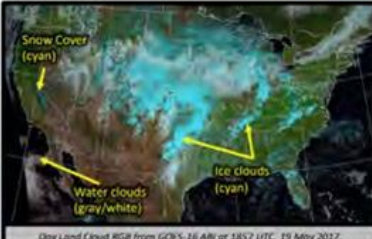
Reviews (12)

Satellite data are important tools for analyses and short-term forecasts of surface floodwater. This lesson will highlight the August 2017 flooding associated with Hurricane Harvey in southeastern Texas, one of the most costly weather disasters in U.S. history. Through the use of interactive exercises the learner will become familiar with use and interpretation of satellite imagery in regions with surface flooding. The lesson will use data from both the S-NPP Visible Infrared Imaging Radiometer Suite (VIIRS) and the GOES-16 Advanced Baseline Imager (ABI). The satellite-derived flood map and the data that go into the flood map will both be highlighted in the lesson. Examples of floodplain inundation, interbasin transfer, and water pooling in reservoirs will be shown along with issues related to spatial and temporal resolution.

Rhea Oklahoma Grassland Fire: https://www.meted.ucar.edu/training_module.php?id=1418
Hurricane Harvey: https://www.meted.ucar.edu/training_module.php?id=1397

Day Land Cloud RGB Quick Guide

Why is the Day Land Cloud RGB Imagery Important?
 The Day Land Cloud RGB is the same as the Natural Color RGB developed by EUMETSAT. This RGB is useful for discriminating water/ice clouds to identify low/high clouds. High ice clouds, snow, and sea ice appear cyan while low water clouds appear dull grey or white. Land/Ocean surfaces are in expected colors (but not true color). This imagery can also be used to assess vegetation and detect land surface changes where vegetation appears green and soil, inactive vegetation, and rock appear brown to dark gray.



Day Land Cloud RGB from GOES-16 ABI at 1857 UTC, 23 May 2017.

Day Land Cloud RGB Recipe

Color	Band / Band Diff. (µm)	Min - Max Gamma	Physically Relates to...	Small contribution to pixel indicates...	Large contribution to pixel indicates...
Red	1.6	0 - 97.5 %	Reflectance of clouds & surfaces	Ice or large particle clouds, water, snow/ice, sea ice	Water clouds with small drops, and desert
Green	0.86	0 - 108.6 %		Water, inactive vegetation, bare soil	Clouds, vegetation, and snow/ice
Blue	0.64	0 - 100.0 %		Thin cloud, water, vegetation, bare soil	Thick clouds and snow/ice

Impact on Operations

Primary Application
 Surface and atmospheric features: Discern high ice clouds from low water clouds, snow/ice cover, land surface features.

High ice clouds, snow, and sea ice are cyan:
 Ice strongly absorbs in the near-IR 1.6 µm band, leading to little red contribution (resulting in cyan) and notable contrast with water clouds (white/gray).

Low water clouds are gray to dull white:
 Water clouds with small droplets (i.e. fog) have a high reflectance in all three bands.

Land surface types are a 'Natural' color:
 Green vegetation, brown deserts and burn scars.

Limitations

Daytime only application: The RGB relies on solar reflectance from visible and near-IR channels.

Sun glint complicates water scenes: Water will appear grey to white as the sun moves overhead and reflects sunlight toward the satellite.

Distinguishing snow cover and high ice clouds: Snow and ice clouds are bright cyan in the RGB, but geographic features and/or cloud motion may help to differentiate between the two.

Thin cirrus/cirrostratus: These clouds are semi-transparent; hence, difficult to detect with the visible channels.

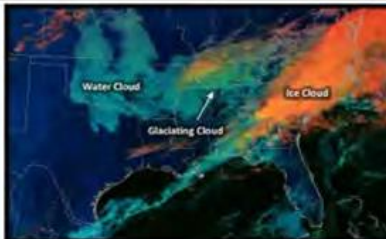
Dust appears similar color as bare land.

Contributor: Dr. Emily Berndt NASA SPoRT <https://weather.msfc.nasa.gov/sport/>

Day Cloud Phase Distinction RGB Quick Guide

* Interpretation still under investigation

Why is the Day Cloud Phase Distinction RGB Important?
 This RGB is used to evaluate the phase of cooling cloud tops to monitor convective initiation, storm growth, and decay. It can also be used to identify snow on the ground. The Day Cloud Phase Distinction RGB takes advantage of cloud reflectance differences between the visible and near infrared channels and temperature variances between land and clouds in the infrared to provide increased contrast between background surfaces and phases of clouds (i.e. water vs. ice).



Day Cloud Phase Distinction RGB from GOES-16 ABI at 1912 UTC, 20 Dec 2017

Day Cloud Phase Distinction RGB Recipe

Color	Band (µm)	Min to Max Gamma	Physically Relates to...	Small contribution to pixel indicates...	Large Contribution to pixel indicates...
Red	10.3 (Ch. 13)	7.5 to -53.5 °C	Surface or cloud top temperature	Warm: land (seasonal), ocean	Cold: land (winter), snow, high clouds
Green	0.64 (Ch. 2)	0 to 78 % albedo		Reflectance of clouds and surfaces	Water, vegetation, land
Blue	1.6 (Ch. 5)	1 to 59 % albedo	Reflectance, particle phase	Ice particles	Water particles, land surface

Impact on Operations

Primary Application
Convective initiation: Used to monitor when clouds are breaking the stable capping layer. Cumulus transitioning from light shades to bolder green and yellow shades indicates vertical development and increasing cloud ice seen with strong storms. Signs of updrafts and overshooting tops help to evaluate how a storm is evolving.

Snow squalls: Preliminary comparisons with radar indicate glaciated cloud bands are associated with heavy precipitation snow events.

Limitations


Daytime only application: The 0.64 µm (VIS) and 1.6 µm (NIR) bands rely on reflected visible solar radiation.

Solar angle and limb effect: For low solar angles (i.e. sunrise and sunset, and during winter) the reflectance values of the VIS and NIR (green and blue components) are decreased. For cold winter scenes and also for viewing at high latitudes (limb cooling effect) the 10.35 µm IR (red component) is skewed towards cold temperatures. Both these effects result in a "reddish" scene.

Contributors: Bernie Connell, Erin Dagg CSU/CIRA <https://www.cira.colostate.edu/>
 Michael Bowlan: NOAA/NWS/SPC <http://www.spc.noaa.gov/> and OU/CIMMS <http://cimms.ou.edu/>

GeoColor Product Quick Guide

Why is the GeoColor Product Important?
 GeoColor imagery provides as close an approximation to daytime True Color imagery as is possible from GOES-16, and thus allows for intuitive interpretation of meteorological and surface-based features. At night, instead of being dark like in other visible bands, an IR-based multispectral product is provided that differentiates between low liquid water clouds and higher ice clouds. A static city lights database derived from the VIIRS Day Night Band is provided as the nighttime background for geo-referencing. The 5-min imagery is mapped into a 1.5 km Mercator grid over the Continental U.S. for AWIPS.



Four examples of operational applications of the GeoColor product. The valley fog example is nighttime, and the other three are daytime.

How is the GeoColor product created?

GeoColor uses a total of five channels from the GOES-R ABI. For the daytime imagery, channels 1, 2, and 3 (0.47 - blue, 0.64 - red, and 0.86 µm - near IR) are first corrected for Rayleigh scattering; this is a key step in order to maximize the contrast between clear sky and clouds, and it results in vibrant colors. Next, the green component is simulated using a lookup table that was built using data from Himawari-8 AHI, which does have a green channel at 0.51 µm. Finally, the red, green, and blue components are combined to create the pseudo-true color RGB. At night, the window IR channel 13 (10.3 µm) and the traditional fog product (10.3-3.9 µm) are used to identify both ice and liquid water clouds, and they are made partially transparent and placed atop a static city lights background. Note that power outages will not be reflected by the city lights since it's a static dataset.

Impact on Operations

Primary Applications
Daytime Aerosols
Detection: Identify smoke, blowing dust, smog, and anything that has a unique color property.
Nighttime cloud detection: Differentiate low liquid water clouds from higher ice clouds at night.
Nighttime Geo-Location: City lights aid geo-referencing by helping determine whether clouds (such as fog) are affecting populated areas.
Intuitive Interpretation: Since the colors of features in the daytime are what we intuitively expect them to be, the product requires little to no training, and has proven to be excellent for social media posts.

Limitations

Shallow Water Colors: Since a lookup table is being used for the green component, sometimes shallow water colors may show up as noisy or incorrect.

Thick vs. Thin clouds at night: The nighttime cloud layer is made partially transparent, and the amount of opacity is a function of the cloud top temperature. Sometimes optically thick clouds in the lower atmosphere may show up as being partially transparent (including precipitating convection).

Sunrise/Sunset: Near sunrise and sunset, the daytime and nighttime portions are blended, which may cause certain clouds (e.g., the blue low cloud enhancement) to briefly change colors or disappear.

Contributor: Dan Bikos, Steve Miller, Dan Lindsey CIRA/RAMMB, Ft. Collins, CO

NOAA Users: <https://vlab.ncep.noaa.gov/group/stor/goes2>

Non-NOAA Users: http://rammb.cira.colostate.edu/training/visit/quick_guides/



FDTD GOES Applications Webinars

Follow us on Twitter @wxsatchat

GOES-16 User Workshop at NWSTC, November 2017

These webinars are peer-to-peer learning; staff from WFOs, National Centers, CWSUs, RFCs lead the presentations. The presentations are short (less than 30 minutes) and recorded for on-demand viewing. They are offered on a routine basis (typically bi-weekly) and offer recent in-season examples ready to apply operationally. The primary objective of these webinars are to share how to apply GOES imagery with other datasets for a specific operational application so that other WFO's learn how to do this.

