CATALYST Simplifies Access to Science Ready SAR Data on Microsoft's Planetary Computer

CATALYST
EARTH DATA, SIMPLIFIED.

The Earth's ecosystems are at risk. Our ecosystems are at risk.

As human activity continues to cause increased strain on our environment, creating more challenges and making monitoring the impact ever more difficult, the existence and role of truly innovative solutions such as Microsoft's Planetary Computer has never been more important.

This revolutionary platform allows scientists across the world to access, analyse, and track multi-disciplinary data – such as climate, land use, biodiversity and much more.

For CATALYST, it was an opportunity to collaborate and contribute with an organisation who shared the urgency for risk management and innovation by enhancing the processing power of the Planetary Computer platform based on its extensive expertise and capabilities to work with multi-source satellite imagery.
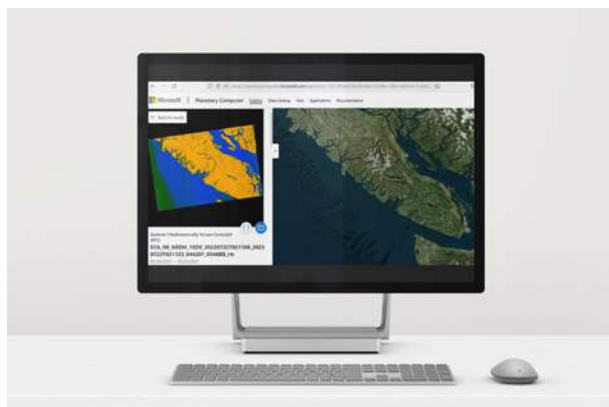

Figure 1: Microsoft Planetary Computer Data Explorer results over Vancouver Island, BC (RTC product on the left, reference optical image on the right)

CATALYST now produces global multi-temporal Sentinel-1 layers corrected to a form of Analysis Ready Data (ARD) processing known as Radiometric Terrain Corrected (RTC).

This is the story of how it came to be.

The Birth Of A Collaboration Built On Shared Visions.

This story starts in late 2020.

Microsoft had just announced the imminent launch of its new Planetary Computer.

Their objective was bold and clear: with this revolutionary platform, they would make earth data visualisation and analysis accessible to everyone – individuals, businesses, and governments - so they could make more sustainable decisions to improve conservation around the world.

Through combining global earth data with intuitive APIs, scientists around the world could view and analyse data layers, such as biomass, temperature, and air quality to ultimately change the way we monitor the health of ecosystems, their population and biodiversity.

For more than 40 years, it has been the driving force behind every innovation, the inspiration for every CATALYST expert, and the type of challenge CATALYST's world-leading image processing technology was created for.

Microsoft

SAR imagery offers an active mode for sensing the earth, whereas optical satellites rely on passive sensing.

Microwave radar signals are emitted from the satellite, and an image is formed by recording the backscattered energy. SAR imagery is unique since it can mostly "see" through clouds, darkness and rain and it can also detect the physical properties of land surfaces.

CATALYST reached out to Microsoft to form a new collaboration, which would deliver global multi-temporal Sentinel-1 layers with RTC applied.

By processing the data to ARD levels and generating images over the same location for quantitative comparison, CATALYST has helped Microsoft produce a high quality, high frequency multi-temporal product that can be used to characterize changes on the ground.

Collaboration Made Possible Through CATALYST Microservices

CATALYST offers a range of products to analyse and view SAR satellite imagery, but very quickly it was clear CATALYST Microservices was the ideal fit.

Comprised of standalone blocks of software, Microservices allows users to process imagery on the cloud and run processes without the need for manual intervention or configuration.

This not only makes them light weight, but by leveraging Microsoft Azures' compute power they can also be run at scale.

CATALYST worked with Microsoft to implement an efficient production pipeline that applies its science to the increasingly growing repository of Sentinel-1 satellite image archives.

It was accomplished in several ways including optimizing the algorithms that process the imagery, co-locating the processing algorithms and Sentinel-1 imagery within the Planetary Computer data centre (hosted on Microsoft Azure), and leveraging microservices architectures.

A key benefit of this system architecture is the ability to implement parallel processing capability that is predictable and configurable, allowing the processing of large volumes of imagery based on throughput and budget requirements.

In the case of the Sentinel-1 ARD processing, CATALYST was able to leverage Azure Batch, a compute management platform from Azure that allows for large scale parallel batch workloads to be run in the cloud.

