

2022 Satellite Needs Working Group (SNWG) Agency Survey: Aggregate Information

SNWG Background

The [SNWG](#) partners with federal civilian agencies to identify high-priority sustained and unmet needs for satellite Earth observations. Starting in 2016, the SNWG has conducted a biennial survey to formally document and communicate satellite Earth-observing needs to NASA and other spaced-based Earth observation providers NOAA and USGS. The Satellite Needs Survey obtains information about key agency objectives that require the application of satellite Earth observations, as well as specific measurement requirements.

Use of the 2022 SNWG Survey Aggregate Information Report

The 2022 Satellite Needs Survey featured 116 responses from 29 agencies. Each response represents an agency's satellite data need. This report presents aggregate statistics about agency measurement requirements as well as a subset of other quantifiable aspects of agency needs. Agency-identifying information, including specific needs, cannot be released publicly and is not included in this report. In interpreting these statistics, please note the following caveats:

- The Satellite Needs Survey is a voluntary reporting in which each agency's leadership chooses whether to participate and which, if any, satellite needs to submit
- The survey responses represent only a subset of the full satellite Earth observation needs of the federal civilian agencies, and the subset and derived statistics cannot be assumed to be unbiased

This report is intended to give readers information about the types of satellite data that agencies request in order to support their needs, including:

- The geophysical feature, parameter, or phenomenon the agency needs to observe
- Technical specifications of data that could support their work, including resolution, coverage, latency, and other data characteristics
- Processing aspects of data use, including data discovery, access methods, and formats

Take-Home Messages

Across five survey cycles, there is a steady increase in the need for continuous, routinely collected, high-quality, free data.

Specific findings from 2022:

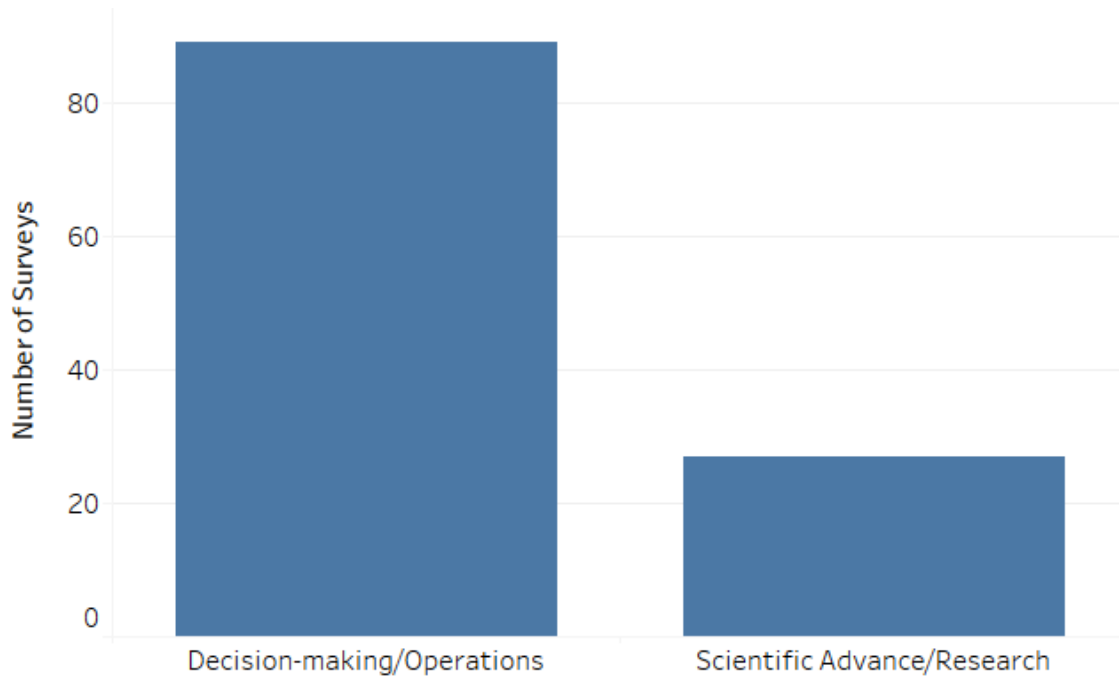
- The observables most frequently requested by agencies were those pertaining to the atmosphere, human dimensions, biosphere, and land surface.

- Atmospheric observation needs frequently encompass multiple related variables, e.g. cloud needs combining cloud fraction, base height, optical depth, and liquid water path.
 - The human dimensions category includes infrastructure as well as the human impacts of natural hazards.
- Decision-making and operational requirements constituted over 75% of identified needs, often necessitating high-level data products such as gridded datasets harmonized from observations from multiple satellites.
- Geographically, the majority of needs were focused on U.S. states and territories, with approximately 35% representing global needs.
- Spatial resolution emerged as the most critical attribute to agencies and exhibited a clear trend toward higher resolution requests.
- Daily data with one-day latency was the most common request, although over 35% of submissions requested sub-daily frequency and latency.
- The most common obstacles to the use of satellite data were data volume, data transformation, and the demand for near real-time data.
- Training in cloud computing use was the most-requested training need, accounting for 50% of responses.

Aggregate Statistics

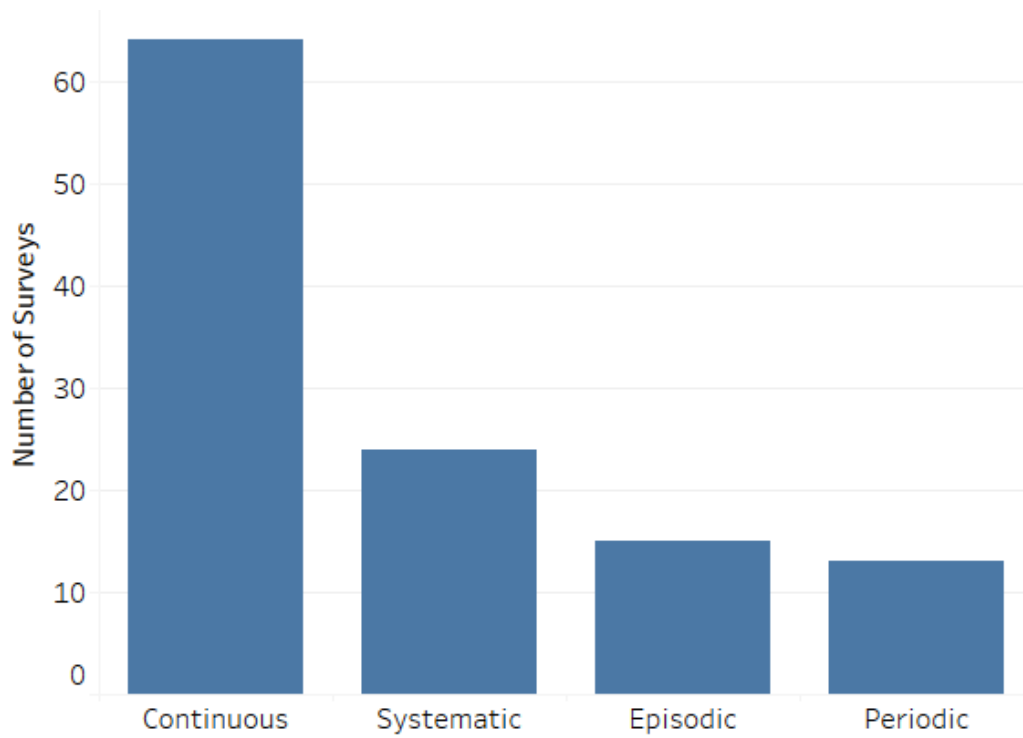
Context for Satellite Measurement or Data Product Need

Which of these descriptions best fits the nature of the need? (1)



Option	# of Surveys (%)
Decision-making/Operations	89 (77%)
Scientific Advance/Research	27 (23%)

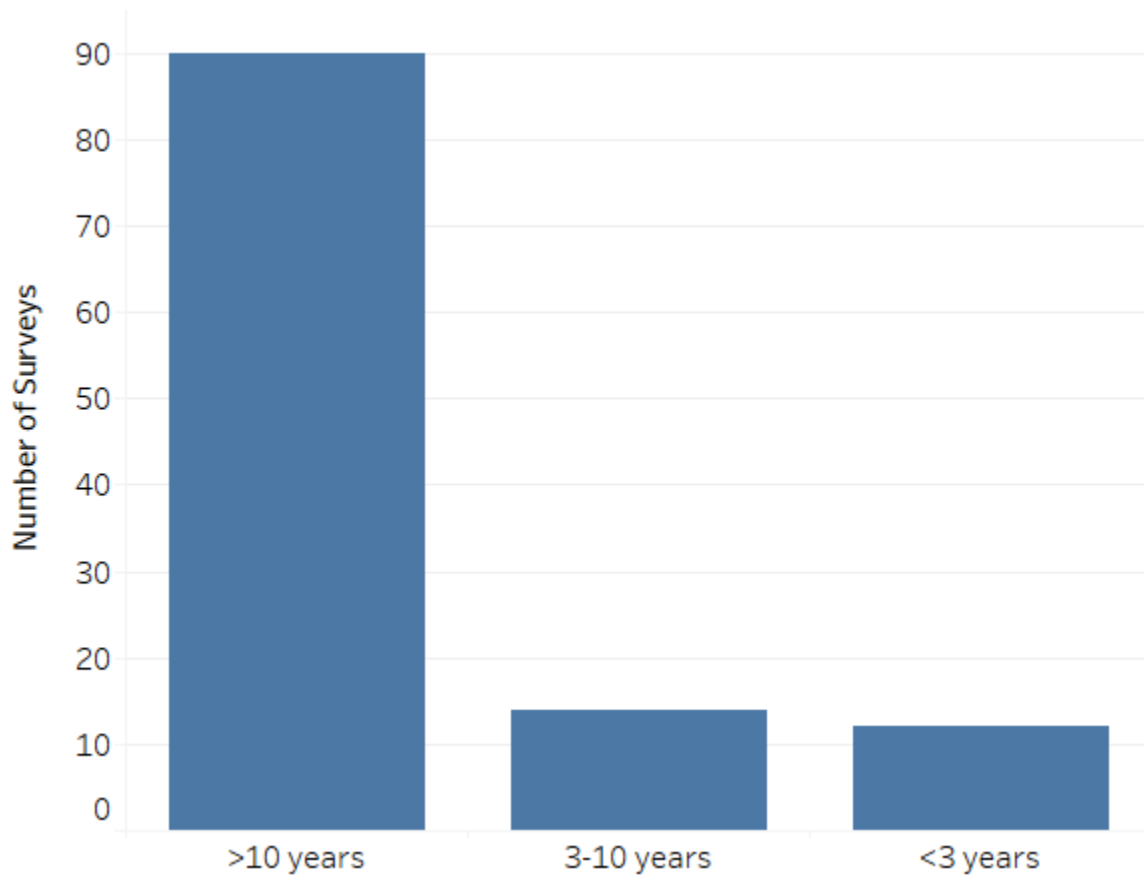
Which of these descriptions best fits the nature of the need? (2)



Option	# of Surveys (%)
Continuous	64 (55%)
Systematic (Examples: time-series to detect landslide motion, volcanic unrest, land-use change, or ecosystem disturbance)	24 (21%)
Episodic (Examples: imagery during forest fires or volcanic eruptions)	15 (13%)
Periodic (Examples: crop health during the growing season or reservoir levels after spring snow melt)	13 (11%)

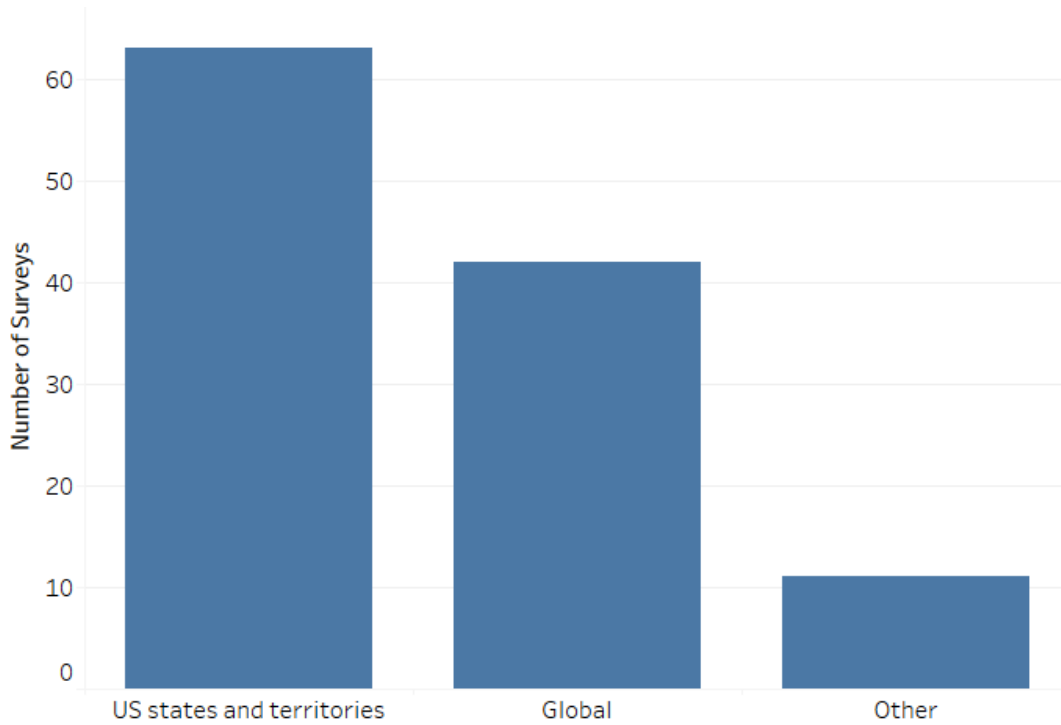
Specific Satellite Measurement or Data Product Need

How long has this data been required in order to meet your agency objectives?



