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Introducing the OGC API – Discrete Global Grid Systems Standard for Enhanced Geospatial Data Interoperability

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Abstract:

The advent of the OGC API – Discrete Global Grid Systems (DGGS) Part 1: Core Standard (Purss and Jacovella-St-Louis, 2025) marks a significant evolution in geospatial data handling, promising to streamline the integration and retrieval of spatial data through an innovative, standardized API framework. This candidate standard is designed to facilitate the efficient retrieval of geospatial data, organized according to a Discrete Global Grid Reference System (DGGRS), tailored for specific areas, times, and resolutions. It emerges as a robust solution aimed at overcoming the complexities traditionally associated with projected coordinate reference systems.

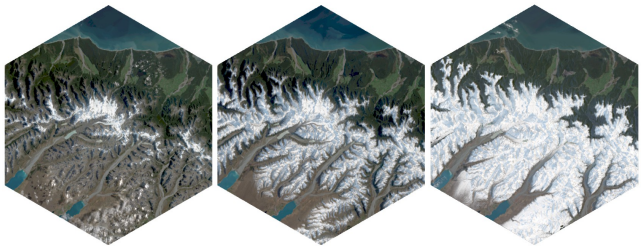


Figure 1. Visualization of satellite imagery from Copernicus SENTINEL-2 (operated by ESA) satellite imagery for an ISEA3H DGGRS zone in New Zealand at different times

A DGGS represents the Earth through hierarchical sequences of tessellations, offering global coverage with progressively more detailed spatial or spatiotemporal refinement levels. This well-defined hierarchical structuring allows each data sample to be precisely allocated within a DGGRS zone that reflects location, size, and precision of the observed phenomenon. This simplifies the aggregation and analysis of spatial data, enhancing capabilities for detailed statistical analysis and other computational operations.

Rooted in the principles outlined in OGC Abstract Specification Topic 21 (Gibb, 2021), the OGC API – DGGS candidate Standard introduces a comprehensive framework for accessing data organized via DGGRS. This API is not merely a repository access point but a dynamic interface that supports complex querying and indexing functionalities integral to modern geospatial data systems. The standard specifies mechanisms for querying lists of DGGRS zones, thus allowing users to seamlessly locate data across vast datasets or identify data that corresponds to specific queries. This is achieved through the integration of HTTP query parameters combined with advanced filtering capabilities offered by the OGC Common Query Language (CQL2) (Vretanos and Portele, 2024).

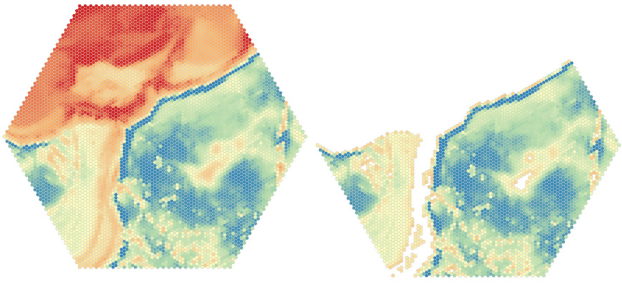
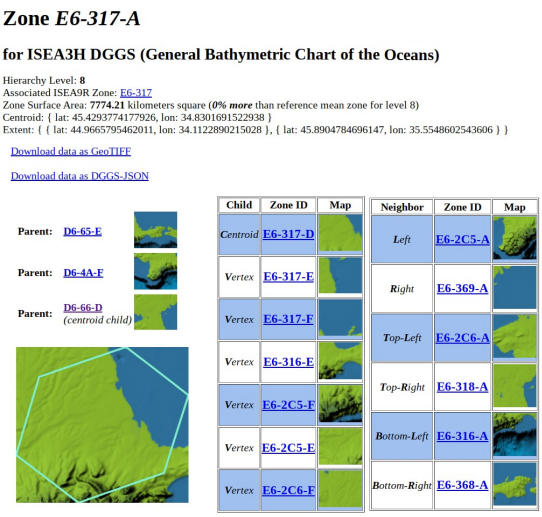


Figure 2. ISEA3H zone data from GEBCO 2014 Grid (left), filter applied to keep depths at least 4000 meters below sea level (right)

Moreover, the candidate standard advocates for multiple data encoding strategies, accommodating a variety of data types and formats. It supports the retrieval of DGGS data using formats based on the widely adopted JSON encoding, and additional requirements classes to cater for raster or vector data quantized to DGGRS zones. Additionally, it provides for compact binary representations for both zone data and zone lists in UBJSON (Kalla and contributors, 2025), Zarr (Zarr developers, 2022), and GeoTIFF (Devys et al., 2019), enhancing data transmission efficiency and processing speed. Traditional indexed geospatial data formats are also supported for interoperability.