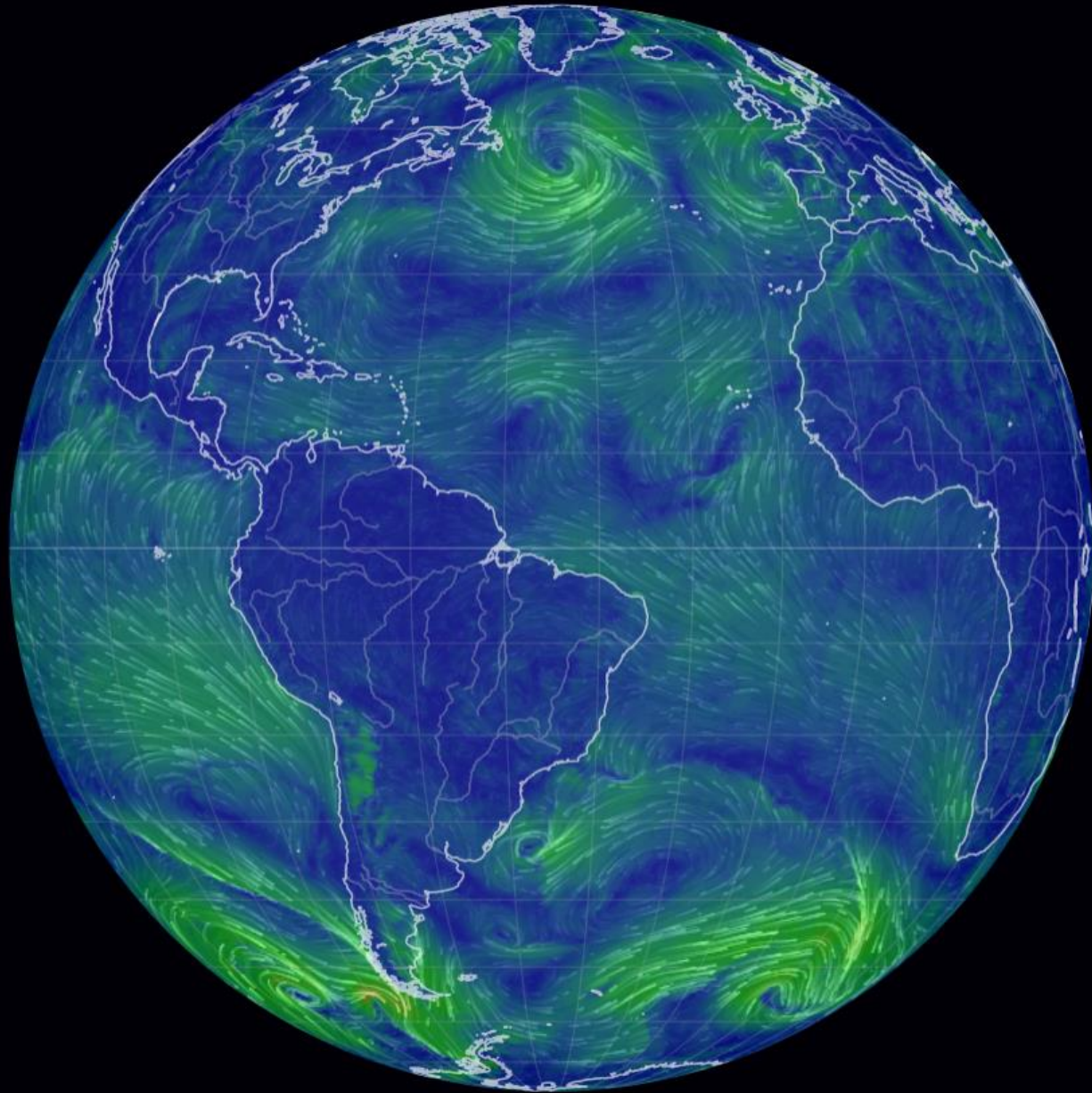
Refer to the [VISIT Training Calendar](#) for the next scheduled FDTD GOES Application webinar.

Below you'll find a list of FDTD GOES Applications Webinar recordings from the past (including links to powerpoint files), listed in reverse chronological order. Be sure to have your speakers on and the volume loud enough to hear the presentation. To sort them by a different column, click the column heading at the top to reorder them.

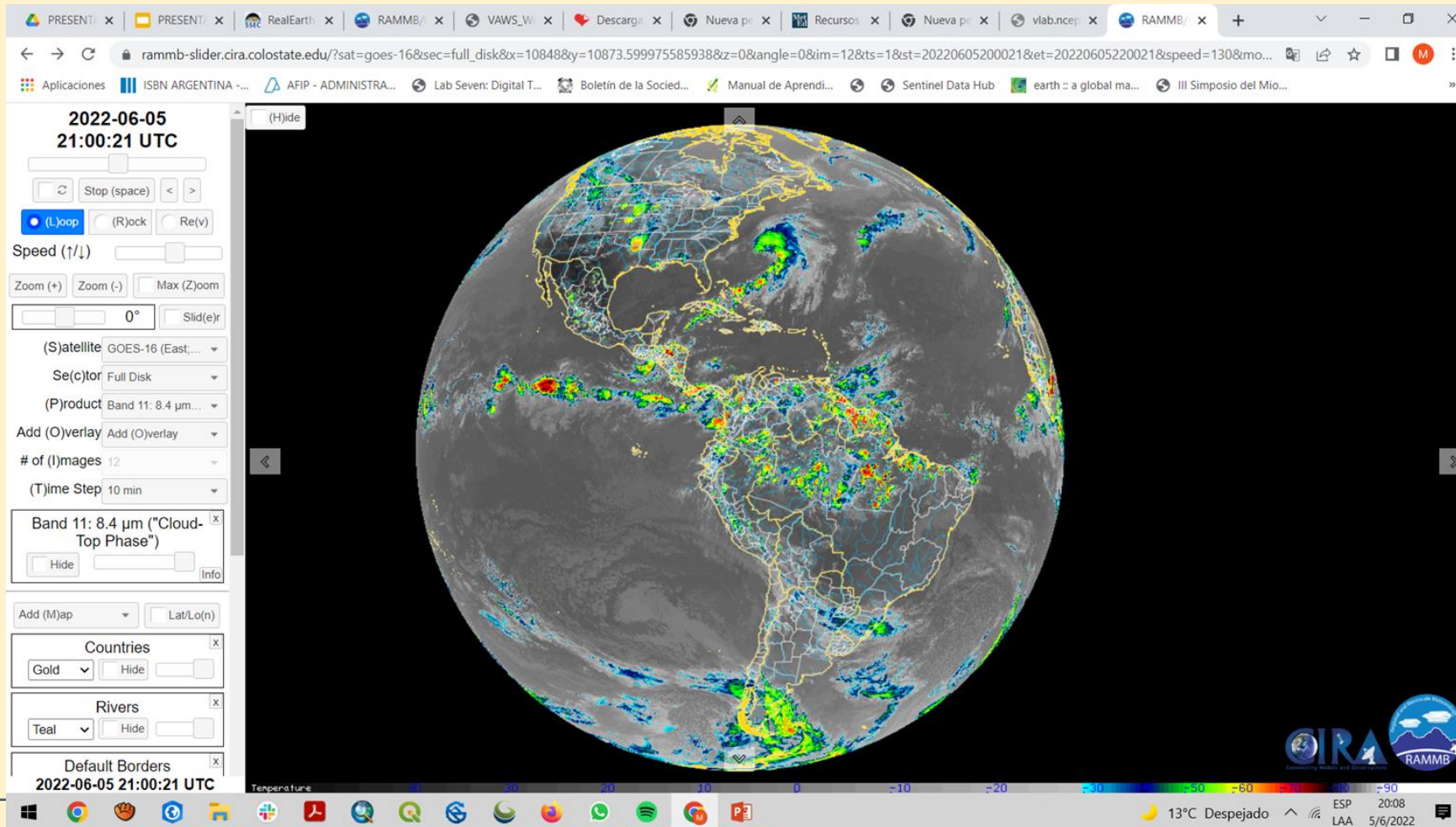
Title	Date	Brief Summary
Issuing Warnings with No Radar	2019-08-21	David Levin summarizes the 27 June 2019 event for southeast Alaska in which the Juneau WFO issued their first ever severe thunderstorm warning. Radar data was not available for this event due to beam blockage and distance from the radar site. This presentation shows the data and the thought process that went into the decision making.
Superior, WI Husky Refinery Explosion NWS Duluth Response	2019-07-17	Joe Moore summarizes the response by the NWS WFO in Duluth, MN to an explosion at a nearby refinery. Monitoring GOES-16 imagery played a role in monitoring the plume from the refinery. Lessons learned on the response for what went well and where improvements could be made are provided.
Nocturnal Wildfire Smoke Tracking using GOES-16	2019-06-12	Kevin Huyck investigates experimental GOES RGB products to assess nighttime detection of smoke from GOES. Smoke can be tracked at night, under clear conditions and also utilizing daytime imagery before nightfall. More development is needed with potential for new products.
The Above Anvil Cirrus Plume: An Important Indicator of a Severe Storm in Visible and IR Imagery	2019-06-05	Kris Bedka summarizes important findings from a recent Weather and Forecasting journal article on the Above Anvil Cirrus Plume (AAP) signature. AAP storms are much more intense than other storms, generating a higher fraction of reported severe weather and the vast majority of significant hail and tornadoes (2+ inch and EF2+ respectively).
New Applications of GOES-17 Imagery in Volcanic Plume Detection for the VAAC/Alaska Region	2019-04-24	Doug Wesley summarizes the use of new GOES-17 imagery to detect volcanic plumes. The primary case study is the Bezymanny volcanic eruption of 16 March 2019. The Ash and SO2 RGB products from GOES-17 are highlighted, but also compared with GOES-15 to illustrate the major improvements since the inception of GOES-17.
Applications of GOES-17 Data in Fog Forecasting for Anchorage, AK	2019-03-20	Doug Wesley summarizes the use of new GOES-17 information to help define the coverage and evolution of a shallow fog event over and near the Anchorage/Cook Inlet area on 26 February 2019. This includes applications of derived product imagery in helping forecasters determine the formation, extent and dissipation of the shallow fog over a relatively data-sparse area.
GOES-16 Identification of Blowing Snow	2019-02-06	Carl Jones discusses using the Day Snow-Fog RGB from GOES-16 for identification of blowing snow. Several examples of blowing snow are shown along with possible explanations as to why it is being detected by GOES-16 and advantages and disadvantages of using this RGB to monitor blowing snow.
A GOES-16 Perspective on a Fatal Snow Squall Event	2018-12-17	Kristen Cassidy and Ashley Novak discuss snow squall warnings and the event of 8 March 2018. GOES-16 Band 8 is useful in identifying and tracking PV anomalies / PV tropopause folds. GOES-16 band 13 and daytime cloud phase distinction RGB have utility in monitoring snow squalls.
Erie PA Lake-Effect Snow event	2018-12-12	Bob LaPlante and Zach Sefcovic discuss the 25-26 December 2017 lake-effect snow event that impacted the Erie, PA vicinity. GOES-16 imagery was particularly useful due to beam overshooting by the 2 nearest WSR-88Ds. A number of GOES-16 RGB products were helpful in identifying the lake-effect snow bands.