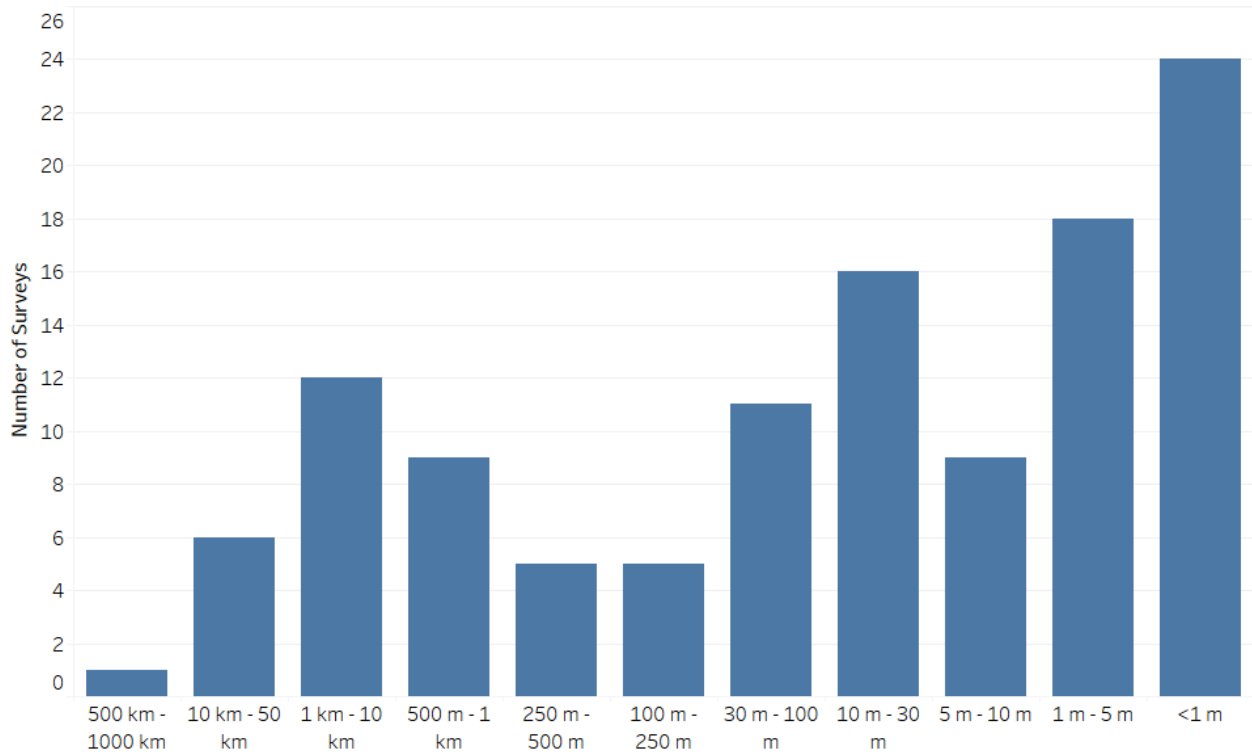
Option	# of Surveys (%)
>10 years	90 (78%)
3-10 years	14 (12%)
<3 years	12 (10%)

What is the optimal geographic coverage to meet your satellite measurement or product need?



Option	# of Surveys (%)
US states and territories	63 (54%)
Global	42 (36%)
Other	11 (10%)
Tropics	0 (0%)
Polar regions	0 (0%)

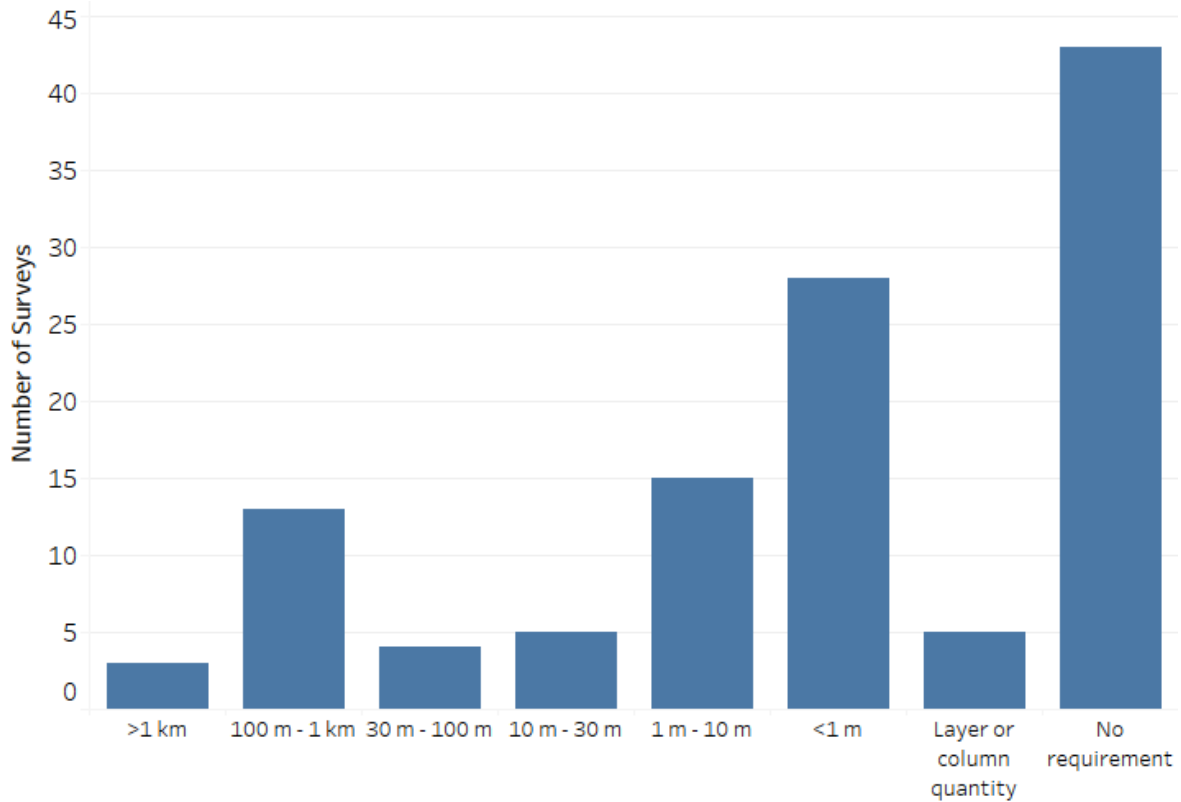
What is the optimal horizontal spatial resolution to meet your need?



Option	# of Surveys (%)
>1000 km (>10 degrees)	0 (0%)
500 km - 1000 km (5-10 degrees)	1 (1%)
250 km - 500 km (2.5-5.0 degrees)	0 (0%)
100 km - 250 km (1.0-2.5 degrees)	0 (0%)
50 km - 100 km (0.5-1.0 degrees)	0 (0%)
10 km - 50 km (0.09-0.5 degrees)	6 (5%)
1 km - 10 km (0.01-0.09 degrees)	12 (10%)
500 m - 1 km	9 (8%)
250 m - 500 m	5 (4%)
100 m - 250 m	5 (4%)
30 m - 100 m	11 (9%)
10 m - 30 m	16 (14%)

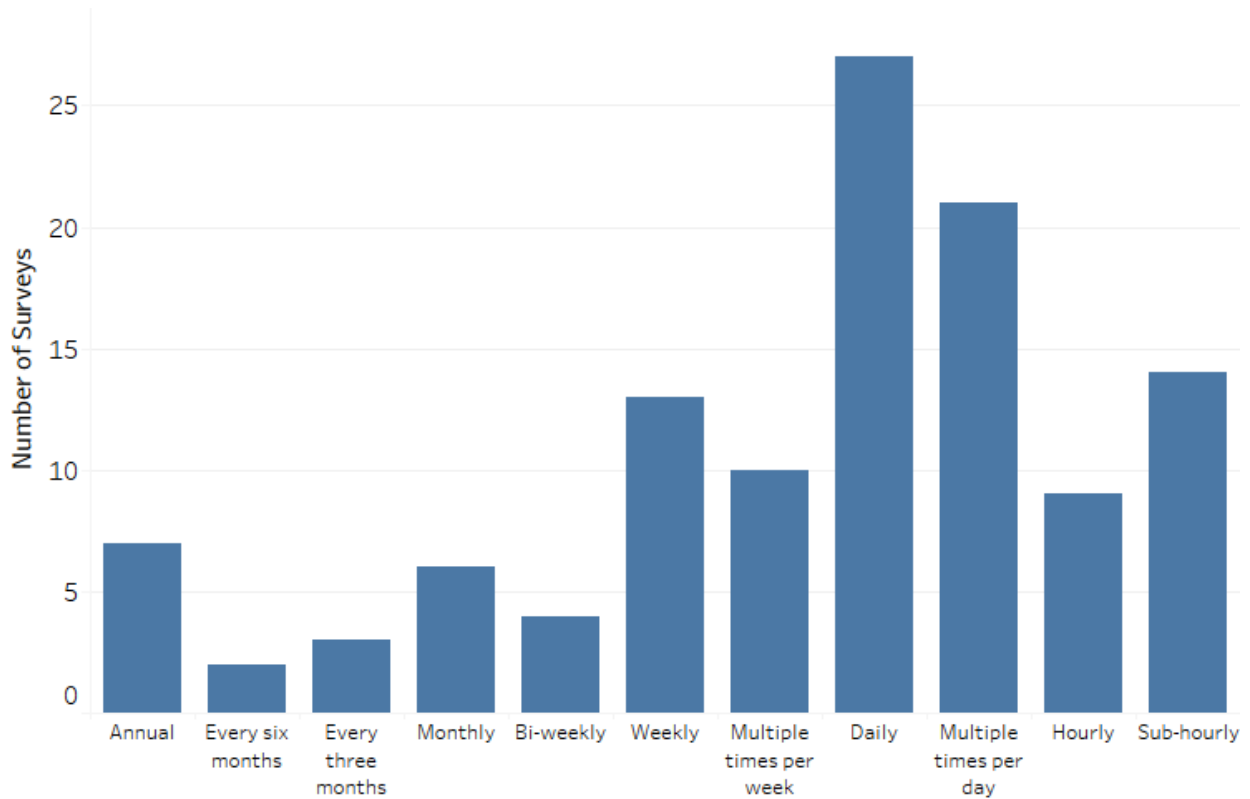
5 m - 10 m	9 (8%)
1 m - 5 m	18 (16%)
<1 m	24 (21%)

What is the optimal vertical spatial resolution to meet your need?



