High-Resolution Satellite Data
Open for Government Research

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U.S. satellite commercial imagery (CI) with resolution less than 1 meter is a common geo-spatial reference used by the public through Web applications, mobile devices, and the news media. However, CI use in the scientific community has not kept pace, even though those who are performing U.S. government research have access to these data at no cost. Previously, studies using multiple CI acquisitions from IKONOS-2, Quickbird-2, GeoEye-1, WorldView-1, and WorldView-2 would have been cost prohibitive. Now, with near-global sub-meter coverage and online distribution, opportunities abound for future scientific studies. This archive is already quite extensive (examples are shown in Figure 1) and is being used in many novel applications.

Novel Earth Science Applications of Submeter Satellite Data

A key benefit of using CI in ecological applications is that it allows surveys of individual trees and shrubs as well as characterization of within-stand heterogeneity. Examples include tree crown delineation [Chopping, 2011] and canopy structure modeling for disturbance monitoring [Zeng et al., 2009]. CI is also being used to enable modeling of aboveground litter fall from estimates of tree cover density [Taskinsu-Meydan et al., 2010], provide assessment of stand treatments for mitigating a mountain pine beetle outbreak [Wulder et al., 2009], and enhance the monitoring of recovery from the 2004 Asian tsunami [Romer et al., 2012]. Widely distributed ecological changes (increased mortality, shrub encroachment, etc.) can often be detected more easily in these data compared to coarser Earth-observing satellite data.

Coastal applications of CI include mapping threatened organisms and habitats that are difficult to distinguish because of sparse distributions and small patch sizes. In the United Kingdom, reed bed habitats (dominated by Phragmites australis, common reed) have been mapped using texture analysis [Onojeighuo and Blackburn, 2011]; in French Polynesia, coral communities’ health (e.g., bleaching or growth) has been mapped [Collin and Planes, 2012]. A key advantage of using these data in aquatic applications is that coral-related pigments can be identified with WorldView-2’s additional coastal blue and yellow-red bands. Furthermore, at sub-4-meter scale, textural and spatial measures can easily identify reed beds in heterogeneous areas.

Unique cryosphere studies using CI have integrated hydrology-modeling improvements of the distribution of moulins (vertical meltwater conduits) in west Greenland, with more accurate assessment of meltwater entry points to the ice [Phillips et al., 2011]. The imagery also allows monitoring trends in the abundance and distribution of Weddell seal (Leptonychotes weddellii) [Laffue et al., 2011] and emperor penguin (Aptenodytes forsteri) [Fretwell et al., 2012] populations in remote Antarctica. The benefit in these cases is that multidate CI allows for increased accuracy of counts in poorly accessible regions, where changing climate influences moulin and populations trends. In addition, CI has been especially useful for field planning and search and rescue efforts in Antarctica.

Recent humanitarian applications of CI include conducting a post-earthquake urban disaster assessment in Haiti using multidate classification of buildings [Guo and Kazama, 2010] and aiding decision support in southern Darfur by detecting and counting dwellings of internally displaced persons [Kemper et al., 2011]. CI provides the means to track crises at the human scale in near real time, document changes in infrastructure, and monitor human security situations.

These applications of CI provide recent novel examples of its use in the Earth sciences and for humanitarian applications. Fusing these data with other remote sensing tools could provide many additional opportunities. The CI archive is growing exponentially with enhanced storage and data transfer capabilities of new sensors. This will enable more studies in the future to use multidate analysis at sub-4-meter resolution at the community/plot level over diverse regions.

Who Can Access Data and How?

The National Geospatial-Intelligence Agency (NGA), through commercial remote sensing space policy, has directed government acquisition of CI since 2003. These data are currently available to those who are performing U.S. government acquisition of CI since 2003.
who perform research that benefits U.S. government interests. In 2009, NGA began to use its online system to archive, retrieve, and distribute CI to federal civilian agencies through the Web-based Access and Retrieval Portal (WARP); data available through WARP are a subset of data archived by the commercial satellite operators. To be eligible for WARP access (https://warp.nga.mil), users are subject to verification and must have a federal.gov or .mil e-mail address. NASA is currently exploring options to support CI access for its funded scientists. Furthermore, the U.S. Geological Survey (USGS) has offered to serve as a conduit to assist with CI needs for the federal civilian scientific communities (NASA, Environmental Protection Agency, National Oceanic and Atmospheric Administration, USGS, etc.). CI requests can be submitted for archived imagery not available in WARP online via the USGS Commercial Remote Sensing Space Policy (CRSSP) Imagery Derived Requirements (CIDR) tool (https://cidr.cr.usgs.gov/). CIDR is a means of communicating and potentially tracking the status of federal civilian imagery needs. More information is available on the Web site.

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The use of trade names is intended for clarity only and does not constitute an endorsement of any product or company by the federal government. This work is coordinated with the National Geospatial Intelligence Agency and the U.S. Geological Survey.

References


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