VISIT Webinar Link: http://rammb.cira.colostate.edu/training/visit/satellite_chat/

- [VISIT Home](#)
- [Training Sessions](#)
- [Training Calendar](#)
- [Blog Sites](#)
- [FDTD GOES Applications Webinars](#)
- [VISIT Satellite Chat](#)
- [VISIT Satellite Help Desk](#)
- [The VISIT Program](#)
- [VISIT Contributors](#)
- [VISIT FAQ](#)
- [Links / Tutorials](#)
- [RAMSDIS Online](#)
- [Quick Reference](#)



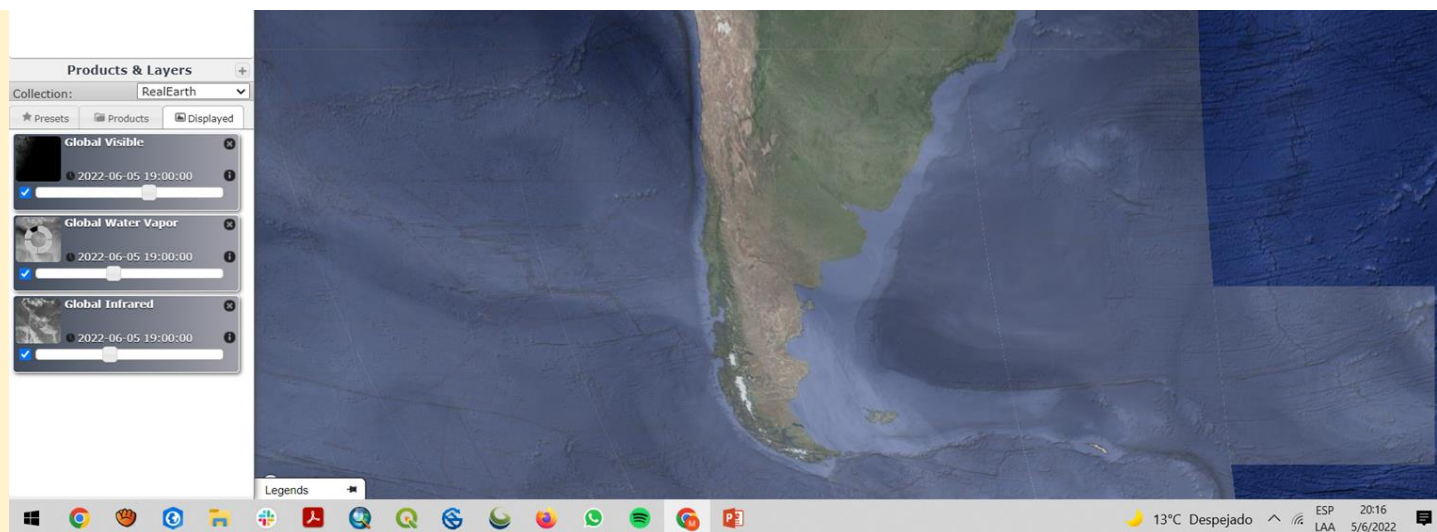
<https://earth.nullschool.net/>



<https://rammb-slider.cira.colostate.edu/>



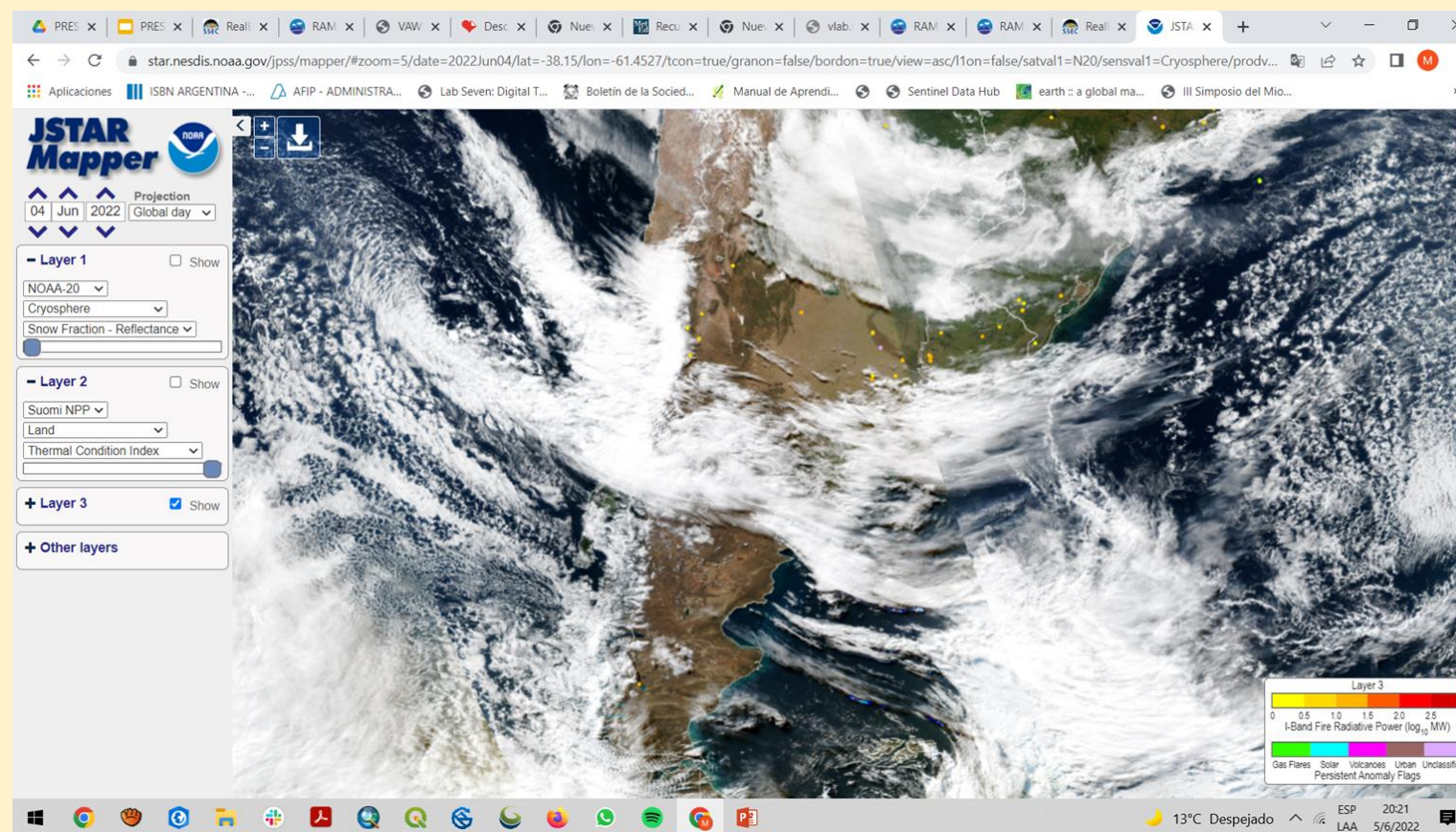
RealEarth <https://realearth.ssec.wisc.edu/>





JSTAR Mapper

<https://www.star.nesdis.noaa.gov/jpss/mapper/>



Módulo 4. Unidad. TEÓRICO. APLICACIÓN DE LOS SATELITES GEOESTACIONARIOS AL ESTUDIO DEL CAMBIO CLIMATICO.



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[Transparencia](#) | [Datos abiertos](#) | [RSS](#)

Imágenes de satélite

 SISTEMA DE ALERTA TEMPRANA >



Argentina

Arg. Sectorizada ▾

Sudamérica

Antártida

Hidroestimador

Nefoanálisis

Visible

Topes Nubosos

Vapor de Agua Niveles Medios

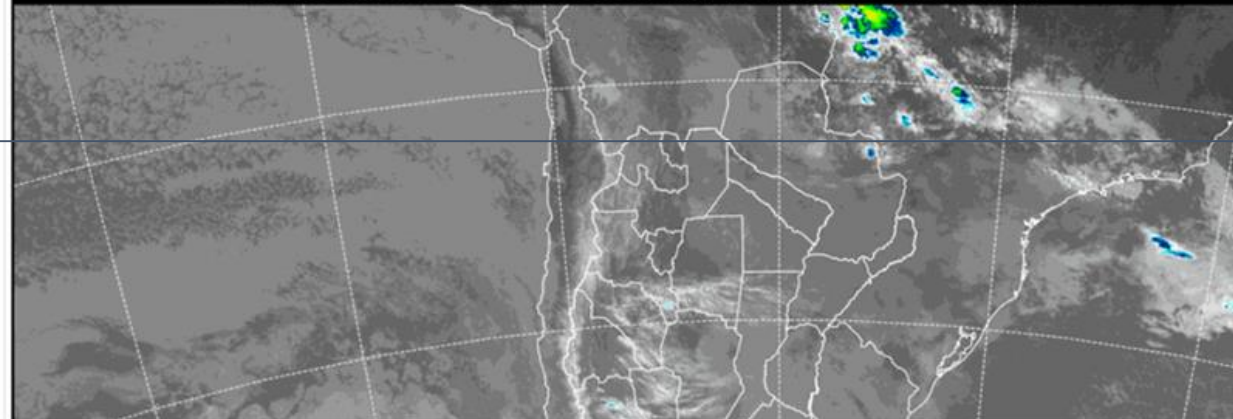
Cantidad de imágenes

1 6 12 24

Controles



GOES16 ABI Canal 13 2022/06/08 10:40:21H0A (13:40:21UTC) SMN-Argentina



<https://www.smn.gob.ar/satelite>

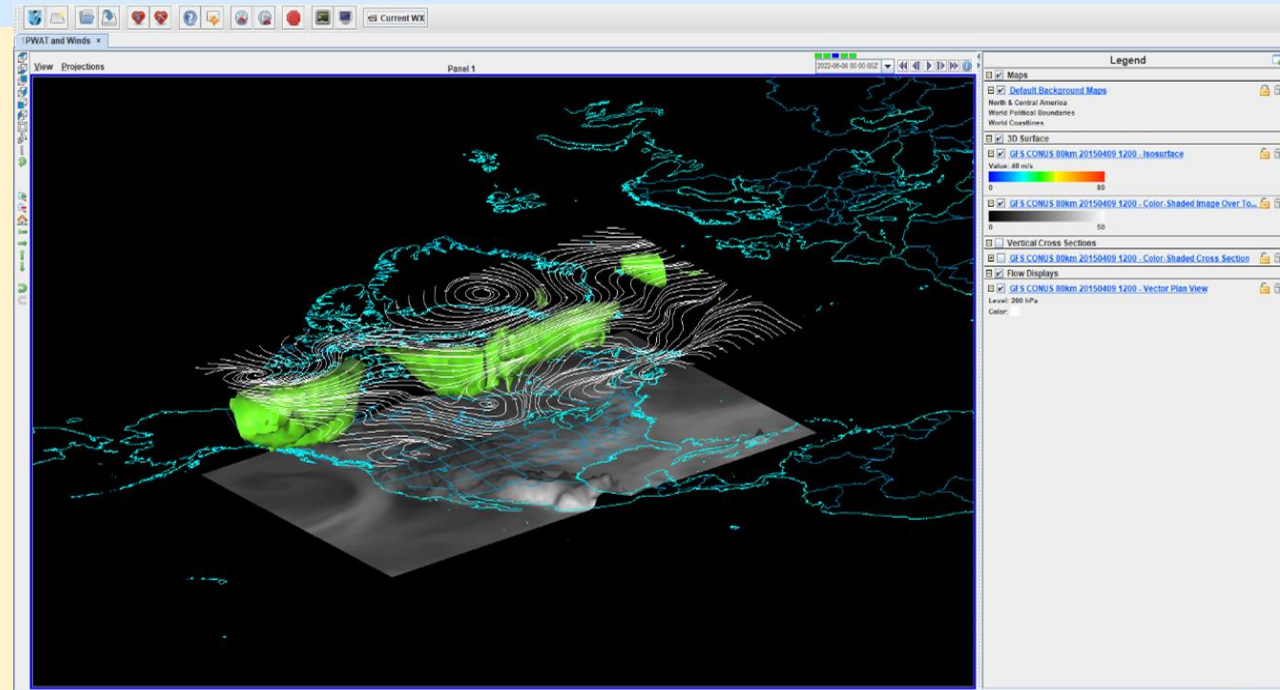
McIDAS para datos GOES-16 y -17

<https://www.ssec.wisc.edu/mcidas/software/v/>



McIDAS-V es un paquete de software **gratuito**, de código abierto, de visualización y análisis de datos que es la próxima generación en los 45 años de historia de SSEC, sofisticados paquetes de software McIDAS. McIDAS-V muestra el satélite meteorológico (incluido el hiperespectral) y otros datos geofísicos en 2 y 3 dimensiones. McIDAS-V también puede analizar y manipular los datos con sus potentes funciones matemáticas.

https://rammb.cira.colostate.edu/training/rmtc/video/McV_Tutorial_GOES16_Intro_Espanol/McV_Tutorial_GOES16_16Channels_20170419_Bundle_playlist.html



El instrumento MODIS está operando en las naves espaciales Terra y Aqua.