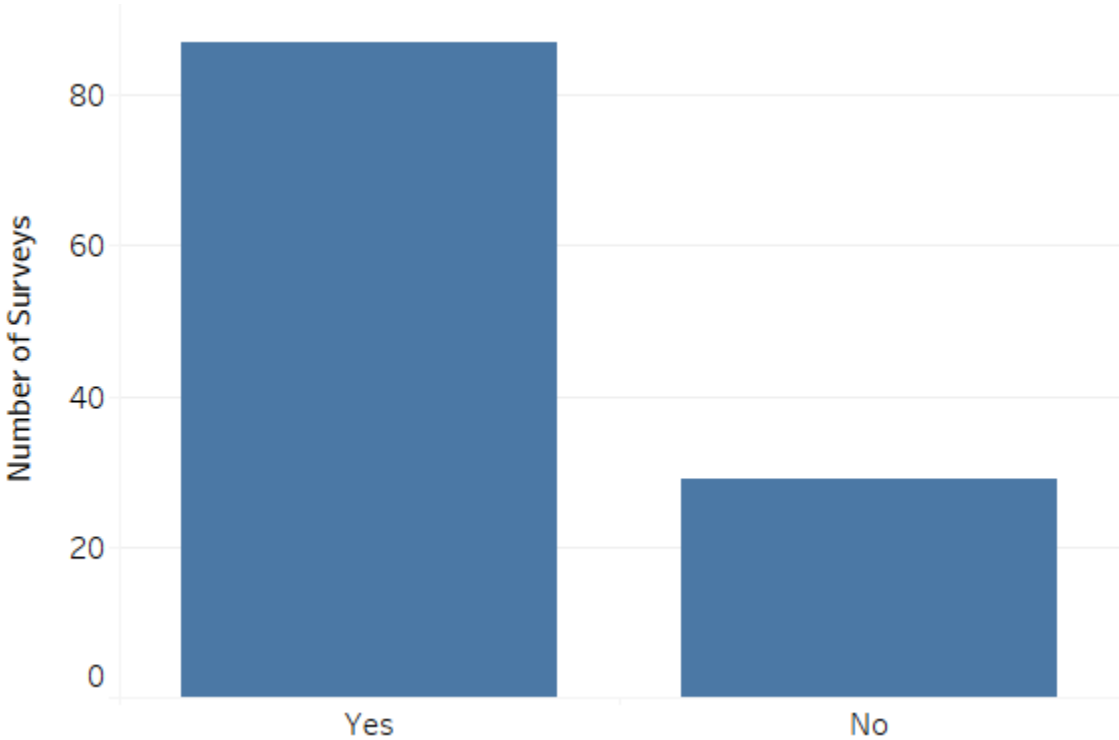
Option	# of Surveys (%)
>1 km	3 (3%)
100 m - 1 km	13 (11%)
30 m - 100 m	4 (3%)
10 m - 30 m	5 (4%)
1 m - 10 m	15 (13%)
<1 m	28 (24%)
Layer or column quantity	5 (4%)
I do not need vertically resolved measurements	43 (37%)

What is the optimal measurement or data product temporal frequency?



Option	# of Surveys (%)
Annual	7 (6%)
Every six months	2 (2%)
Every three months	3 (3%)
Monthly	6 (5%)
Bi-weekly	4 (3%)
Weekly	13 (11%)
Multiple times per week	10 (9%)
Daily	27 (23%)
Multiple times per day	21 (18%)
Hourly	9 (8%)
Sub-hourly	14 (12%)

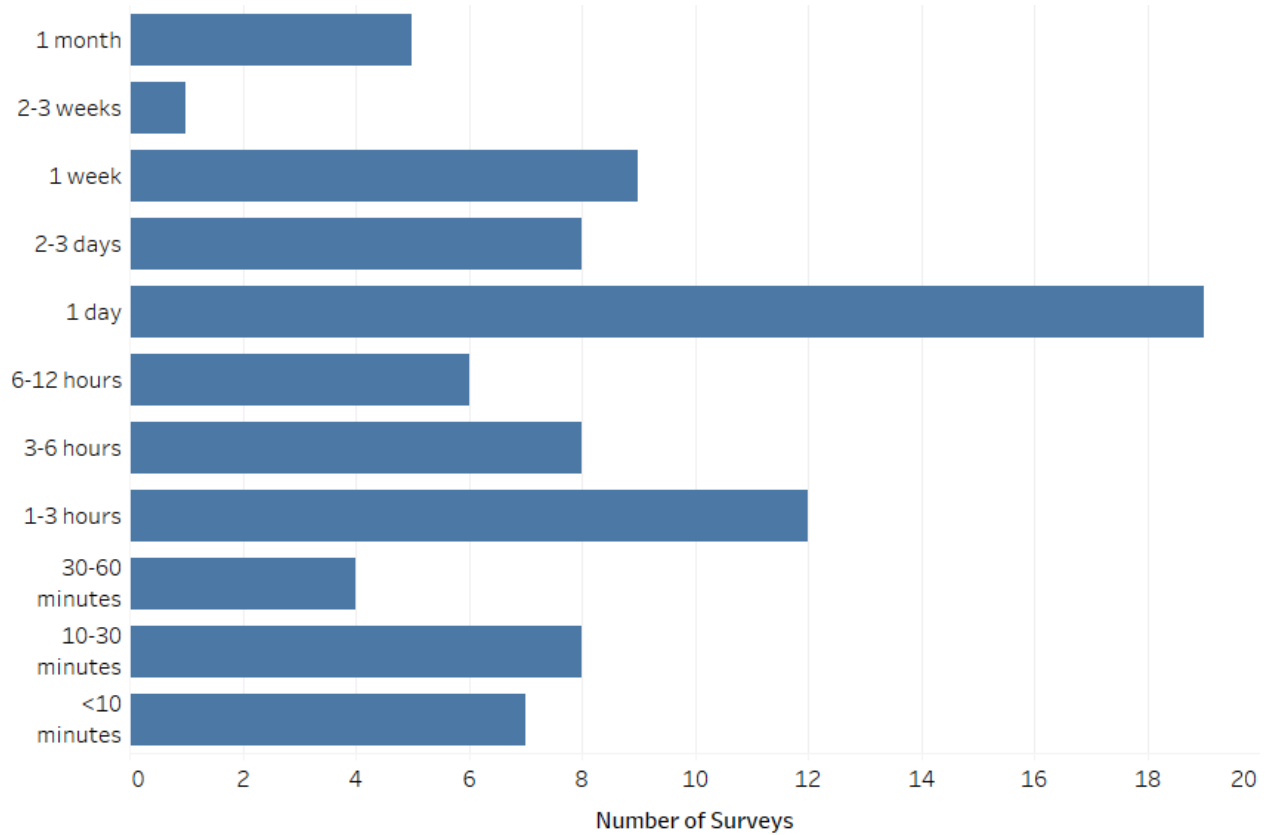
Is data latency a critical attribute for these needs?



Option	# of Surveys (%)
Yes	87 (75%)
No	29 (25%)

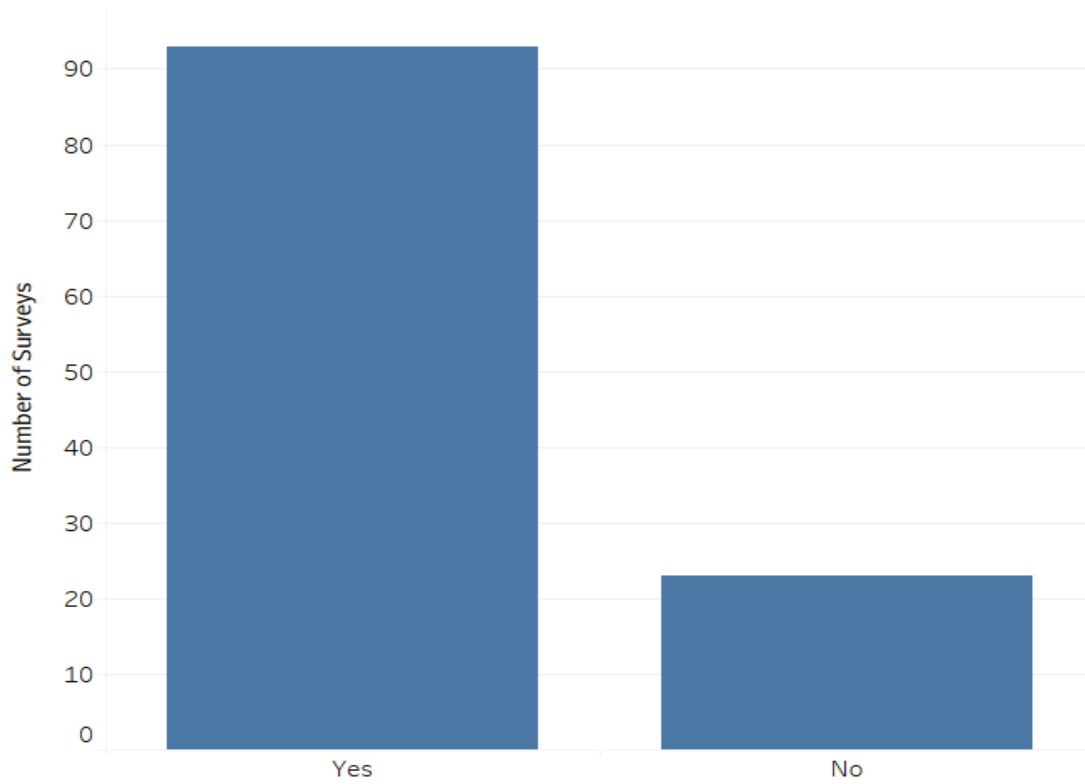
What is the optimal data latency to meet your measurement or product need?

For the 87 surveys (75%) that indicated a critical data latency need:



Option	# of Surveys (% of those responding)
1 month	5 (6%)
2-3 weeks	1 (1%)
1 week	9 (10%)
2-3 days	8 (9%)
1 day	19 (22%)
6-12 hours	6 (7%)
3-6 hours	8 (9%)
1-3 hours	12 (14%)
30-60 minutes	4 (5%)
10-30 minutes	8 (9%)
<10 minutes	7 (8%)

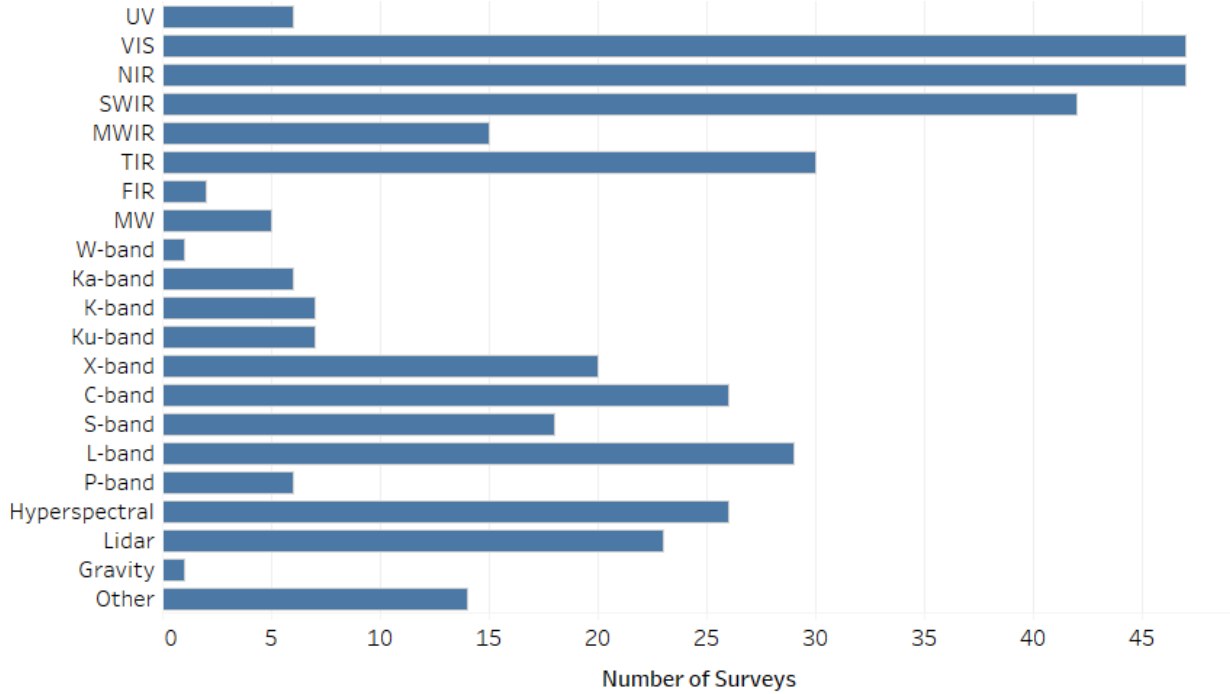
Are specific spectral bands critical in meeting your need?