MSFT PC Sentinel-1 GRD Processing	
Number of Images	2,500,000
Total Time Required (mins)	102,500,000
Days Required (single Insance)	71,181
Number of Concurrent Instances	17,000
Total Days	4.187
Images Per Day	597,074

Figure 2: Processing timelines using CATALYST Algorithms deployed to Azure Cloud.

In addition, the team implemented scalable processing using spot instances to greatly reduce the compute costs. This made it possible to process the backlog Sentinel-1 GRD imagery using up more than 17,000 concurrent processing instances – clearing the backlog in a few short days using CATALYST's Microservices.

While CATALYST software was initially designed for expert users on dedicated compute instances, this project demonstrated how delivery through modern cloud-based architectures is not only possible, but opens up a new opportunities to leverage CATALYST science to process planetary scale catalogs efficiently and in a predictable manner.

Figure 2: Unprocessed Sentinel-1 GRD image (left), Reference Elevation model (Middle), RTC processed image (right)

| SAR Backscatter (GRD) | Terrain Flattened Image | Synthesized SAR Image (from DEM) |
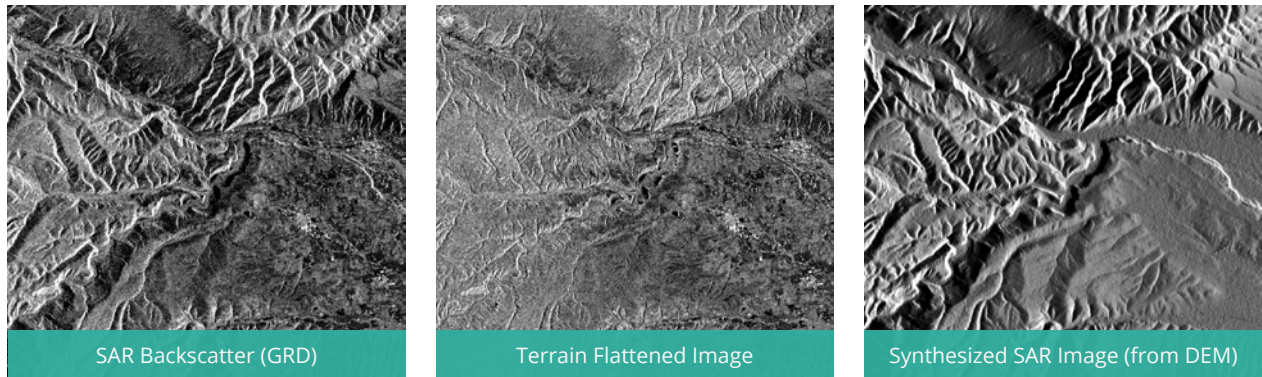
The Results

For Industry

- Analysis ready imagery accessible for free with a registered account
- Possibility of newer, faster, and more effective risk management strategies through active monitoring of sites and assets
- Near real-time decision making to respond to changes in ecosystems or other natural environments

Seamless integration of cloud based, large-volume imagery processing without need for installation or configuration.

For Geoscience

- All archive images collected by Sentinel-1A and 1B have been corrected to RTC processing levels
- At a minimum, each location on Earth has been observed roughly 230 times over the course of the operational lifespan of the Sentinel-1 mission
- Many areas are collected in both ascending and descending pass directions, meaning the frequency of observation is even higher
- The data can be streamed as Cloud Optimized GeoTIFFs (COGs) to create new applications and change detection analyses
- All processed imagery has been catalogued using the SpatioTemporal Asset Catalog (STAC) specification standard
- Users of the Planetary Computer have performed searches against the RTC dataset over 1.7 million times since its launch.

About Catalyst

CATALYST is a PCI Geomatics brand, which has been introduced to put our leading edge technology into the hands of decision makers. CATALYST provides proven algorithms rooted in photogrammetry and remote sensing to offer engineers, environmental management, and other professionals accessible earth data measurements on a reliable basis derived with leading edge, scalable software solutions and platforms. We're a startup – with hundreds of algorithms, scalable solutions, and decades of experience.

To learn more, visit www.catalyst.earth

CATALYST's Science

Microsoft required technology for high quality, science ready layers from SAR. The data needed to be available as Radiometrically Terrain Corrected (RTC) and should provide stable measurements over time to enable multi temporal analysis. With a comprehensive SAR toolset and unique capabilities, CATALYST was able to provide Microsoft with a solution and collaboration to produce world class science ready data.

Discover more at catalyst.earth/ technology