Tiene un ancho de banda de visualización de 2.330 km y ve la superficie completa de la Tierra cada uno o dos días.

Sus detectores miden 36 bandas espectrales entre 0,405 y 14,385 μm , y adquiere datos en tres resoluciones espaciales: 250 m, 500 m y 1000 m.

Los numerosos productos de datos derivados de las observaciones de MODIS describen características de la tierra, los océanos y la atmósfera que se pueden utilizar para estudios de procesos y tendencias a escala local y global.

Datos MODIS nivel 1, geolocalización, máscara de nubes y productos atmosféricos:

<http://ladsweb.nascom.nasa.gov/>

Productos terrestres MODIS:

<https://lpdaac.usgs.gov/>

Productos de criosfera MODIS:

<http://nsidc.org/daac/modis/index.html>

Productos MODIS de color del océano y temperatura de la superficie del mar:


<http://oceancolor.gsfc.nasa.gov/>

MODIS.

<https://visibleearth.nasa.gov/collection/1513/modis-rapid-response>


NASA Visible Earth - Home - Google Chrome



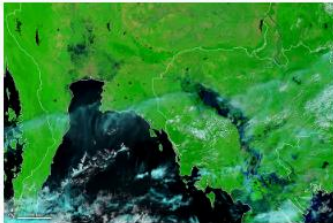
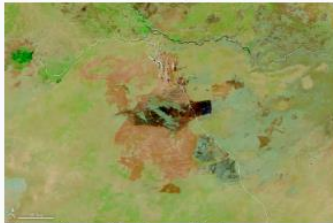


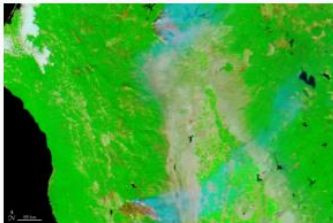




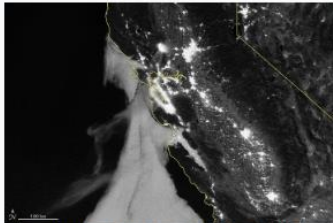
visibleearth.nasa.gov/collection/1513/modis-rapid-response

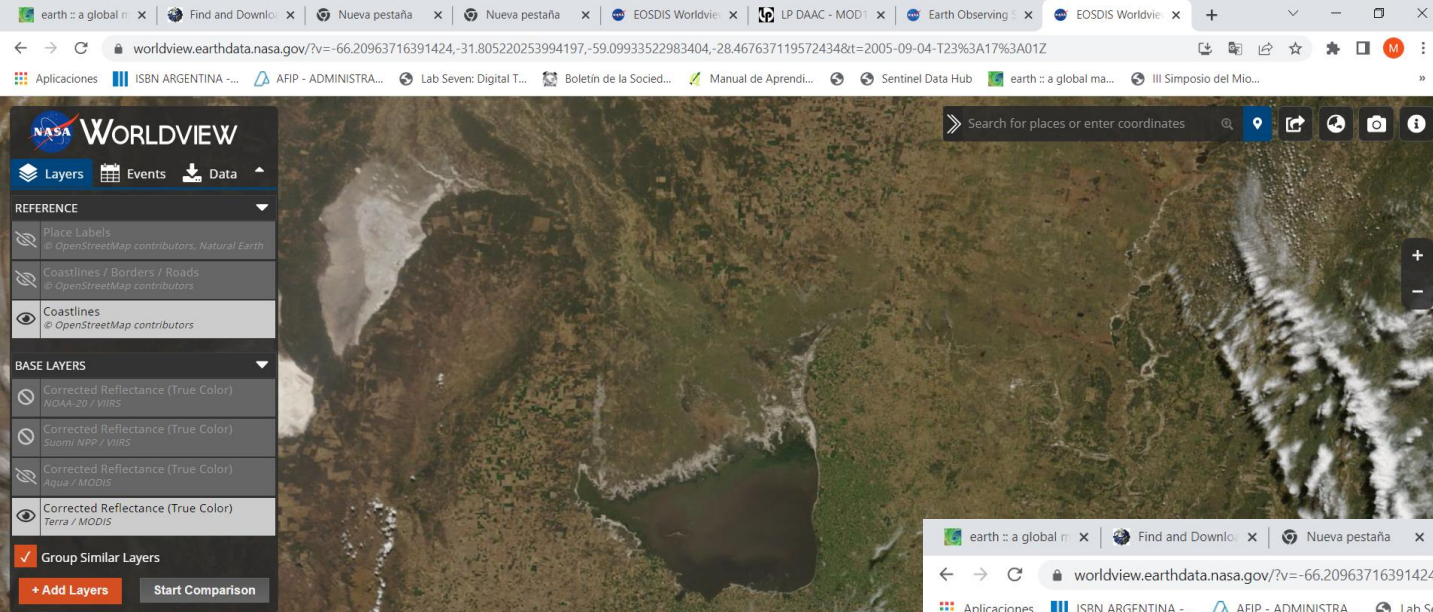
 **visible earth**
A catalog of NASA images and animations of our home planet

Keyword Search Go

Browse by: Source ▾ Collection ▾ Show All

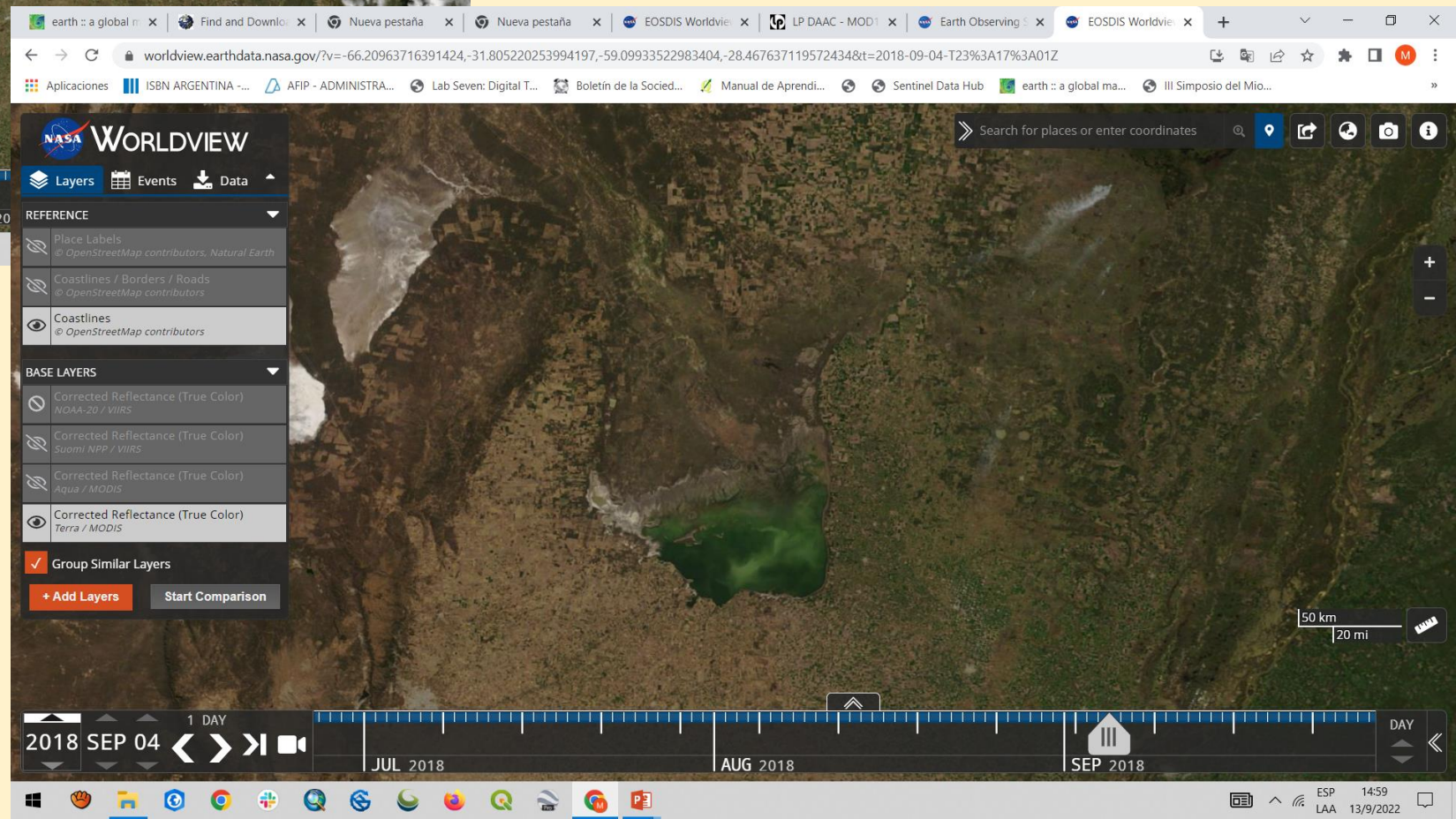
Collection: MODIS Rapid Response 

 Sediment Swirls Off the Yucatán	 Spring Bloom for South Africa	 Flooding in Thailand and Cambodia	 Fires Scar Northern Botswana
 Typhoon Soulik	 Smoky Oregon	 Carr Fire and Mendocino Complex	 Milky Blue Water Near Prince of Wales Island
 There Goes the Ice	 Fires in Manitoba and Northern Ontario	 Makgadikgadi Salt Pans	 County Fire Lights Up the Night



MODIS (color real)

2005 y 2018



<https://climate.nasa.gov/news/2744/two-decades-of-earth-data/>

earth :: a global map of win... Find and Download MODIS... Nueva pestaña... EODIS Worldview... LP DAAC - MOD14

worldview.earthdata.nasa.gov/?v=-154.00582957697642,-46.546875,58.099579576976424,53.015625&t=2022-09-13-T17%3A09%3A18Z

Aplicaciones ISBN ARGENTINA... AFIP - ADMINISTRA... Lab Seven: Digital T... Boletín de la Socied... Manual de Aprendi... Sentinel Data Hub earth :: a global ma... III Simposio del Mio...

NASA WORLDVIEW

Layers Events Data

REFERENCE

- Place Labels
© OpenStreetMap contributors, Natural Earth
- Coastlines / Borders / Roads
© OpenStreetMap contributors
- Coastlines
© OpenStreetMap contributors

BASE LAYERS


- Corrected Reflectance (True Color)
NOAA-20 / VIIRS
- Corrected Reflectance (True Color)
Suomi NPP / VIIRS
- Corrected Reflectance (True Color)
Aqua / MODIS
- Corrected Reflectance (True Color)
Terra / MODIS

☒ Group Similar Layers

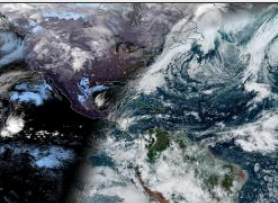
+ Add Layers Start Comparison

Welcome to Worldview!