Option	# of Surveys (%)
Yes	93 (80%)
No	23 (20%)

What are the optimal spectral bands to meet your measurement or data product need?
(select all that apply)

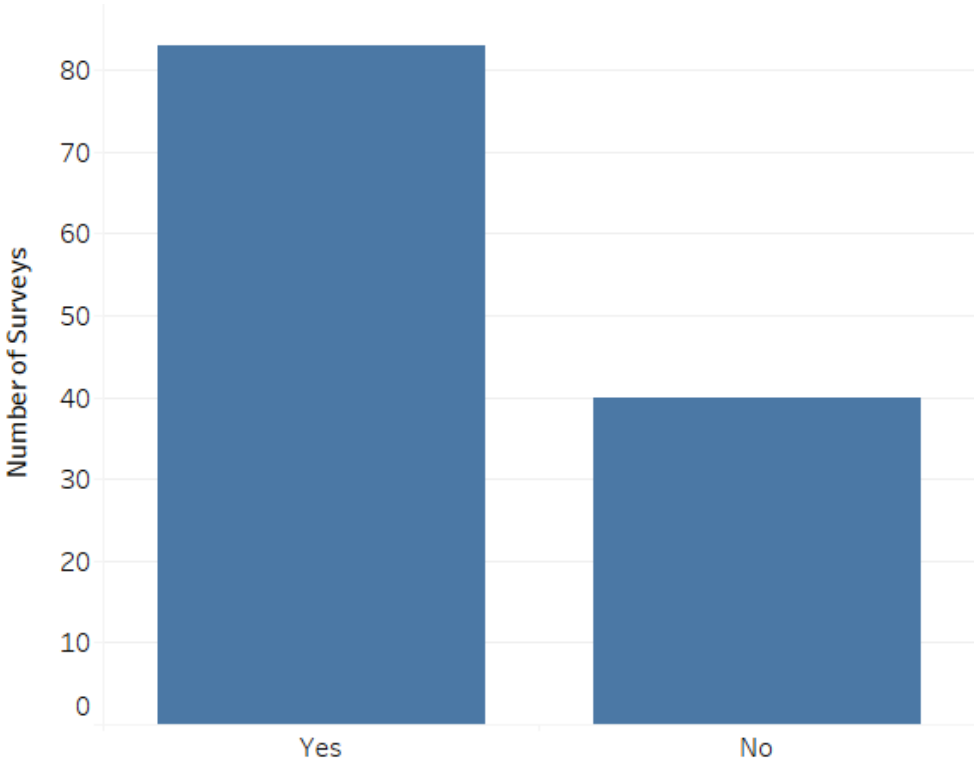
For the 93 surveys (80%) that indicated a critical spectral band need:



Option	# of Surveys (% of those responding)
UV (~0.01 μm - ~0.40 μm)	6 (6%)
VIS (~0.40 μm - ~0.75 μm)	47 (51%)
NIR (~0.75 μm - ~1.3 μm)	47 (51%)
SWIR (~1.3 μm - ~3.0 μm)	42 (45%)
MWIR (~3.0 μm - ~6.0 μm)	15 (16%)
TIR (~6.0 μm - ~15.0 μm)	30 (32%)
FIR (~15.0 μm - ~0.1 cm)	2 (2%)
MW (~1.0 cm - ~100 cm)	5 (5%)
W-Band (94 GHz)	1 (1%)
Ka-Band (26.5 - 40 GHz)	6 (6%)
K-Band (18 - 26.5 GHz)	7 (8%)

Ku-Band (12.5 - 18 GHz)	7 (8%)
X-Band (12.5 - 8 GHz)	20 (22%)
C-Band (8 - 4 GHz)	26 (28%)
S-Band (4 - 2 GHz)	18 (19%)
L-Band (2 - 1 GHz)	29 (31%)
P-Band (0.999 - 0.2998 GHz)	6 (6%)
Hyperspectral	26 (28%)
Lidar	23 (25%)
Gravity	1 (1%)
Other	14 (15%)

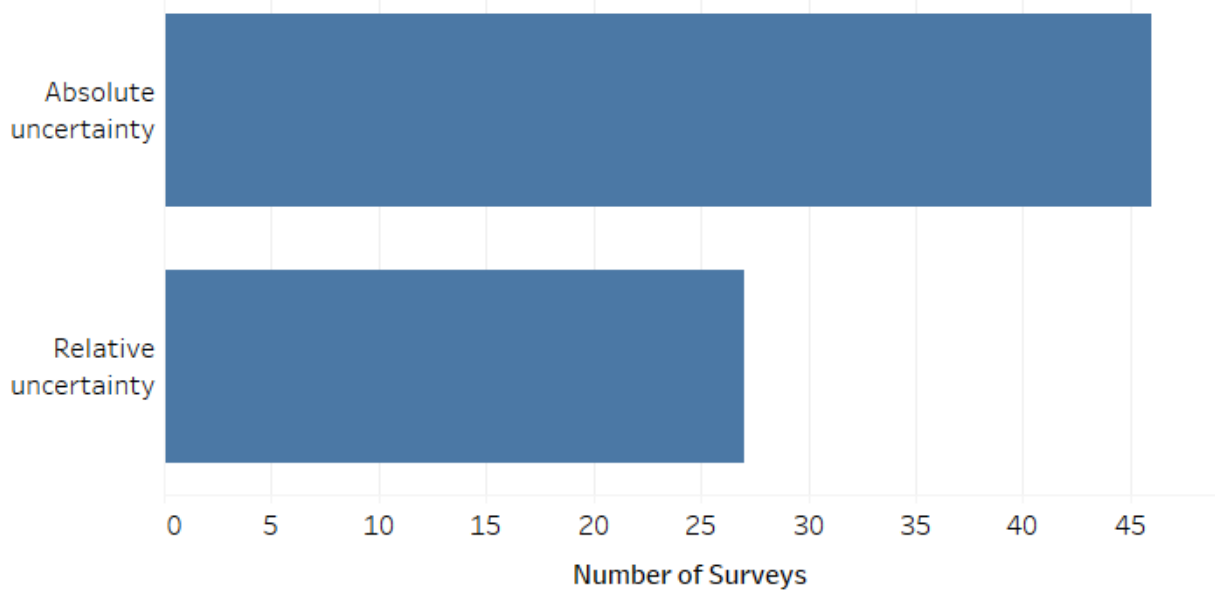
Is measurement uncertainty a critical attribute in meeting your need?



Option	# of Surveys (%)
Yes	73 (63%)
No	43 (37%)

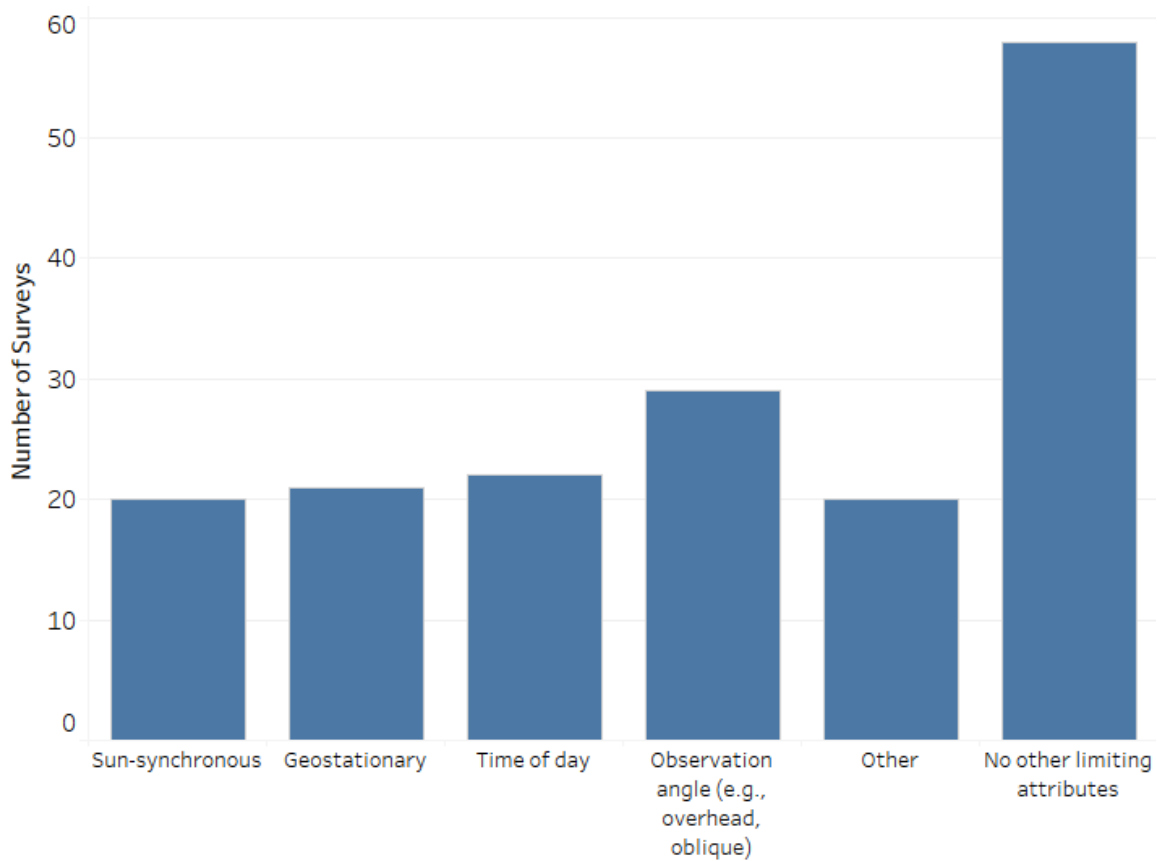
Which type of uncertainty is more important in meeting your need?

For the 73 surveys (63%) that indicated a critical measurement uncertainty latency need:



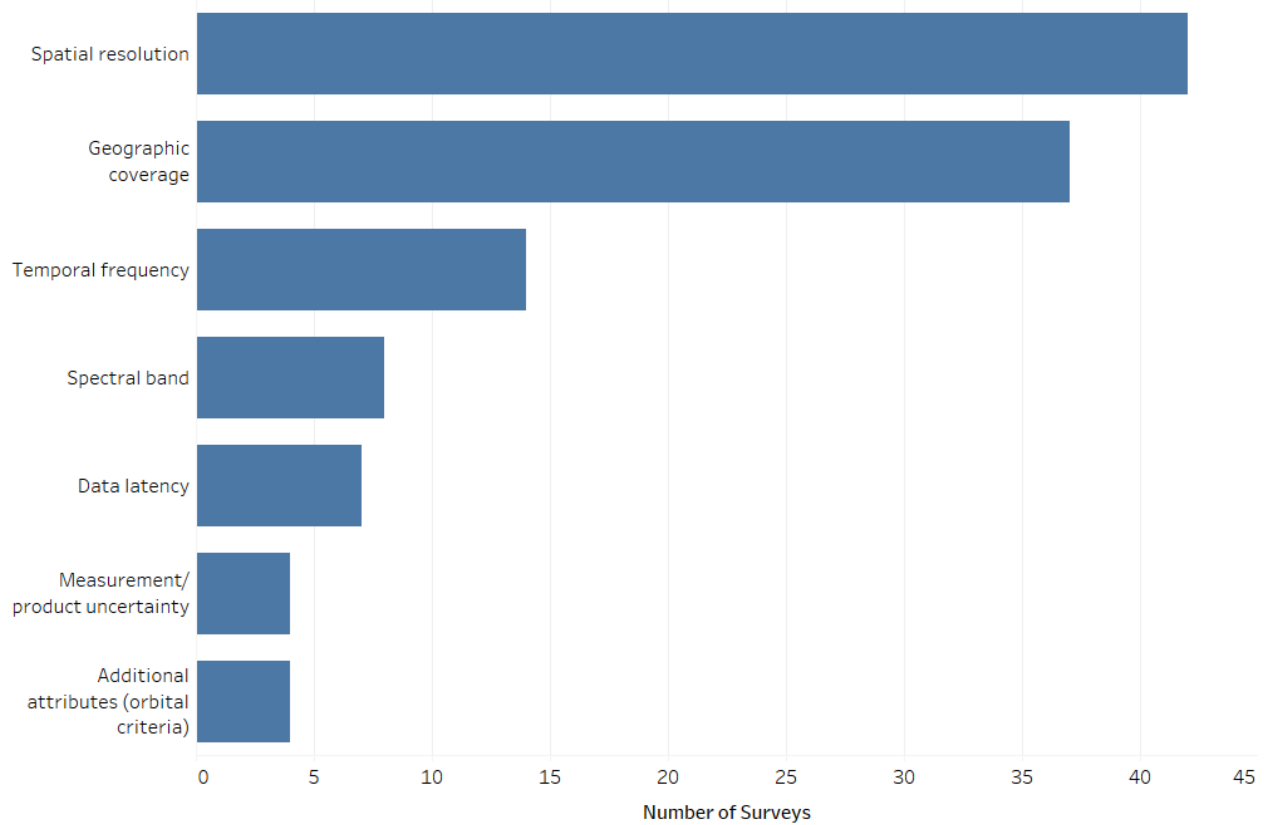
Option	# of Surveys (% of those responding)
Absolute uncertainty (e.g., +/- 0.1 m)	46 (63%)
Relative uncertainty (e.g., within 5%)	27 (37%)

Are there other limiting attributes such as the following? (select all that apply)



Option	# of Surveys (%)
Sun-synchronous	20 (17%)
Geostationary	21 (18%)
Time of Day	22 (19%)
Observation angle (e.g., overhead, oblique)	29 (25%)
Other	20 (17%)
No other limiting attributes	58 (50%)

Rank how critical each of the above attributes is for meeting your need, with 1 = most important.