Zone *E6-317-A*

for ISEA3H DGGS (General Bathymetric Chart of the Oceans)

Hierarchy Level: **8**
Associated ISEA9R Zone: E6-317
Zone Surface Area: **7774.21** kilometers square (***0% more*** than reference mean zone for level 8)
Centroid: { lat: 45.4293774177926, lon: 34.8301691522938 }
Extent: { { lat: 44.9665795462011, lon: 34.1122890215028 }, { lat: 45.8904784696147, lon: 35.5548602543606 } }

Download data as GeoTIFF

Download data as DGGS-JSON

Parent:	D6-65-E	
Parent:	D6-4A-F	
Parent:	D6-66-D *(centroid child)*	

Child	Zone ID	Map
Centroid	E6-317-D	
Vertex	E6-317-E	
Vertex	E6-317-F	
Vertex	E6-316-E	
Vertex	E6-2C5-F	
Vertex	E6-2C5-E	
Vertex	E6-2C6-F	

Neighbor	Zone ID	Map
Left	E6-2C5-A	
Right	E6-369-A	
Top-Left	E6-2C6-A	
Top-Right	E6-318-A	
Bottom-Left	E6-316-A	
Bottom-Right	E6-368-A	

Figure 3. HTML Information for ISEA3H DGGRS zone E6-317-A for GEBCO 2014 Grid with parent, children and neighboring zones, as well as centroid and geospatial extent

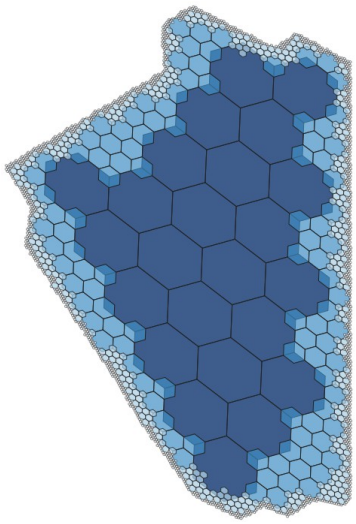


Figure 4. Results of compact zone query for National Arts Center building (data © OpenStreetMap Contributors)

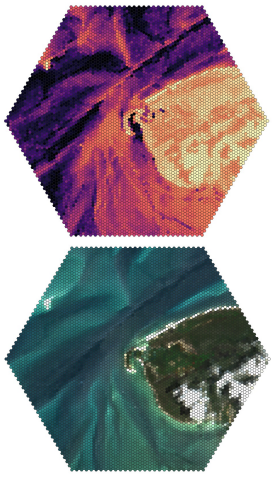


Figure 5. Near-infrared (top) and RGB (bottom) bands data from ISEA3H DGGS zone (Copernicus SENTINEL-2)

The OGC API – DGGS candidate Standard also includes an informative annex providing a JSON schema allowing to describe any DGGRS, coupled with practical examples of DGGRS definitions. This annex serves as a valuable resource for developers and system architects aiming to implement the standard, offering guidance and examples that demonstrate the versatility and applicability of the DGGS approach.

Figure 6. Level 2 zone identifiers of GNOSIS Global Grid DGGRS overlaid on visualization of GEBCO 2014 Grid

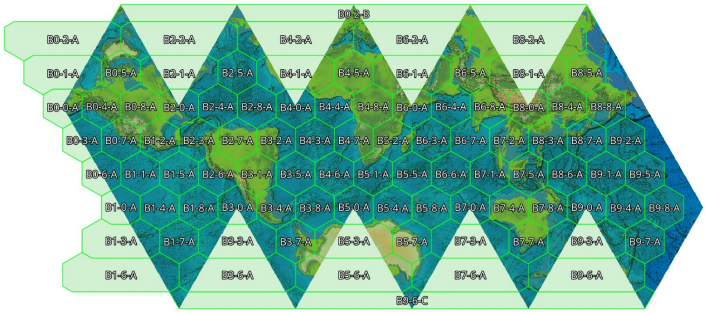


Figure 7. Level 2 zone identifiers of ISEA3H DGGRS overlaid on visualization of GEBCO 2014 Grid

By defining a uniform standard for DGGS APIs, this initiative paves the way for a new era of geospatial data exchange and indexing. It addresses the growing challenges of managing massive geospatial datasets in today's digital age, promising enhanced interoperability, precision, and efficiency in geospatial data services. As the candidate Standard moves along the OGC standardization process and becomes more widely implemented in geospatial software tools, OGC API – DGGS is poised to become a cornerstone in the geospatial science and industry, fostering a more interconnected and accessible digital Earth.

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