Visually explore the past and the present of this dynamic planet from a satellite's perspective. Select from an array of stories below to learn more about Worldview, the satellite imagery we provide and events occurring around the world. [Start using Worldview](#)




Night Lights from NASA's Black Marble




Geostationary Imagery Every 10 Minutes!




Satellite Detections of Fire (2021 update)



Introduction to Worldview



Harmonized Landsat Sentinel-2



Clouds

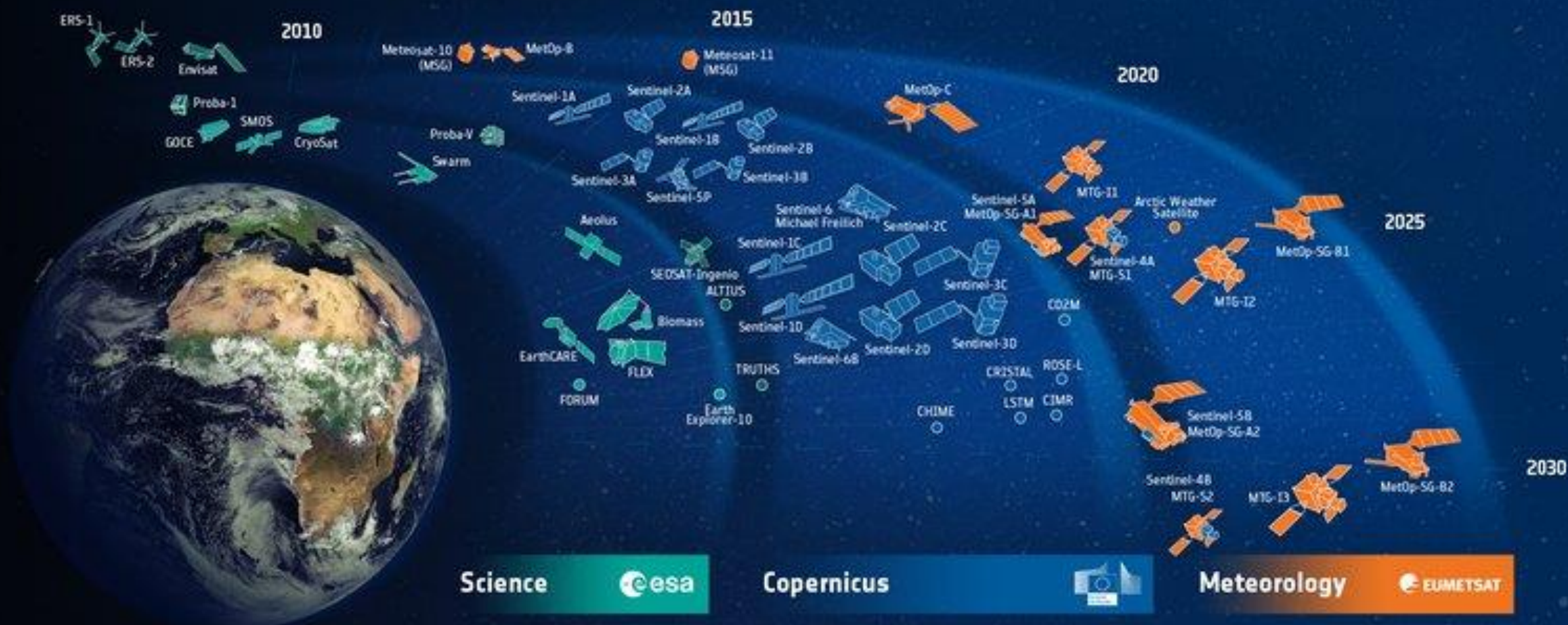
☐ Do not show until a new story has been added.

2022 SEP 13 1 DAY 2022 AUG 2022 SEP 2022 DAY

1000 km 1000 mi

Windows Taskbar: File Explorer, Edge, Chrome, Firefox, VS Code, PowerPoint, etc. System tray: ESP LAA, 14:49, 13/9/2022

<https://worldview.earthdata.nasa.gov/?v=-154.00582957697642,-46.546875,58.099579576976424,53.015625&t=2022-09-13-T17%3A09%3A18Z>



← → ↻ climate.esa.int/en/

Aplicaciones ISBN ARGENTINA -... AFIP - ADMINISTRA... Lab Seven: Digital T... Boletín de la Socied... Manual de Aprendi... Sentinel Data Hub earth :: a global ma... III Simposio del Mio...

NEW PROJECT

precursors of aerosols and ozone

“Scientific evidence for warming of the climate is unequivocal (IPCC Fifth Assessment Report, 2013)”

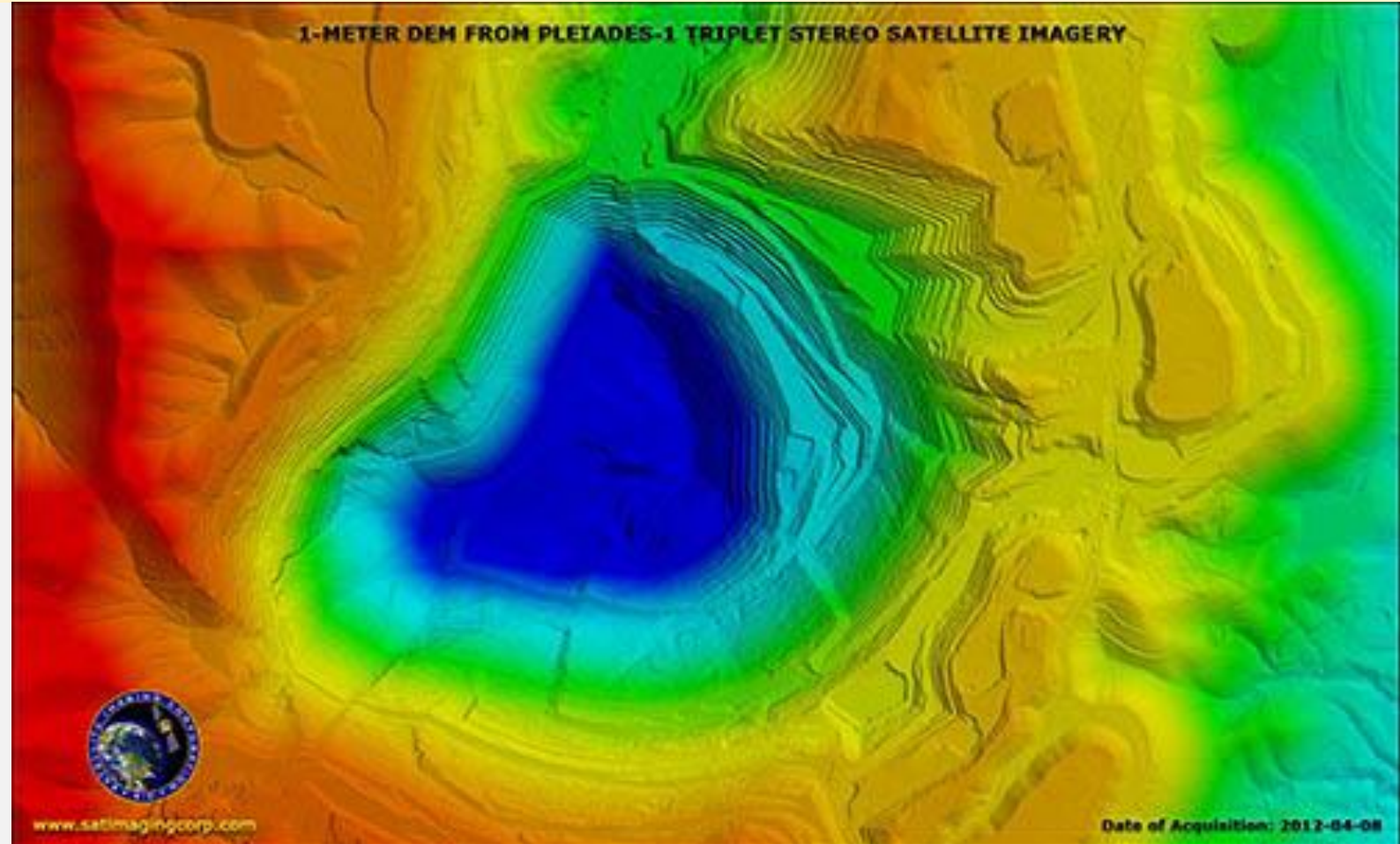
Monitoring and Tracking Climate Change

- Climate from space: the evidence →
- Satellite-based discoveries →
- What is climate change? →
- Space for understanding climate →

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Fuente de datos MDE

- Cartas topográficas (analógicas)-Rasterización y georreferenciación
- Satelital: Radar y Optico
- Fotogrametría (aerotransportado)
- Lidar (aerotransportado)
- Combinaciones de MDEs



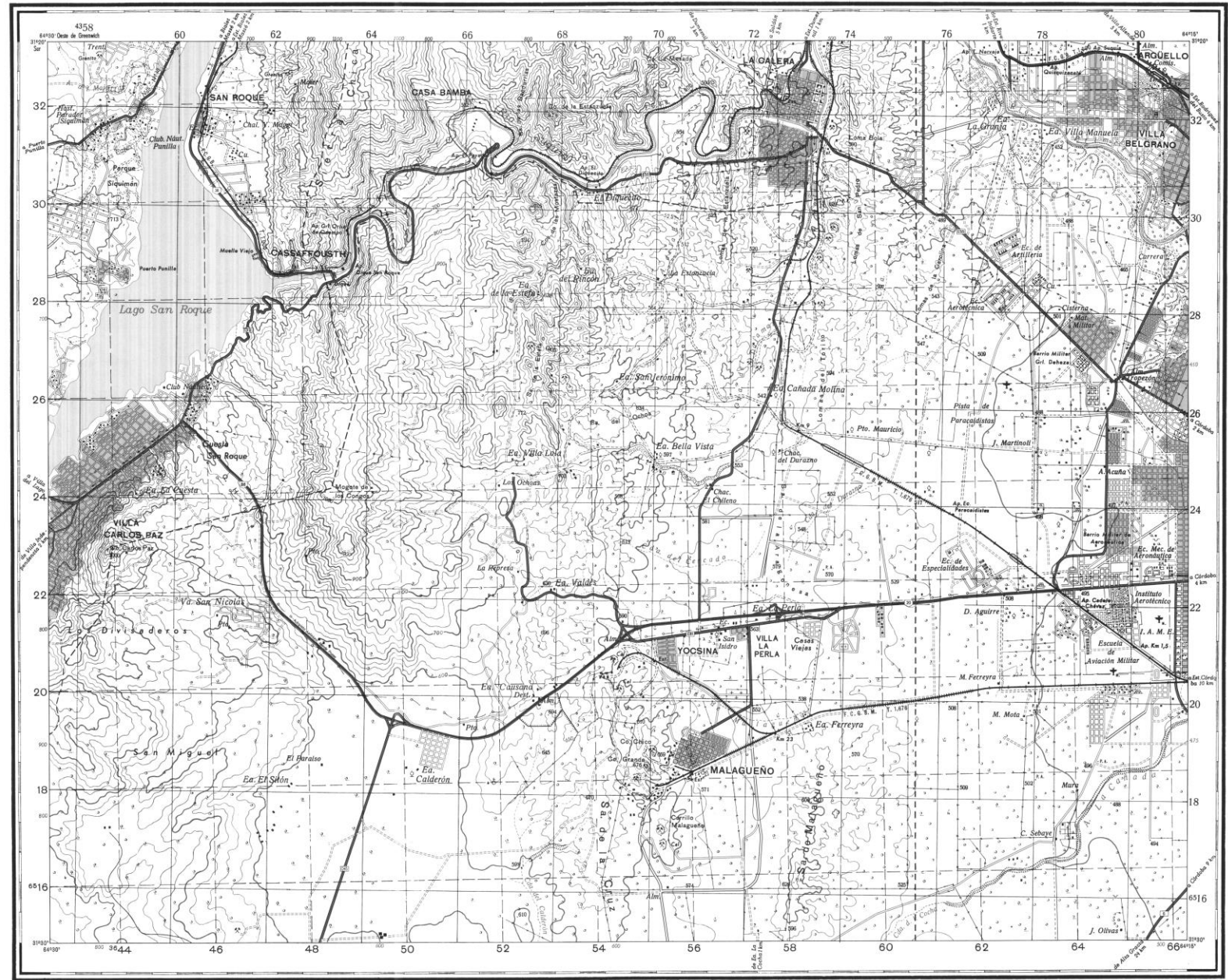
Los modelos de elevación pueden generarse a través de la medición directa de coordenadas de puntos o la extracción de valores x, y, z de otros conjuntos de datos. La recolección directa más común, por supuesto, es a través de un estudio de campo con receptores GPS, que puede ser muy preciso pero también extremadamente costoso y lento. Los DEM también se pueden extraer de los mapas de contorno topográficos, pero su precisión es tan buena como la de los mapas originales.