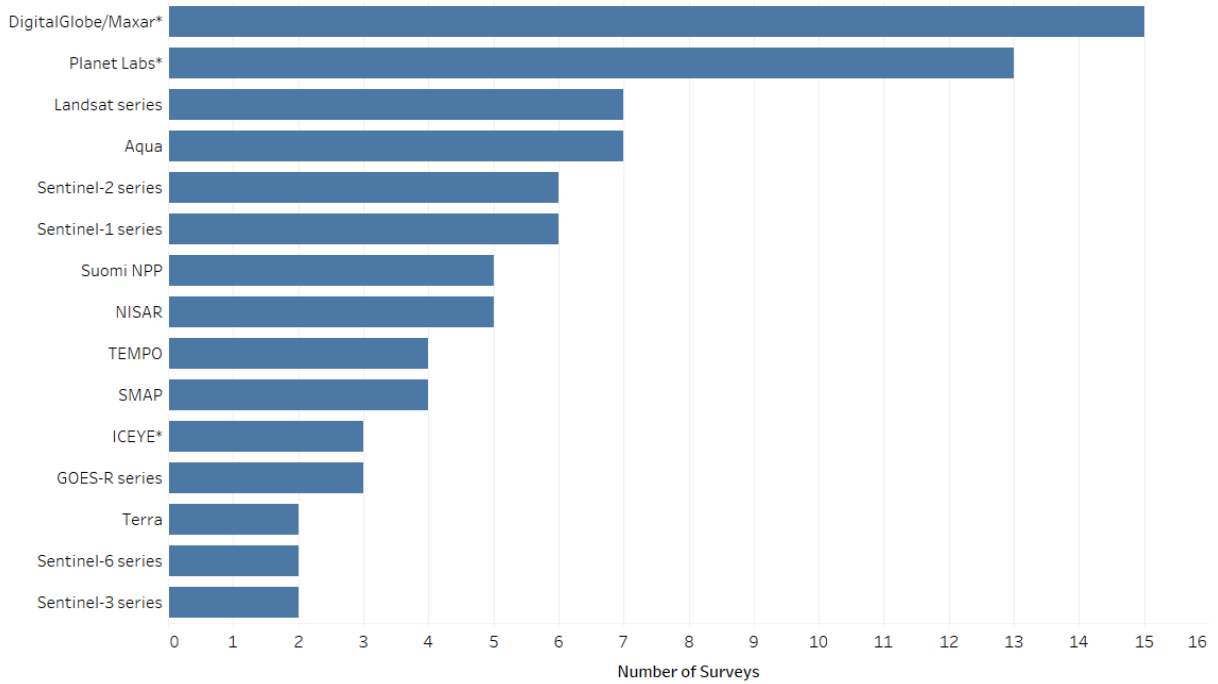


Option	# of Surveys Ranking #1 (%)	# of Surveys Ranking #2 (%)
Spatial resolution	42 (36%)	30 (26%)
Geographic coverage	37 (32%)	15 (13%)
Temporal frequency	14 (12%)	37 (32%)
Spectral band	8 (7%)	22 (19%)
Data latency	7 (6%)	6 (5%)
Measurement/product uncertainty	4 (3%)	3 (3%)
Additional attributes (orbital criteria)	4 (3%)	3 (3%)

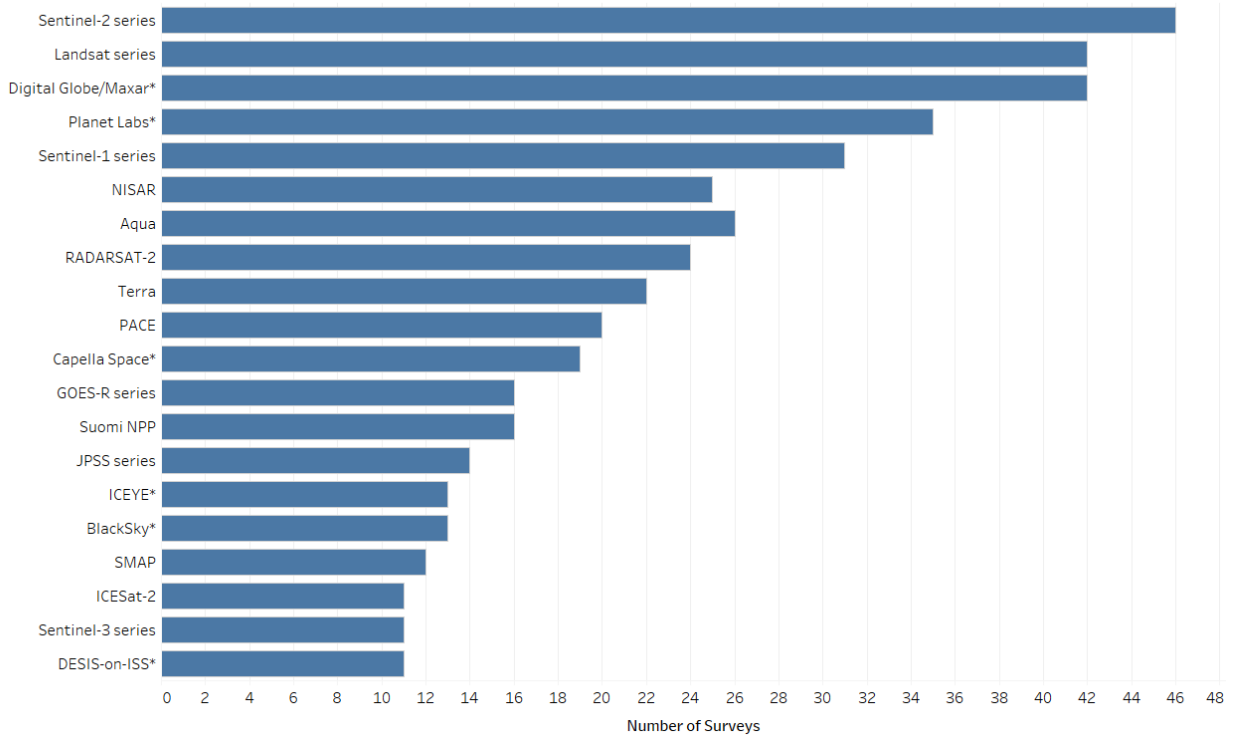
If you know which satellite mission or sensor is currently or could be used to satisfy your needs, please rank in order of priority, with 1 = most important.

Note: responses marked with an asterisk signify that the mission or sensor is commercial

Number of Responses Ranking Satellite #1



Number of Responses Ranking Satellite in Any Position



Option	# of Surveys Ranking #1 (%)	# of Surveys Ranking Overall (%)
I don't know	11 (9%)	16 (14%)
ADM-Aeolus	1 (1%)	2 (2%)
ALOS-2/ALOS-3/ALOS-4	1 (1%)	8 (7%)
ALTIUS	0 (0%)	0 (0%)
Aqua (AIRS, AMSR-E, AMSU-A, CERES, HSB, MODIS)	7 (6%)	26 (22%)
Aura (HIRDLS, MLS, OMI, TES)	1 (1%)	3 (3%)
AWS	0 (0%)	0 (0%)
Biomass	0 (0%)	0 (0%)
BlackSky (optical products)	0 (0%)	13 (11%)
CALIPSO	0 (0%)	1 (1%)
Capella Space	0 (0%)	19 (16%)
CLARREO Pathfinder-on-ISS	0 (0%)	0 (0%)
CloudSat	1 (1%)	3 (3%)
COSMIC-1/COSMIC-2	1 (1%)	1 (1%)
COSMO-SkyMed1/COSMO-SkyMed2/COSMO-SkyMed3/COSMO-SkyMed4	0 (0%)	8 (7%)
CryoSat-2	0 (0%)	3 (3%)
CYGNSS	0 (0%)	2 (2%)
Deimos-1	0 (0%)	1 (1%)
DEISIS-on-ISS	0 (0%)	11 (9%)
DigitalGlobe (Worldview-1/Worldview-2/Worldview-3/Worldview-4/GeoEye-1)	15 (13%)	42 (36%)
DMC UK-2/DMC3	0 (0%)	0 (0%)
DMSP F-14/F-15/F-16/F-17/F-18	0 (0%)	0 (0%)
DSCOVER	0 (0%)	0 (0%)
EarthCARE	1 (1%)	2 (2%)
ECOSTRESS-on-ISS	1 (1%)	4 (3%)
EMIT-on-ISS	0 (0%)	1 (1%)
ESP-MACCS	0 (0%)	0 (0%)

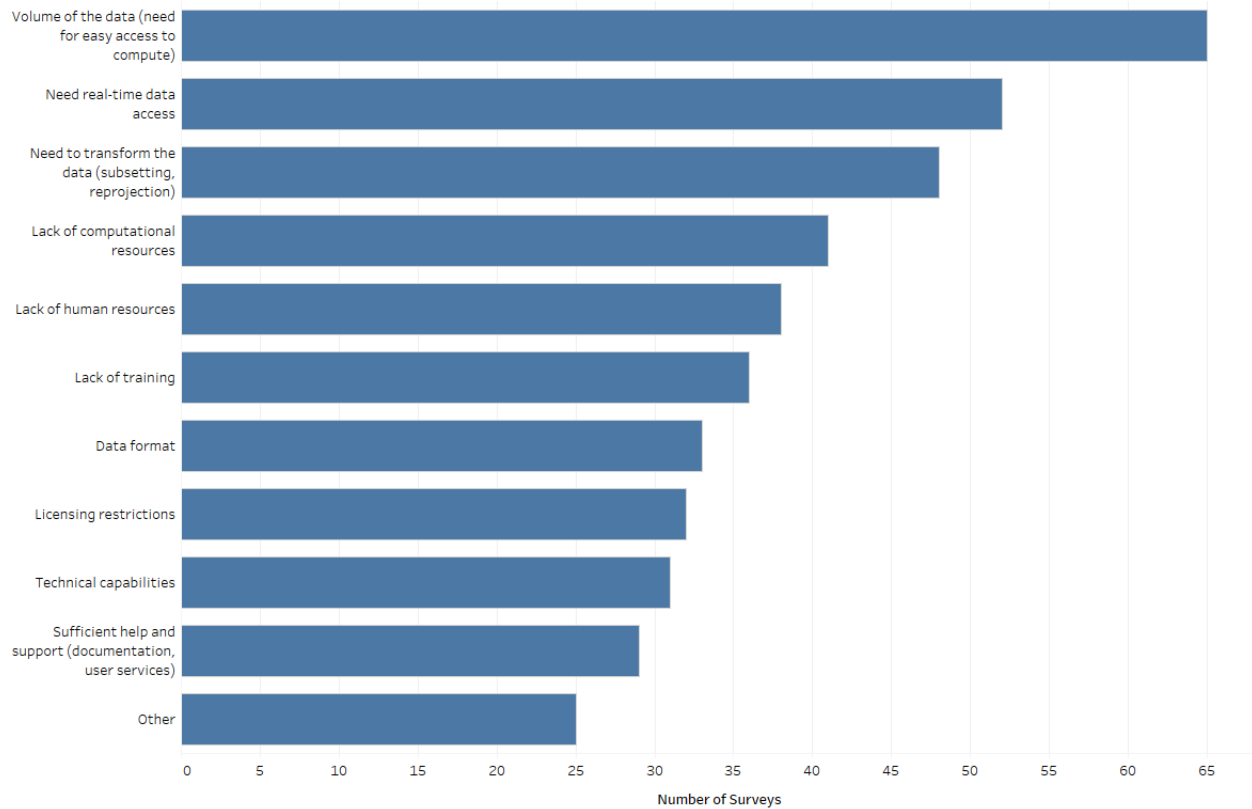
FLEX	0 (0%)	1 (1%)
GCOM-C/GCOM-W	0 (0%)	4 (3%)
GEDI-on-ISS	1 (1%)	4 (3%)
GeoCarb	1 (1%)	3 (3%)
GeoOptics	0 (0%)	1 (1%)
GHGSat	0 (0%)	4 (3%)
GLIMR	0 (0%)	0 (0%)
GOES-16/GOES-17/GOES-18 (ABI, GLM)	3 (3%)	16 (14%)
GOSAT/GOSAT-2/GOSAT-GW	1 (1%)	1 (1%)
GPM	1 (1%)	5 (4%)
GRACE/GRACE-FO	1 (1%)	4 (3%)
Himawari-8/Himawari-9	0 (0%)	6 (5%)
HydroGNSS	0 (0%)	0 (0%)
Hyperion	0 (0%)	3 (3%)
ICESat-2	1 (1%)	11 (9%)
ICEYE	3 (3%)	13 (11%)
Jason-2/Jason-3	0 (0%)	3 (3%)
JPSS-1/JPSS-2/JPSS-3/JPSS-4	1 (1%)	14 (12%)
LAGEOS-1/LAGEOS-2	0 (0%)	0 (0%)
Landsat 7/Landsat 8/Landsat 9	7 (6%)	42 (36%)
LIS-on-ISS	0 (0%)	0 (0%)
MAIA	0 (0%)	0 (0%)
Meteosat-8/Meteosat-9/Meteosat-10/ Meteosat-11	0 (0%)	5 (4%)
Metop-A/Metop-B/Metop-C	1 (1%)	7 (6%)
METOP-SG A1/METOP-SG A2/ METOP-SG A3	0 (0%)	2 (2%)
METOP-SG B1/METOP-SG B2/ METOP-SG B3	0 (0%)	2 (2%)
MTG-I1/MTG-I2/MTG-I3/MTG-I4	0 (0%)	0 (0%)
MTG-S1/MTG-S2	0 (0%)	0 (0%)
NISAR	5 (4%)	25 (22%)

