The research questions remain: How are the ecosystems of the GLB changing and what can we as a society do about it? Continuous monitoring of surface elevation will detect both natural changes (such as from flooding, forest blowdown, fire, insects and disease outbreaks) and anthropogenic changes (such as harvest and land-cover change). Further, MTVEEM will improve habitat and biological modeling. Finally, MTVEEM will be used binationally to better visualize canopy change in forested habitats and freshwater wetland resources within the GLB.

METHODS & CODES
Stereo-mode acquisition through Digital Globe over the entire GLB started in 2016 and will continue through 2019 as clouds and other higher tasking priorities permit (Fig. 1). In 2017, we processed over 83,000 stereo pairs, where each job consisted of converting the input imagery into a standard format (GeoTIFF) and then calling the elevation extraction software (SETSM) [1]. We expect 50,000 additional satellite image stereo pairs for 2018. Each stereo pair task is run on a single node, submitted in batches of 2 to 100 tasks per job to the low-priority queue to maximize scheduler throughput. Complete processing of one stereo pair to 2m takes an average of 12 node hours (charged as six node hours due to using the low-priority queue) to perform quality control checks to enable scaling to much beyond our pilot study areas. This will allow us to adjust processes and perform quality control checks to enable scaling to much larger geographic regions, such as all of North America. With any remaining processing hours, the project may start half-meter MTVEEM processing, which has already been tested.

WHY BLUE WATERS
Stereo satellite imagery allows for the generation of highly accurate surface elevation models. We have already tasked stereo-mode acquisition through Digital Globe over the entire GLB. Each stereo pair is about 1.25 GB and the total number of pairs processed to date is about 83,000, soon to exceed 100,000. The amount of stereo imagery in a study area the size of the Great Lakes Basin and the computational burden to process each of these image pairs is well beyond those available from academic, private, and government systems. This is precisely why we need a leading-edge petascale resource such as Blue Waters.

PUBLICATIONS & DATA SETS
DigitalGlobe, WorldView-3 scene A 1040010021C77D00; B 1040010020D3080, Level Standard 2A, DigitalGlobe, Longmont, Colo., 08/03/2016.

Figure 1: Great Lakes Basin digital surface model (DSM) production status as of March 2018. The source of the stereo imagery used to produce these DMs can be found in the archive, starting in about 2008 to early 2016. (2018 DigitalGlobe NextView License.)