MINISTERIO DE ECONOMIA Y FINANZAS
SUBSECRETARÍA DE HACIENDA Y FINANZAS
DIRECCIÓN GENERAL DE CATASTRO

Hoja 3163-25-1
VILLA CARLOS PAZ
Provincia de Córdoba

SITUACIÓN DE LA HOJA			DIVISIÓN POLÍTICA		LEVANTAMIENTO	
Hoja 3163-25-1	Hoja 3163-25-2	Hoja 3163-25-3	Dep. Santa María	Dep. Capital	Topográfico	Regular



Levantamiento I.G.M. año 1948
Actualización Planimétrica con
Imágenes de satélite Landsat 17-01-92
Impresión 1996

ESCALA 1: 50 000



Equidistancia 25 metros

UTE-Albano-Madero-Lanuse
Belauategui-Telespazio

Hojas Topográficas

**1980's DMA 90
m**

10^2 cells/km²

1990's USGS DEM 30

10^3 cells/km²

2000's NED 10-30 m

10^4 cells/km²

2010's LIDAR ~1 m

10^6 cells/km²



MODELOS NUMERICOS DEL TERRENO

MNT de alta resolución mediante el tratamiento de imágenes por satélite:

Estereoscopia

GeoEye-1,1m - 5m HI-DEM

IKONOS 1m – 5m HI-DEM

ALOS PRISM -5 m DEM

Intermap 5m DEM/DTM/ORI

WorldView-1,1m - 5m HI-DEM

Cartosat 2,5m DEM

SPOT 20m DEM

ASTER - 15 y 30 m DEM

Interferometría radar

SRTM 90 m DEM

Harris SRTM-90 Gap Filled DEM

GTOPO30 1Km DEM

ETOPO2 2' DEM

IMAGENES SATELITE RADAR

Satélite de media (100 metros) a muy alta resolución
(1 metro) :

ALOS PALSAR (libres 12.5m, 30m)

ENVISAT

ERS

JERS

RADARSAT

TERRASAR-X

IMAGENES AEREAS LASER

LIDAR de alta (1 metro) a muy alta resolución (0,1 metro)

DEM Availability

[Supported data formats.](#) [Bathymetry.](#)

Scale	Spacing	Data series	Coverage	Provider	Web Source	Notes
Global	5' (~10 km)	ETOPO5	Entire world, including ocean basins	NOAA		Get ETOPO1 and thin
	2'	ETOPO2				Get ETOPO1 and thin.
	2' long (lat has Mercator factor)	Smith & Sandwell Predicted topography	Entire world, including ocean basins	SIO/NOAA	Scripps	Ideal for regional base maps, especially for geologists
	1'	ETOPO1			NGDC	Entire data set, or custom grids
	30"	SRTM-15 Plus, SRTM-30 Plus : Merge of SRTM30, Smith & Sandwell, and IBCAO	Entire world, including ocean basins		Scripps	Get the SRTM version files, with a data file and an ERS header. Open with MICRODEM which will use GDAL. You will probably have to edit the header to get the correct SW corner.
	30" (~1 km)	GTOPO30	Entire world, land only	USGS	GTOPO30	Use GMTED2010 as better alternative.
		SRTM-30	Entire world, land only		SRTM-30	Use GMTED2010 as better alternative.
	30", 15", and 7.5"	Global Multi-resolution Terrain Elevation Data 2010 (GMTED2010)	Entire world	USGS	GMTED	
Regional	3" (60-90 m)	SRTM-3		JPL	SRTM	Entire world except for polar regions (broadly defined) National Map Viewer directions.
	2" (40-60 m)	USGS 100K	United States	USGS		Must order from USGS (\$)
	1" (20-30 m)	SRTM-1		JPL		National Map Viewer
	1" (20-30 m)	3DEP (formerly NED)	United States	USGS	<ul style="list-style-type: none"> National Map Viewer 	National Map Viewer
	1"	EU DEM	Europe, Turkey, parts of North Africa			
	1"	ALOS Global Digital Surface Model "ALOS World 3D - 30m" (AW3D30)			JAXA download or Home page	Free version of 5 m grid.

https://www.usna.edu/Users/oceano/pguth/md_help/html/dems.htm

Bathymetry Availability

[Using NOAA point soundings](#) [NOAA main bathymetry site](#) [USGS Bathymetry Portal](#) [DEM](#)s on land

MICRODEM requires that depths have negative z values. You can quickly [edit the DEM to multiply the depths by -1](#).

Spacing	Data series	Coverage	Provider	Web Source	Notes
5' (~10 km)	ETOPO5/1	Entire world, including ocean basins	NOAA	ETOPO1	Need header for MICRODEM. The original bathymetry came from the version of DBDBV available at the time ETOPO5 was created.
2' long (1st Mercator factor)	Smith & Sandwell Predicted topography	Entire world, including ocean basins	SIO/NOAA	Scripps	Ideal for geological base maps
2' long	ETOPO2		NOAA	NOAA download	GEODAS build a grid (use ASCII XYZ)
1' long	GEBCO One Minute Grid	Worldwide		http://www.gebco.net/data_and_products/gridded_bathymetry_data/ https://www.bodc.ac.uk/data/online_delivery/gebco/	Full data or subsets. netCDF, Geotiff, or ESRI ASCII
1' long	ETOPO1			NOAA	
30"	GEBCO_2014 Grid			http://www.gebco.net/data_and_products/gridded_bathymetry_data/ https://www.bodc.ac.uk/data/online_delivery/gebco/	Full data or subsets. netCDF, Geotiff, or ESRI ASCII
30"	Merge of SRTM30, Smith & Sandwell, and IBCAO	Entire world, including ocean basins		Scripps	Get the SRTM version files, with a data file and an ERS header. Open with MICRODEM which will use GDAL. You will probably have to edit the header to get the correct SW corner.
	Global Multi-Resolution Topography Data Portal (includes RIDGE data)			MGDS	
	Seamount database			Scripps	GMT format
	USGS Coastal mapping (includes lakes)		USGS	USGS 2	Crater Lake, Lake Tahoe, San Francisco, Los Angeles, San Diego, Hawaii, Gulf of Mexico--not all may be supported in MICRODEM
3" to 10'	NOAA Design a Grid			NOAA info NOAA download	US coastal and Great Lakes GEODAS build a grid (use ASCII XYZ for export). If you use the G98 format, expect to have to edit the coordinates of the SW corner.
	NOAA Multibeam Viewer and Data Downloader			NOAA	

https://www.usna.edu/Users/oceano/pguth/md_help/html/bathymetry.htm



1 meter Digital Elevation Models (DEMs) - USGS National Map 3DEP Downloadable Data Collection

View ▾

Dates

Publication Date : 2017
Start Date : 2015-01

Citation

U.S. Geological Survey, 2017, 1 meter Digital Elevation Models (DEMs) - USGS National Map 3DEP Downloadable Data Collection: U.S. Geological Survey.

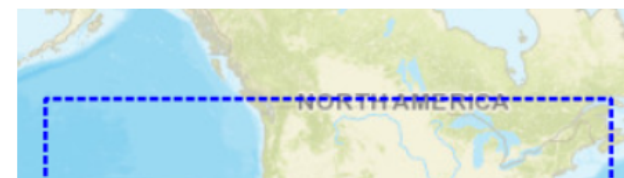
Summary

This is a tiled collection of the 3D Elevation Program (3DEP) and is one meter resolution. The 3DEP data holdings serve as the elevation layer of The National Map, and provide foundational elevation information for earth science studies and mapping applications in the United States. Scientists and resource managers use 3DEP data for hydrologic modeling, resource monitoring, mapping and visualization, and many other applications. The elevations in this DEM represent the topographic bare-earth surface. USGS standard one-meter DEMs are produced exclusively from high resolution light detection and ranging (lidar) source data of one-meter or higher resolution. One-meter DEM surfaces are seamless within collection projects, but, not necessarily seamless across projects. The spatial reference used for tiles of the one-meter DEM within the conterminous United States (CONUS) is Universal Transverse Mercator (UTM) in units of meters, and in conformance with the North American Datum of 1983 (NAD83). All bare earth elevation values are in meters and are referenced to the North American Vertical Datum of 1988 (NAVD88). Each tile is



Thumbnail JPG image

Map »



Dataset	Resolution	Coverage	Download Link
SRTM1	1 arcsec / 30 meter / 98 feet	United States	Download
SRTM3	3 arcsec / 90 meter / 295 feet	World except polar areas	Download
SRTM30	30 arcsec / 1 km / 0.5 NM	World except polar areas	Download
GTOPO30	30 arcsec / 1 km / 0.5 NM	World	Download
ETOPO5	5 min / 9.3 km / 5 NM	World	Download

Año	DEM	Cobertura	Metodología	Resolución Espacial	Desarrollado por	Disponibilidad	Error
1996	GTOPO	Global	Interpolación Curvas a Nivel	30 arc- seg. (1km)	USGS (U.S. Geological Survey's)	Gratuito	
Febrero 2000	SRTM	80%	RADAR (trasbordador espacial Endeavour durante una misión de 14 días)	90- 30 m	NASA, USGS, NGA	Gratuito 90 m - Restringido 30 m	± 11 y 15 m
2000-2008	ASTER (GDEM)	Global	Estereoscopia Satelital	30 m	METI y NASA	Gratuito	± 20 y 25 m
1999	STAR3I	Areas Especificas	RADAR	10 m	Inter Map		± 3m
	LIDAR		Láser	alta resolución			± 1 m