NOAA-18/NOAA-19	1 (1%)	5 (4%)
OCO-2/OCO-3-on-ISS	0 (0%)	1 (1%)
Odin	0 (0%)	0 (0%)
PACE	0 (0%)	20 (17%)
Planet Labs [PlanetScope (Dove), RapidEye, SkySat]	13 (11%)	35 (30%)
Pleiades 1A/Pleiades 1B	1 (1%)	9 (8%)
PREFIRE	0 (0%)	1 (1%)
PROBA/PROBA-V	0 (0%)	0 (0%)
RADARSAT-2	0 (0%)	24 (21%)
RCM-1/RCM-2/RCM-3	0 (0%)	5 (4%)
RESOURCESAT-2/RESOURCESAT-2A/RESOURCESAT-3/RESOURCESAT-3A/RESOURCESAT-3S/RESOURCESAT-3SA	0 (0%)	1 (1%)
SAGE-III-on-ISS	0 (0%)	0 (0%)
SAOCOM 1A/SAOCOM 1B/SAOCOM-2A/SAOCOM-2B	0 (0%)	4 (3%)
SARAL	0 (0%)	3 (3%)
SCATSAT-1/SCATSAT-1A	0 (0%)	1 (1%)
SCISAT-1	0 (0%)	0 (0%)
Sentinel-1 A/Sentinel-1 B/Sentinel-1 C/Sentinel-1 D	6 (5%)	31 (27%)
Sentinel-2 A/Sentinel-2 B/Sentinel-2 C/Sentinel-2 D	6 (5%)	46 (40%)
Sentinel-3 A/Sentinel-3 B/Sentinel-3 C/Sentinel-3 D	2 (2%)	11 (9%)
Sentinel-4 A/Sentinel-4 B	0 (0%)	0 (0%)
Sentinel-5 precursor/Sentinel-5 A/Sentinel-5 B/Sentinel-5 C	0 (0%)	6 (5%)
Sentinel-6 A Michael Freilich/Sentinel-6 B	2 (2%)	4 (3%)
SMAP	4 (3%)	12 (10%)
SMOS	0 (0%)	8 (7%)
Spire	0 (0%)	2 (2%)

Suomi NPP	5 (4%)	16 (14%)
SWOT	1 (1%)	1 (1%)
TanDEM-X	0 (0%)	7 (6%)
TEMPO	4 (3%)	6 (5%)
Terra (ASTER, CERES, MISR, MODIS, MOPITT)	2 (2%)	22 (19%)
TerraSAR-X/PAZ	0 (0%)	8 (7%)
TROPICS/TROPICS Pathfinder	0 (0%)	0 (0%)
TRUTHS	0 (0%)	0 (0%)
TSIS-1-on-ISS/TSIS-2	0 (0%)	0 (0%)
Other	3 (3%)	17 (15%)

Processing for Satellite Measurement or Data Product Need

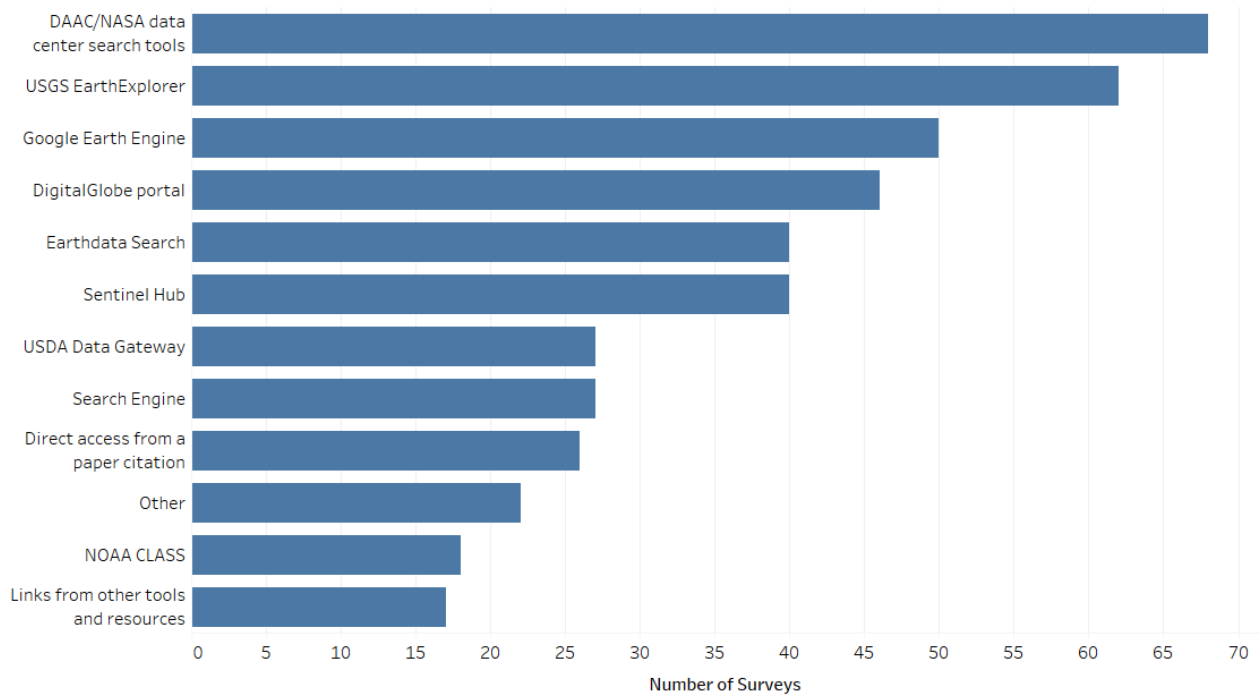
What factors limit your ability to use satellite data? (select all that apply)



Option	# of Surveys (%)
Volume of the data (need for easy access to compute)	65 (56%)
Need near real-time data access (data latency < 3 h)	52 (45%)
Need to transform the data (subsetting, reprojection)	48 (41%)
Lack of computational resources	41 (35%)
Lack of human resources	38 (33%)
Lack of training	36 (31%)
Data format	33 (28%)
Licensing restrictions	32 (28%)
Technical capabilities	31 (27%)

Sufficient help and support (documentation, user services)	29 (25%)
Other	25 (22%)

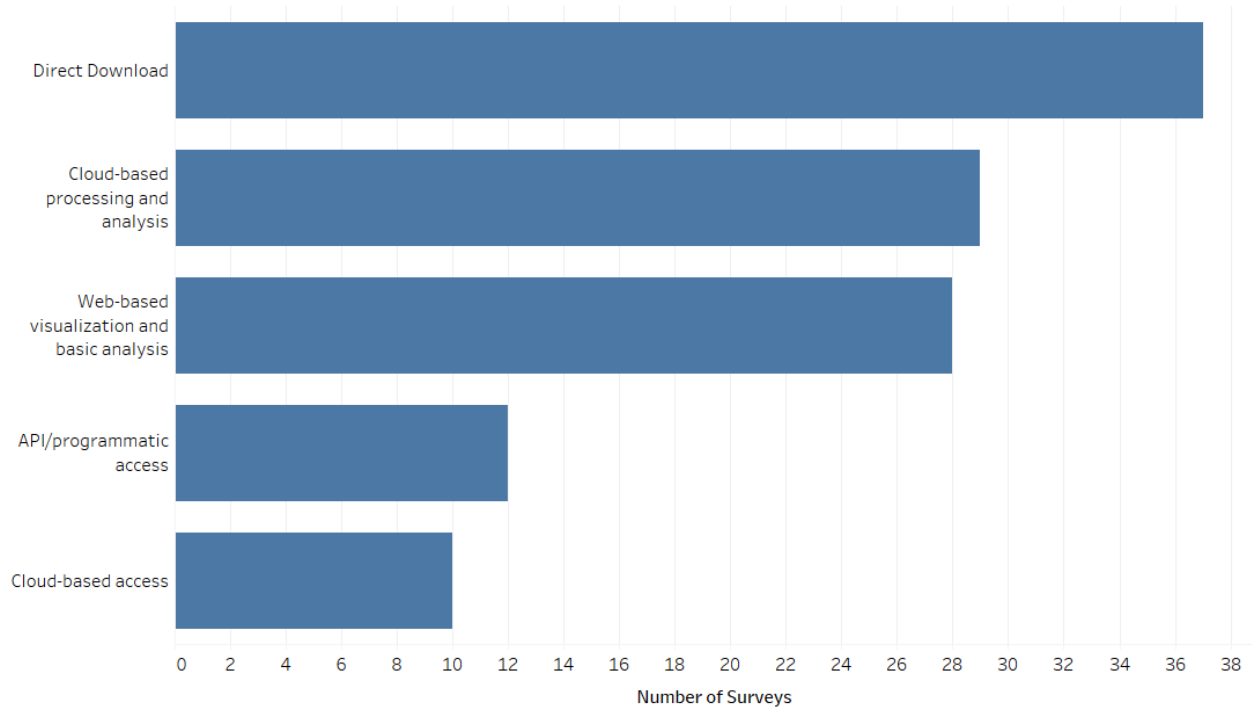
Which data discovery tools have you used to find satellite datasets? (select all that apply)



