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Documenting Rapidly Changing Arctic Sea Ice with High-Resolution Imagery Provided by the Global Fiducials Program

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Documenting dynamically changing Arctic sea ice is difficult for many reasons, including: (1) the remoteness of the area; (2) the scarcity of high-resolution sensors capable of repeatedly imaging the polar latitudes where Arctic sea ice exists; (3) and the absence of no-cost high-resolution, unrestricted-use imagery available to the Arctic sea ice community. One significant exception is the Global Fiducials Program (GFP) website (http://gfl.usgs.gov), developed by the US Geological Survey (USGS) to provide public access to imagery time-series containing more than 2,000 Arctic sea ice images.

In 1999, the GFP began to systematically monitor Arctic sea ice with imagery from US National Imagery Systems. Initially, six static locations were selected to understand: sea ice dynamics, distribution, age, melt history, and annual variability. The location of the static sites include: 1) Beaufort Sea; 2) Barrow, Alaska; 3) Chukchi Sea; 4) Canada Basin; 5) Fram Strait; and 6) East Siberian Sea. In 2009, the decision was made to release about 700, generally cloud-free, $\sim$1 m resolution digital images of these sites for unrestricted public use. Since more than 2/3 of images collected have significant cloud cover, this initial release represented more than 2,000 attempts to image the static sites. Through the end of 2015, the number of static site released images has doubled.

Additionally, from 2009 through 2014, more than 40 GPS-equipped drift buoys have been tracked and imaged as they move through the Arctic Ocean Basin. This permits the GFP to monitor the 'same' ice through an entire Arctic Summer. Drift buoy monitoring is used to study ice fracture patterns, melt pond activity, snow cover, ice thickness and age, ice and snow ridges, ocean currents, and many other variables that are important for providing climatological parameters.
Information from the static sites as well as the buoys is used as input aimed at refining more accurate climate models.

Today, the gfl.usgs.gov website offers more than 2,200 Arctic sea ice images collected between 1999 and 2014 for unrestricted, cost-free download. More than 880 images are from the six 'static' sites, more than 800 are of sea ice containing the drifting buoys, and 520 are of Marginal Ice Zone, Ice Edge, and Seasonal Ice Zone Region sites collected in cooperation with the US Office of Naval Research. New 2015 imagery will be added by the middle of 2016.

In addition to Arctic sea ice imagery, the GFP has publicly released imagery time series of more than 125 other environmentally important geographic locations. Recently, the GFP has developed a second website (http://gfp.usgs.gov) to provide more in-depth scientific descriptions of the time series to the public.