Appropriate Scale

DEM Resolution and Source

Proposed Name

1:5 Million to 1:10 Million

1:1 Million to 1:5 Million

1:250,000 to 1:1 Million

1:125,000 to 1:250,000

1:50,000 to 1:125,000

1:10,000 to 1:50,000

1:5,000 to 1:10,000

1:1,000 to 1:5,000

9 x 9 km (ETOPO5)

1 x 1 km (GTOPO30)

500 x 500 m (DTED)

100 x 100 m (SRTM)

25 x 25 m

10 x 10 m

5 x 5 m

1 x 1 m

Physiographic Province

Physiographic Region

Physiographic District

Physiographic System

Unnamed and undefined

Landform Type

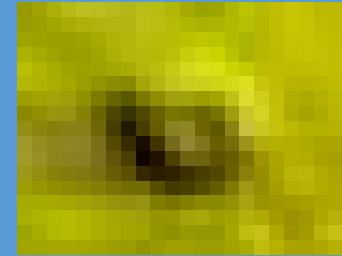
Landform Element

Unnamed and undefined

Multiresolución con diferentes fuentes de datos

Ejemplo Cerro El Morro
San Luis

GMTED



1000 m

GMTED



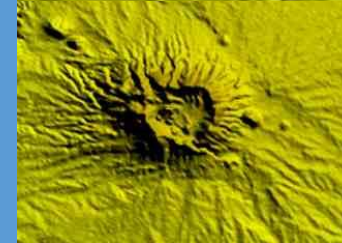
500 m

GMTED



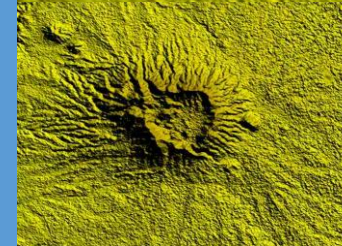
250 m

SRTM



90 m

ASTERDEM



30m

Appropriate scale	DEM resolution and source	Proposed Name
1:2000 to 1:5000	1x1 m	Unnamed - undefined
1:5000 to 1:10000	5x5 m	Landform Element
1:10000 to 1:50000	10x10 m	Landform Type
1:50000 to 1:125000	25x25 m	Unnamed - undefined
1:125000 to 1:250000	100x100 m SRTM	Physiographic System
1:250000 to 1:1 Million	500x500 m DTED	Physiographic District
1:1 Million to 1:5 Million	1x1 km GTOPO30	Physiographic Region
1:5 Million to 1:10 Million	9x9 km ETOPOS	Physiographic Province

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< Copernicus DEM: 30 meter dataset now publicly available

Copernicus DEM: 30 meter dataset now publicly available

1 Year Ago

ESA is pleased to announce that, in addition to the Copernicus Digital Elevation Model (DEM) GLO-90 released in December 2019, the access rights for the **Copernicus DEM** with global coverage at 30 meter resolution (GLO-30) have now been extended and the dataset is openly available to any registered user.

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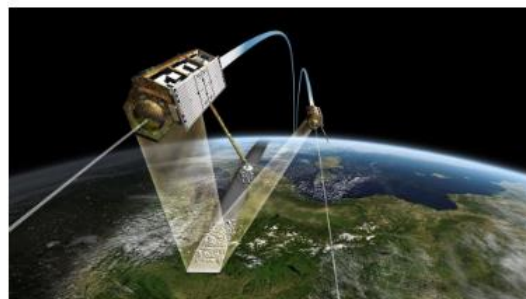
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News



[February 24, 2022]

TanDEM-X Again In Operation

We would like to inform you that TanDEM-X is since 16.02.2022 again in nominal operation. Proposal for new data acquisitions are again accepted and welcome.

TANDEM 90M

<https://download.geoservice.dlr.de/TDM90/>

The screenshot shows a web browser window with the URL download.geoservice.dlr.de/TDM90/. The browser's address bar and tabs are visible at the top. The website's header includes the 'eoc geo service' logo, navigation links (About, News, Services, Maps, Downloads, Data Guides), and the DLR logo.

The main content area is divided into a left sidebar and a main map area. The sidebar, titled 'Download', contains a 'Select Items:' section with the instruction 'Keep Ctrl pressed to select Bounding Box.' Below this are buttons for 'Clear all', 'List', and 'Metalink'. A single item, 'S32W065', is listed with download and delete icons.

The main map area displays a topographic map of a coastal region, likely South America, with a grid overlay. A specific grid cell is highlighted in blue. The map includes zoom controls (+/-) in the top left and a menu icon in the top right.

The footer of the website contains the 'Geoservice' and 'Partner' sections, with links to 'Contact', 'Privacy', 'Terms', and 'Imprint'. It also lists 'DLR Portal', 'EOC Portal', and 'EOWEB® GeoPortal'.

The Windows taskbar at the bottom shows various application icons, including the Start button, File Explorer, Edge, and several other programs. The system tray on the right indicates the temperature is 23°C, it is 'Muy soleado' (Very sunny), and the date is 13/9/2022.

MERIT (Obtenido desde diversas fuentes)

MERIT DEM: Multi-Error-Removed Improved-Terrain DEM

Last Update: 15 Oct, 2018

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[Dai Yamazaki](#)

[CaMa-Flood](#)

[Global Hydrodynamic Model](#)

[MERIT Hydro](#)

[Global hydrography map](#)

[MERIT DEM](#)

[Accurate DEM](#)

[GWD-LR](#)

[Global River Width](#)

[G3WBM](#)

[Global Water Map](#)

[OSM water layer](#)

[OpenStreetMap water](#)

FrontPage

General Information

Product Info

The MERIT DEM was developed by removing multiple error components (absolute bias, stripe noise, speckle noise, and tree height bias) from the existing spaceborne DEMs (SRTM3 v2.1 and AW3D-30m v1). It represents the terrain elevations at a 3sec resolution (~90m at the equator), and covers land areas between 90N-60S, referenced to EGM96 geoid.

Hydrologically adjusted DEM is now available as a component of MERIT Hydro datasets.

Please visit [MERIT Hydro webpage](#) to get an access.

Data Summary

Spaceborne Digital Elevation Models (DEMs) are a fundamental input for many geoscience studies, but they still include non-negligible height errors. Here we introduce a high accuracy global DEM at 3 arcsecond resolution (~90 m at the equator) by eliminating major error components from existing DEMs (NASA SRTM3 DEM, JAXA AW3D DEM, Viewfinder Panoramas' DEM). We separated absolute bias, stripe noise, speckle noise and tree height bias using multiple satellite datasets and filtering techniques.

After the error removal, land areas mapped with 2 m or better vertical accuracy were increased from 39% to 58%. Significant improvements were found in flat regions where h networks and hill-valley structures became clearly represented. We found the topography slope of previous DEMs was largely distorted in most of world major floodplains (e.g. i

The newly developed DEM will enhance many geoscience applications which are terrain-dependent.

-- [Description Paper in GRL](#)

Data Source

MERIT DEM was developed by processing the following products as baseline data (all are freely available from their web page).

- NASA SRTM3 DEM v2.1: [link to the SRTM webpage](#)

- JAXA AW3D-30m DEM v1: [link to the AW3D-30m webpage](#)

- Viewfinder Panoramas' DEM [link to the ViewfinderPanoramas webpage](#)

In addition to the above baseline DEMs, below products were used as supplementary data:

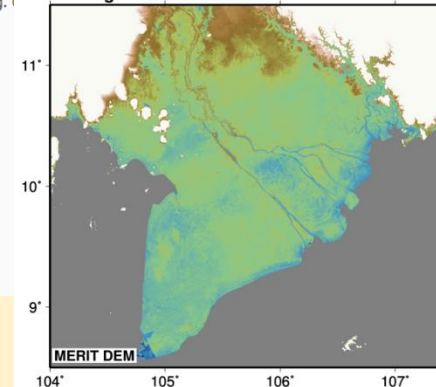
- NASA-NSIDC ICESat/GLAS GLA14 data [link to the NSIDC webpage](#)

- U-Maryland Landsat forest cover data [link to the Global Forest Change webpage](#)

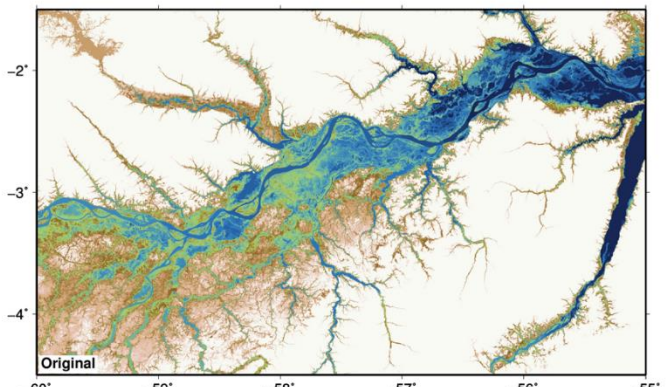
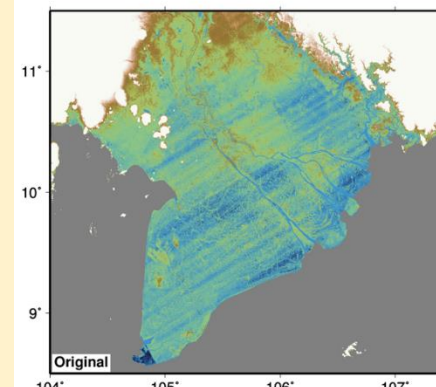
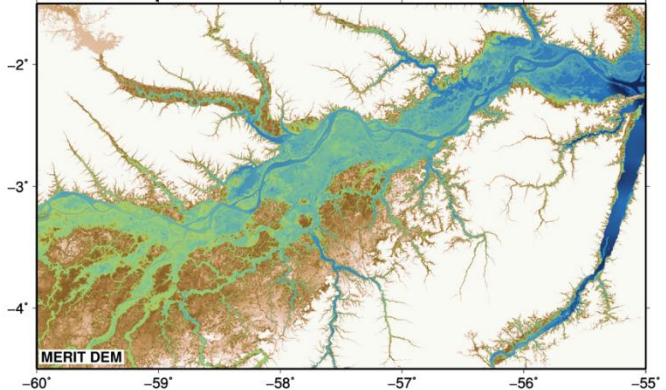
- NASA Global Forest Height Data [link to NASA webpage](#)

- JAMSTEC/U-Tokyo G3WBM water body data [link to G3WBM webpage](#)

Mekong Delta



Amazon Floodplain



http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/

FABDEM

Followers

0

Organisation



Science

Some of the most significant discoveries of the last century are associated with research carried out in Bristol. We currently enjoy an outstanding international reputation as...

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Social

Dataset

FABDEM

As an experiment we also have a bittorrent download available at

<https://academictorrents.com/details/a3ce54e3de8177011a3c6e1b9ed130e0467c3f4e>

FABDEM (Forest And Buildings removed Copernicus DEM) is a global elevation map that removes building and tree height biases from the Copernicus GLO 30 Digital Elevation Model (DEM). The data is available at 1 arc second grid spacing (approximately 30m at the equator) for the globe. The FABDEM dataset is licensed under a Creative Commons "CC BY-NC-SA 4.0" license.