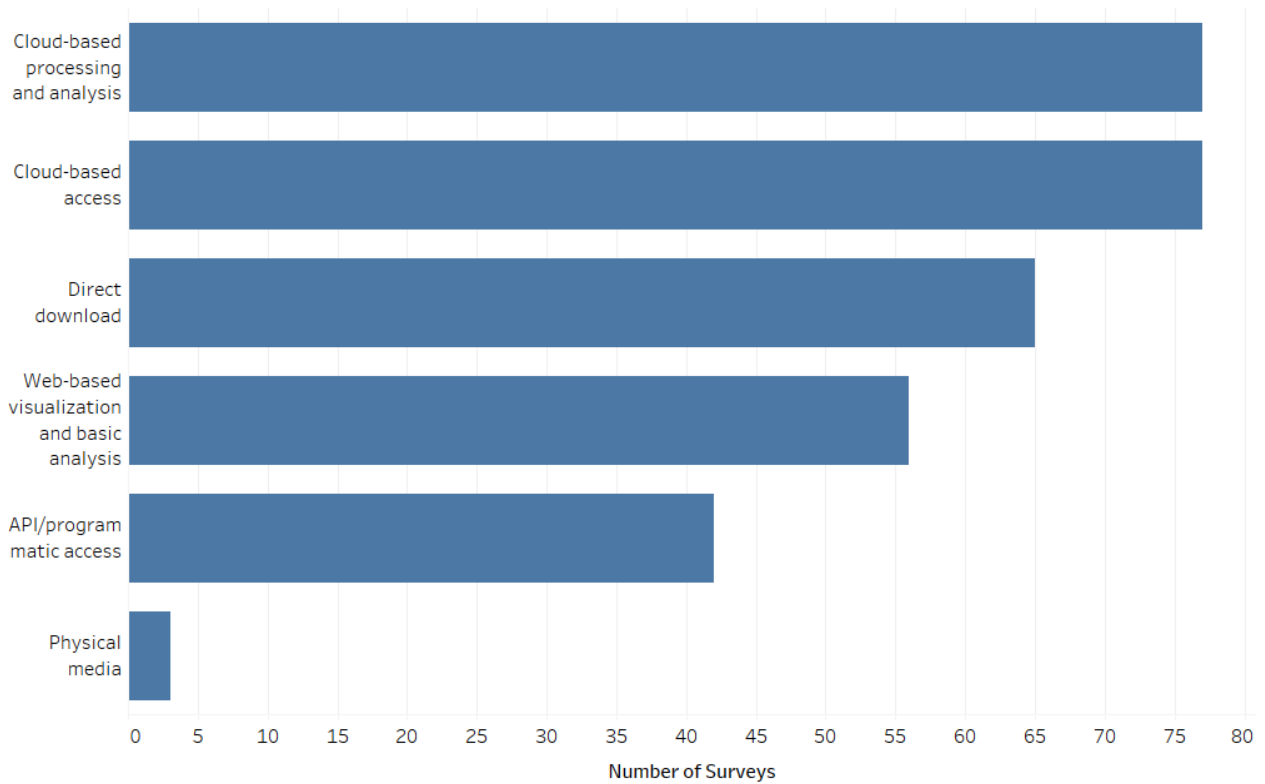
Option	# of Surveys (%)
DAAC/NASA data center search tools	68 (59%)
USGS EarthExplorer	62 (53%)
Google Earth Engine	50 (43%)
DigitalGlobe Portal	46 (40%)
Sentinel Hub	40 (34%)
Earthdata Search	40 (34%)
USDA Data Gateway	27 (23%)
Search engine	27 (23%)
Direct access from a paper citation	26 (22%)
Other	22 (19%)
NOAA CLASS	18 (16%)
Links from other tools and resources	17 (15%)

Rank the following access mechanisms in order of preference, with 1 = most preferred.

Number of Responses Ranking Access Mechanism #1



Number of Responses Ranking Access Mechanism in Top 3

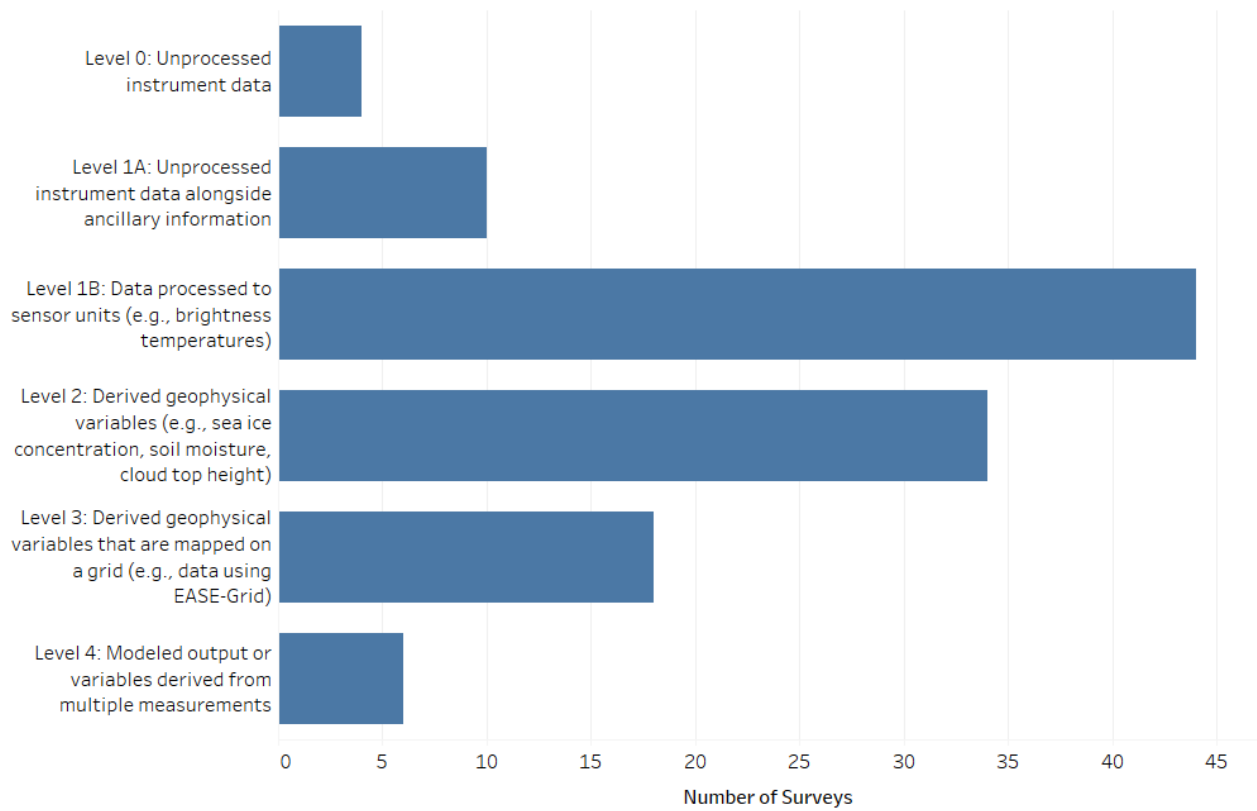


Option	# of Surveys Ranking #1 (%)	# of Surveys Ranked Top 3 (%)
Direct Download (FTP, HTTPS)	37 (32%)	65 (56%)
Cloud-based processing and analysis	29 (25%)	77 (66%)
Web-based visualization and basic analysis	28 (24%)	56 (48%)
API/programmatic access	12 (10%)	42 (36%)
Cloud-based access (i.e., no download)	10 (9%)	77 (66%)
Physical media	0 (0%)	3 (3%)

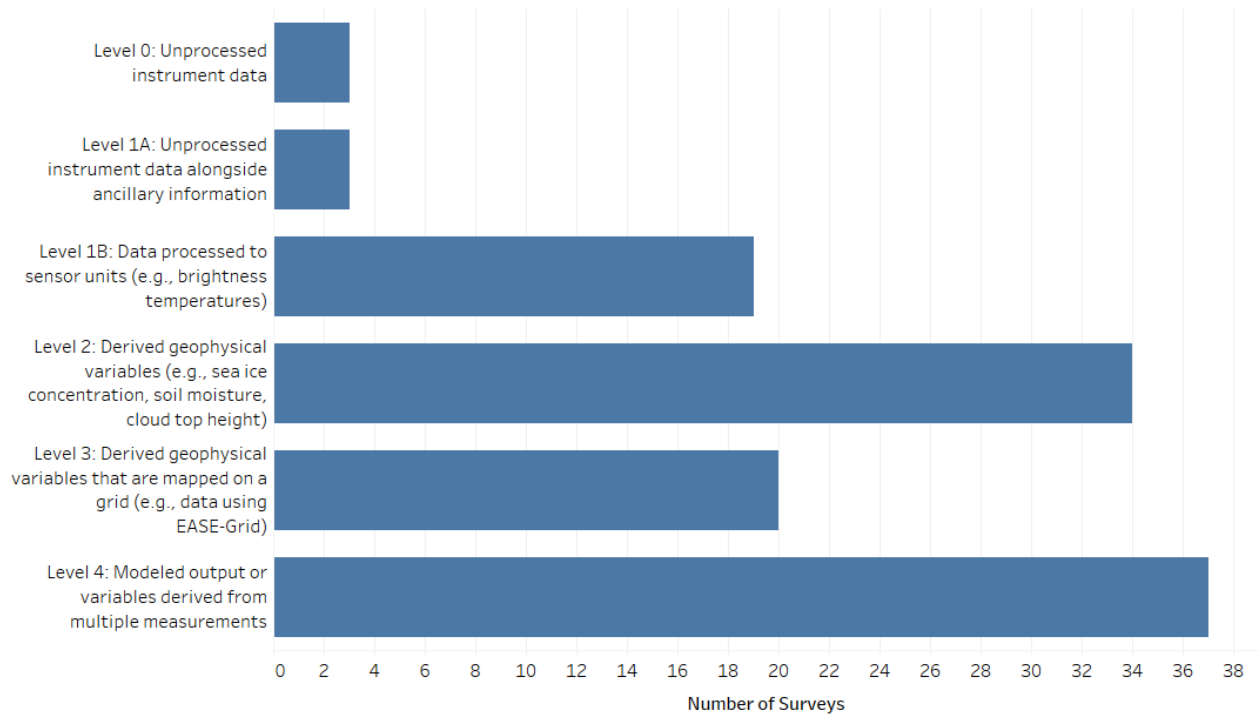
What would be the required and optimal levels of data processing for your agency to exploit the satellite measurements or products requested? (A full description of data processing levels is available at:

<https://www.earthdata.nasa.gov/learn/earth-observation-data-basics/data-processing-levels>)

Number of responses indicating required level of data processing

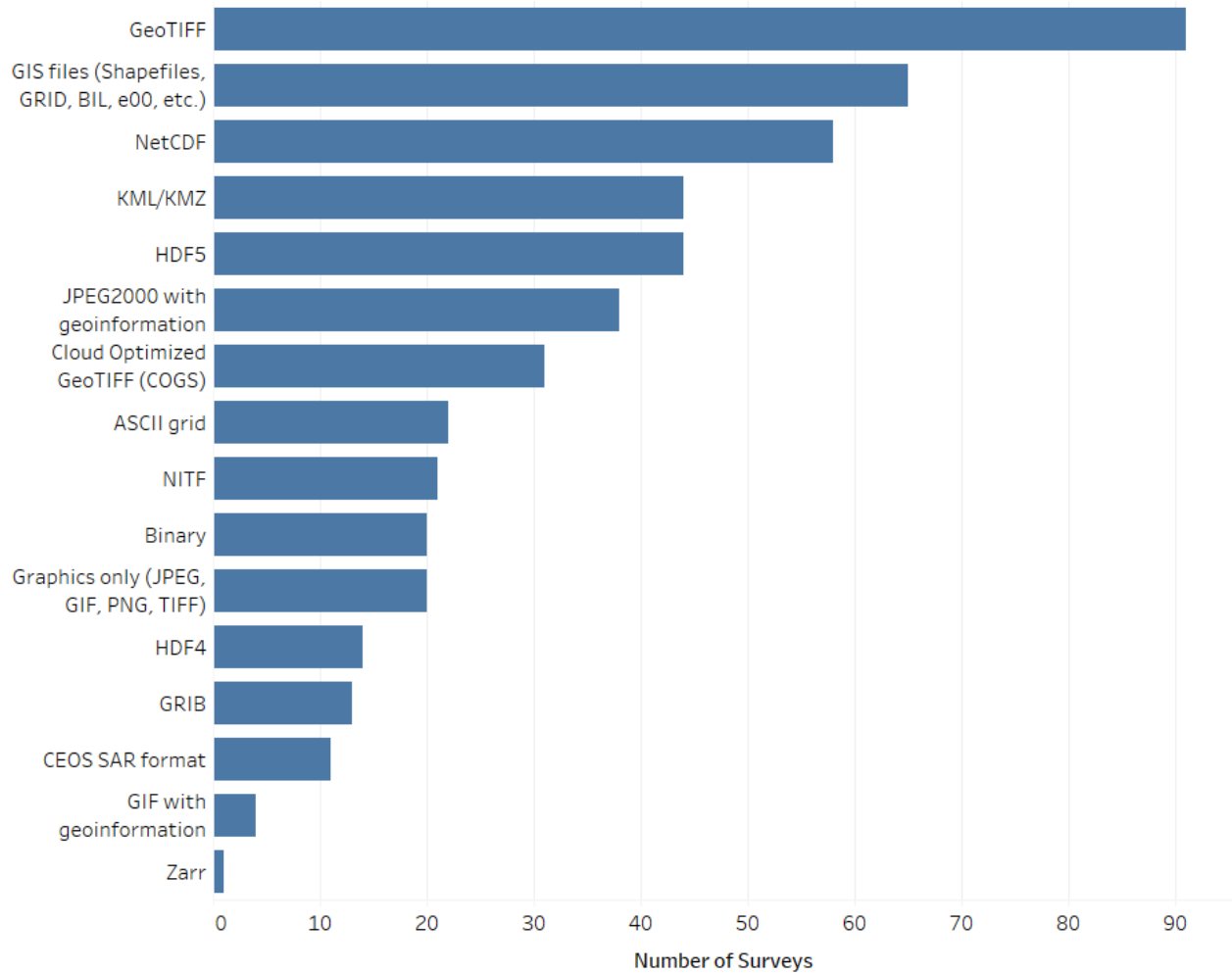


Number of responses indicating optimal level of data processing



Option	# of Surveys Selecting "Required" (%)	# of Surveys Selecting "Optimal" (%)
Level 0: Unprocessed instrument data	4 (3%)	3 (3%)
Level 1A: Unprocessed instrument data alongside ancillary information	10 (9%)	3 (3%)
Level 1B: Data processed to sensor units (e.g., brightness temperatures)	44 (38%)	19 (16%)
Level 2: Derived geophysical variables (e.g., sea ice concentration, soil moisture, cloud top height)	34 (29%)	34 (29%)
Level 3: Derived geophysical variables that are mapped on a grid (e.g., data using EASE-Grid)	18 (16%)	20 (17%)
Level 4: Modeled output or variables derived from multiple measurements	6 (5%)	37 (32%)

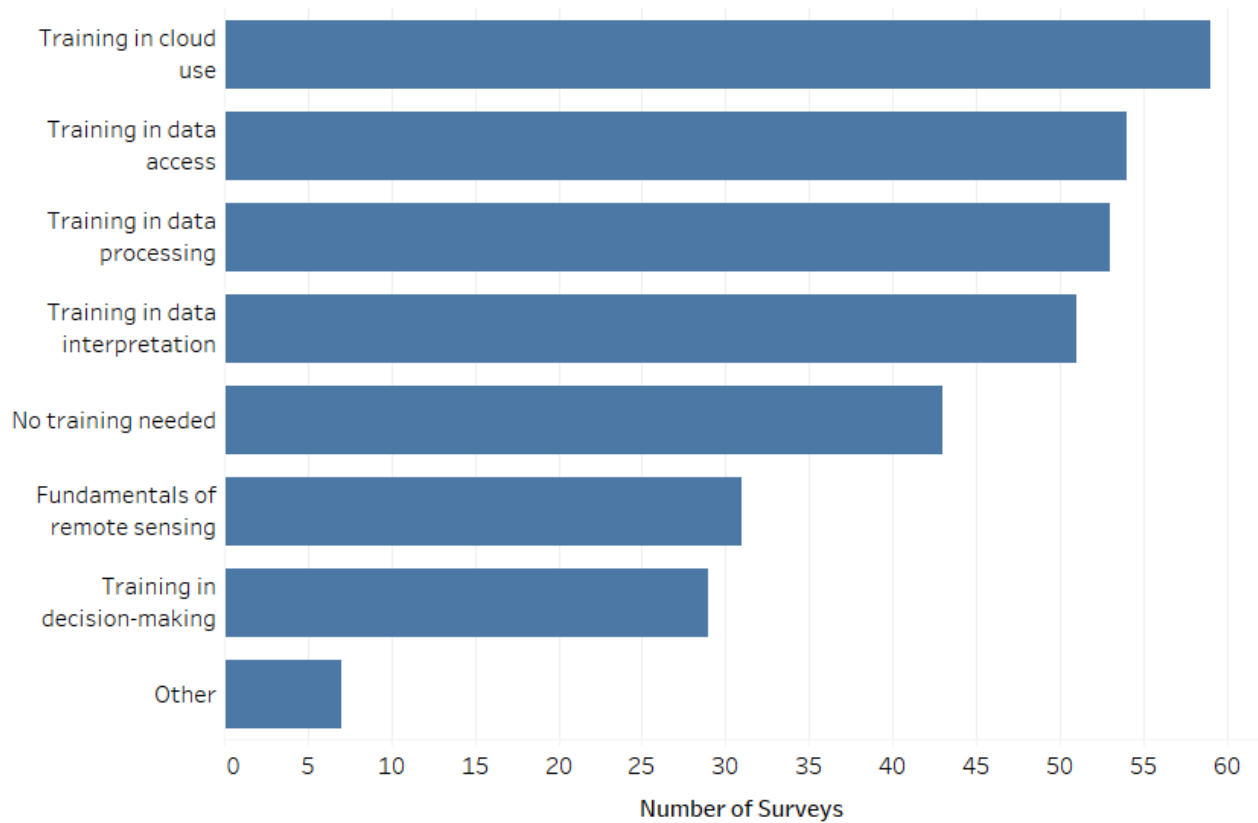
Select your top 5 preferred data formats. If you are able to make use of fewer than 5 formats, select only those that you can use.



Option	# of Surveys (%)
GeoTIFF	91 (78%)
GIS files (Shapefiles, GRID, BIL, e00, etc.)	65 (56%)
NetCDF	58 (50%)
KML/KMZ	44 (38%)
HDF5	44 (38%)
JPEG2000 with geoinformation	38 (33%)
Cloud Optimized GeoTIFF (COGS)	31 (27%)
ASCII grid	22 (19%)

NITF	21 (18%)
Binary	20 (17%)
Graphics only (JPEG, GIF, PNG, TIFF)	20 (17%)
HDF4	14 (12%)
GRIB	13 (11%)
CEOS SAR format	11 (9%)
GIF with geoinformation	4 (3%)
Zarr	1 (1%)

Do you need training in data use? (select all that apply)



Option	# of Surveys (%)
Training in cloud use	59 (51%)
Training in data access	54 (47%)
Training in data processing	53 (46%)
Training in data interpretation	51 (44%)
No training needed	43 (37%)
Fundamentals of remote sensing	31 (27%)
Training in decision-making	29 (25%)
Other	7 (6%)

Aggregate Geophysical Observables

What feature or quantity do you need to observe? (E.g., evapotranspiration, aerosol optical depth, land surface deformation)

Agencies provided free-form text responses to this survey question. From these, individual geophysical observables were extracted and, where possible, mapped to the Global Change Master Directory ([GCMD](#)) [keywords](#), described by NASA as “a hierarchical set of controlled Earth Science vocabularies that help ensure Earth science data, services, and variables are described in a consistent and comprehensive manner.” The table below shows the number of instances where a mapped observable falls under the first three levels of the GCMD Earth Science hierarchy, along with a list of the fourth level keywords with mapped instances. Note that keywords with no mapped instances are excluded, and that 16 extracted observables could not be mapped to a GCMD keyword.

GCMD Keyword Hierarchy	# of Instances (%)
Earth Science	425 (100%)
Earth Science > Agriculture	10 (2%)
Earth Science > Agriculture > Agricultural Engineering	1 (0%)
Earth Science > Agriculture > Agricultural Plant Science	7 (2%)
Earth Science > Agriculture > Forest Science	1 (0%)
Earth Science > Agriculture > Plant Commodities	1 (0%)
Earth Science > Atmosphere	102 (24%)
Earth Science > Atmosphere > Aerosols	21 (5%)
Earth Science > Atmosphere > Air Quality	1 (0%)
Earth Science > Atmosphere > Altitude	1 (0%)
Earth Science > Atmosphere > Atmosphere/Surface Interactions	3 (1%)
Earth Science > Atmosphere > Atmospheric Chemistry	29 (7%)
Earth Science > Atmosphere > Atmospheric Pressure	3 (1%)
Earth Science > Atmosphere > Atmospheric Radiation	4 (1%)
Earth Science > Atmosphere > Atmospheric Temperature	9 (2%)
Earth Science > Atmosphere > Atmospheric Water Vapor	13 (3%)
Earth Science > Atmosphere > Atmospheric Winds	6 (1%)

Earth Science > Atmosphere > Clouds	5 (1%)
Earth Science > Atmosphere > Planetary Boundary Layer	1 (0%)
Earth Science > Atmosphere > Precipitation	2 (0%)
Earth Science > Atmosphere > Weather Events	4 (1%)
Earth Science > Biological Classification	9 (2%)
Earth Science > Biological Classification > Animals/Vertebrates	5 (1%)
Earth Science > Biological Classification > Bacteria/Archaea	2 (0%)
Earth Science > Biological Classification > Plants	2 (0%)
Earth Science > Biosphere	75 (18%)
Earth Science > Biosphere > Ecological Dynamics	13 (3%)
Earth Science > Biosphere > Ecosystems	22 (5%)
Earth Science > Biosphere > Vegetation	40 (9%)
Earth Science > Climate Indicators	2 (0%)
Earth Science > Climate Indicators > Biospheric Indicators	1 (0%)
Earth Science > Climate Indicators > Cryospheric Indicators	1 (0%)
Earth Science > Cryosphere	1 (0%)
Earth Science > Cryosphere > Snow/Ice	1 (0%)
Earth Science > Human Dimensions	70 (16%)
Earth Science > Human Dimensions > Boundaries	3 (1%)
Earth Science > Human Dimensions > Economic Resources	1 (0%)
Earth Science > Human Dimensions > Environmental Impacts	5 (1%)
Earth Science > Human Dimensions > Habitat Conversion/Fragmentation	3 (1%)
Earth Science > Human Dimensions > Human Settlements	3 (1%)
Earth Science > Human Dimensions > Infrastructure	30 (7%)
Earth Science > Human Dimensions > Natural Hazards	24 (6%)
Earth Science > Human Dimensions > Population	1 (0%)

Earth Science > Land Surface	55 (13%)
Earth Science > Land Surface > Erosion/Sedimentation	1 (0%)
Earth Science > Land Surface > Geomorphic Landforms/Processes	2 (0%)
Earth Science > Land Surface > Land Use/Land Cover	14 (3%)
Earth Science > Land Surface > Landscape	1 (0%)
Earth Science > Land Surface > Soils	15 (4%)
Earth Science > Land Surface > Surface Radiative Properties	2 (0%)
Earth Science > Land Surface > Surface Thermal Properties	6 (1%)
Earth Science > Land Surface > Topography	7 (2%)
Earth Science > Oceans	43 (10%)
Earth Science > Oceans > Coastal Processes	4 (1%)
Earth Science > Oceans > Ocean Chemistry	1 (0%)
Earth Science > Oceans > Ocean Circulation	1 (0%)
Earth Science > Oceans > Ocean Optics	5 (1%)
Earth Science > Oceans > Ocean Temperature	2 (0%)
Earth Science > Oceans > Ocean Waves	1 (0%)
Earth Science > Oceans > Ocean Winds	4 (1%)
Earth Science > Oceans > Salinity/Density	3 (1%)
Earth Science > Oceans > Sea Ice	16 (4%)
Earth Science > Oceans > Sea Surface Topography	4 (1%)
Earth Science > Oceans > Water Quality	2 (0%)
Earth Science > Solid Earth	10 (2%)
Earth Science > Solid Earth > Gravity/Gravitational Field	2 (0%)
Earth Science > Solid Earth > Tectonics	8 (2%)
Earth Science > Spectral/Engineering	3 (1%)
Earth Science > Spectral/Engineering > Infrared Wavelengths	1 (0%)
Earth Science > Spectral/Engineering > Radar	1 (0%)

Earth Science > Radio Wave	1 (0%)
Earth Science > Terrestrial Hydrosphere	45 (11%)
Earth Science > Terrestrial Hydrosphere > Snow/Ice	9 (2%)
Earth Science > Terrestrial Hydrosphere > Surface Radiative Properties	1 (0%)
Earth Science > Terrestrial Hydrosphere > Surface Water	25 (6%)
Earth Science > Terrestrial Hydrosphere > Terrestrial Hydrosphere Change	1 (0%)
Earth Science > Terrestrial Hydrosphere > Water Quality/Water Chemistry	9 (2%)
Earth Science Services	1 (0%)
Earth Science Services > Hazards Management	1 (0%)
Earth Science Services > Hazards Management > Disaster Response	1 (0%)