For commercial use queries, please contact fabdem@fathom.global

This dataset is published in support of the paper "A 30 m global map of elevation with forests and buildings removed" published by IOP in Environmental Research Letters at

<https://dx.doi.org/10.1088/1748-9326/ac4d4f>.

UPDATE 14/03/2022 - Tile N00E011_FABDEM_V1-0.tif was corrupted and has now been replaced. This has been reflected in the geotiff tags with the following text "NOTE=This file is a replacement for originally corrupted file for tile N00E011" -mo "UPDATED=2022-02-23"

Complete download (zip, 462.3 GiB)

SIG

GIS layer-stack eastern Gulf of Mexico

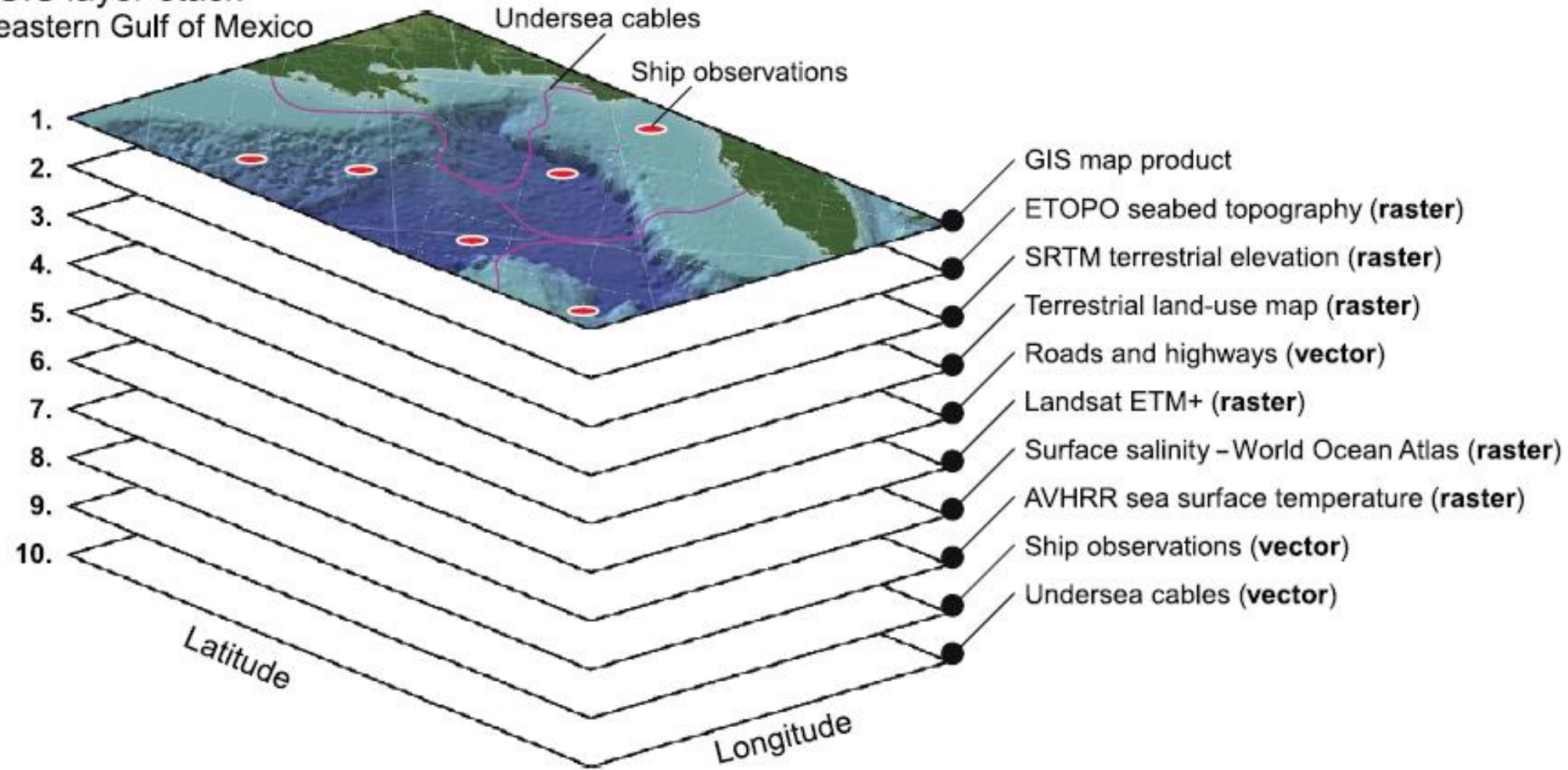


Figure 4.11 A Geographical Information System (GIS) layer-stack.

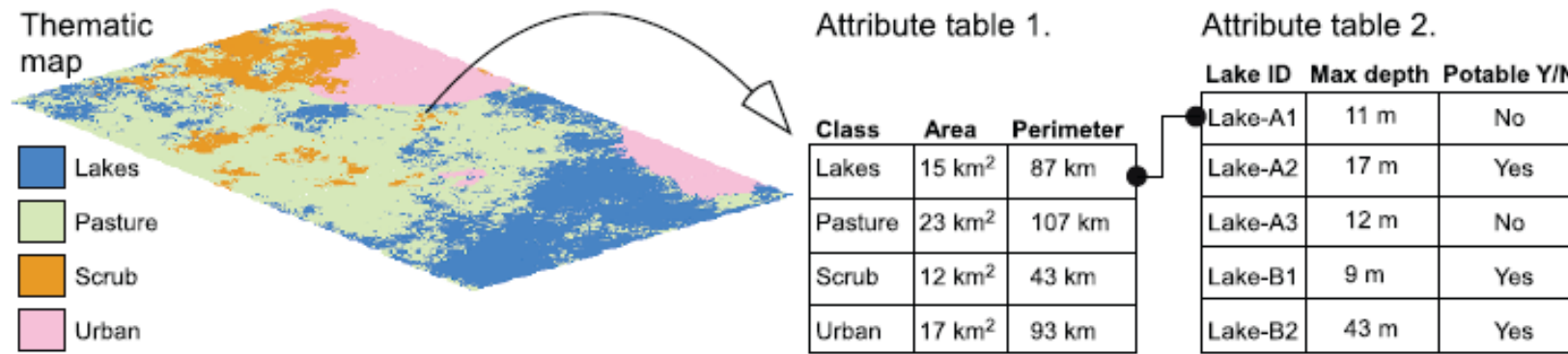


Figure 4.12 Storage of GIS attribute information in a relational database.

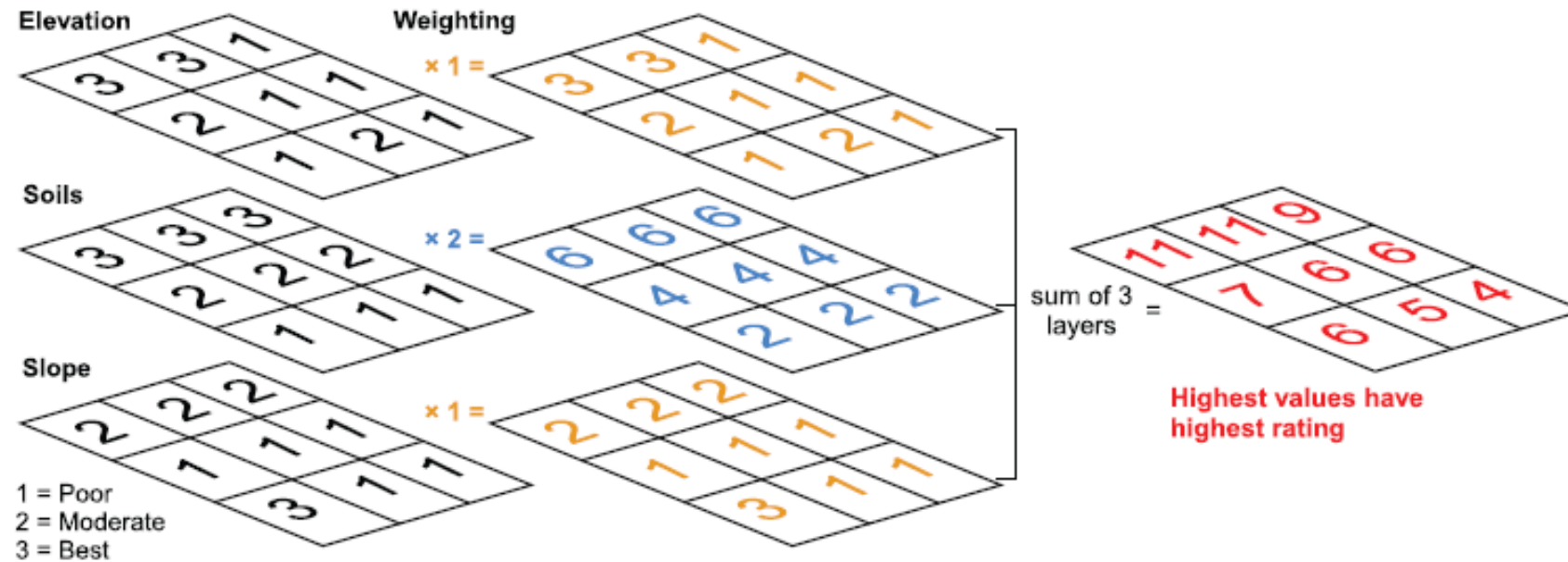


Figure 4.13 GIS overlay operation using different weights for data layers. Modified with permission from Davis (1996).

LECTURAS COMPLEMENTARIAS

- NASA ARSET : <https://appliedsciences.nasa.gov/join-mission/training>
- Panel Intergubernamental del Cambio Climático: <https://ipcc.ch>
- NASA GISS Temperaturas: <https://data.giss.nasa.gov/gistemp/>
- NASA Signos Vitales: <https://climate.nasa.gov/>

<https://acolita.com/la-gran-lista-satelital-50-satelites-en-30-palabras-o-menos/>

<https://climate.esa.int/en/evidence/observations-change/>

- IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [MassonDelmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press.
- Gaffney, O.; Steffen, W. (2017). "The Anthropocene equation," *The Anthropocene Review* (Volume 4, Issue 1, April 2017), 53-61.
- "Global Climate Change: Evidence." *NASA Global Climate Change and Global Warming: Vital Signs of the Planet*. Jet Propulsion Laboratory / National Aeronautics and Space Administration, 15 June 2008. Web. 14 Jan. 2015.
<http://climate.nasa.gov/evidence/>.
- Levitus, S.; Antonov, J.; Boyer, T.; Baranova, O.; Garcia, H.; Locarnini, R.; Mishonov, A.; Reagan, J.; Seidov, D.; Yarosh, E.; Zweng, M. (2017). NCEI ocean heat content, temperature anomalies, salinity anomalies, thermosteric sea level anomalies, halosteric sea level anomalies, and total steric sea level anomalies from 1955 to present calculated from in situ oceanographic subsurface profile data (NCEI Accession 0164586). Version 4.4. NOAA National Centers for Environmental Information. Dataset. doi: 10.7289/V53F4MV