UN-GGCE International Workshop on the Integration of Terrestrial, Maritime, Built and Cadastral Domains

"Joining Land and Sea"

2 – 5 December 2024
Badan Informasi Geospasial
Bogor, Indonesia

DRAFT Summary Notes and Decisions
10 December 2024

Preamble

In this workshop, participants including experts from the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), Expert Group on Land Administration and Management (EG-LAM), Working Group on Marine Geospatial Information (WG-MGI), Working Group on Policy and Legal Frameworks, Subcommittee on Geodesy, International Hydrographic Organization (IHO), Open Geospatial Consortium, and the UN-GGCE came together to discuss, and share ideas, on how to integrate data across terrestrial, maritime, built and cadastral domains.

Within our specific domains, we are able to make high quality decisions based on our frames of reference. For example, a hydrographer can accurately compute the under-keel clearance of a ship leaving port. A land surveyor can work out the maximum curvature of a road which is safe to drive on. But when it comes to complex questions such as, what are the economic, social and environmental impacts of 10 - 15 cm / yr subsidence in a major city like Jakarta, this requires expertise beyond the frame of reference of a single domain. Questions like these require an expanded frame of reference by connecting the domains of land and sea.

There is no guidance available for Member States which explains how to integrate land and sea data to address these complex questions. This limits our ability to make informed decisions. By the middle of next year, the UN-GGCE with support from all the UN-GGIM Working Groups and other partners to develop this guidance to assist Member States.

Summary of the meeting

Day 1 – Monday 2 December - Workshop Panel Session

Opening remarks

Nicholas Brown (Head of Office, UN-GGCE)

Mr Nicholas Brown expressed gratitude to the staff of Badan Informasi Geospasial (BIG) and the Local Organizing Committee for their exceptional efforts in preparing the meeting and warmly welcoming participants. He emphasized the UN-GGCE's motto, "Stronger. Together," highlighting its significance as the organization hosts its first workshop.

The workshop brings together experts from diverse fields such as marine, land, geodesy, standards, communications, and government policy to tackle pressing global challenges, including measuring and mitigating sea level rise and understanding the impact of floods on freshwater aquifers. These challenges, Brown noted, require an interdisciplinary approach and broader "frames of reference" for effective decision-making.

He elaborated on the concept of "frames of reference," explaining their relevance in both technical and conceptual contexts. In specific domains like marine or land geodesy, professionals rely on established frames of reference for tasks such as measuring under keel clearance or determining road curvature. However, addressing complex, cross-disciplinary problems like sea level rise demands an expanded frame of reference that integrates expertise beyond individual fields.

Mr Brown encouraged participants to use the workshop as an opportunity to broaden their perspectives, engage with colleagues from other disciplines, and collaborate to solve complex issues. He concluded by urging attendees to embrace new viewpoints and build connections throughout the event.

Muh Aris Marfai (Chairman, BIG)

Muh Aris Marfai kindly welcomed the participants to Indonesia and encouraged them to share their ideas and information so that we may learn from each other.

1st Session: Introduction and Setting the Scene

Moderator: Ade Komara Mulyana (Director, Directorate of Land Topographic Mapping, BIG)

Speakers:

- *Antonius Bambang Wijanarto (Deputy Chair of Thematic Geospatial Information, BIG)*
- *Parry Oei (Chair of the Working Group on Marine Geospatial Information, Singapore)*
- *Victor Khoo (Chair of the Expert Group on Land Administration and Management, Singapore)*

Mr Wijanarto outlined how critical it is that Indonesia is able to integrate land and sea data to improve decision making. In Indonesia's geographic context, Mr Wijanarto spoke about the 3,000,000 km2 Exclusive Economic Zone, 2,800,000 km2 continental shelf extent and 17,374 islands of Indonesia. He also spoke of the challenges experienced such as tidal inundation of homes in some parts of Indonesia caused by land subsidence of 10 cm / yr or greater along the northern border. Recognising that integrating their datasets was essential to improving their decision-making capability, in 2023, Indonesia transitioned to integrated land, sea and coastal basemap (no longer have 3 separate basemaps) which uses a single reference system – the geoid as the key to data integration.
Mr Wijanarto noted that the Indonesian Geoid model (InaGeoid) has an accuracyy varying between 6 cm (in East Kalimantean) and 29 cm (in Sumatera). In the future, BIG plan to harmonise policies across

sectors, strengthen international cooperation, educate communities on the importance of integration and encourage all stakeholders to adopt a single reference system.

Mr. Oei spoke of the role of Member States to take both mitigative measures, and reactive measures in response to climate change and natural disasters (e.g. the 2004 Indonesia tsunami and 2011 event in Fukishima). The work done in the land, sea domains by Member States is critical for both.
Mr Oei emphasised the need to provide information in a way that the user wants it. For example, if they need information with respect to, LAT, MHW, land datum, geoid, ellipsoid – it doesn't matter; it is our role as experts to abstract the complexities from the user and deliver them information they need in their frame of reference with uncertainty values.

Mr Oei also advocated for opening the data as much as possible to the public and allowing them to develop applications and businesses for a broader audience. Mr Oei noted that in order to "gather once and use many times", this requires investment in standards and FAIRness.

Mr Khoo spoke about the problems in Joining Land and Sea data from the perspective of EG-LAM. Integration is critical for an increasing number of government 3D applications which require high accuracy for decision making including Digital Twins, climate adaptation, underground asset management and Smart Land Administration. Mr Khoo noted that there are a range of challenges including the scale of data, lack of interoperability and that it is increasingly difficult to get long-term investment for foundation level activities for both the technical and non-technical elements.

All speakers noted that much of the work that is currently being done is project focused with limited scope as this is the way funding if generally provided within countries.

2nd Session: Exploring Case Studies Around the Globe

Moderator: Nicholas Brown (Head of Office, UN-GGCE)

Speakers:

- *Andrick Lal (Secretariat of the Pacific Community, Fiji)*
- *Andri Suprianta (Head of Thematic Area Subdirectorate, Ministry of Agrarian Affairs and Spatial Planning/National Land Agency, Indonesia)*
- *Charisma Victoria de la Cruz-Cayapan (Engineer, National Mapping and Resource Information Authority, Philippines)*
- *Bayu Triyogo Widyantoro (Act. Director, Directorate of Geospatial Reference System, BIG)*

In this session speakers from around the Asia-Pacific region outlined the different ways in which countries are integrating land and sea data. Mr Lal presented on the 30-year program in the Pacific in which sea level information from tide gauges is integrated with land motion movements observed with GNSS by performing precise levelling between the tide gauge and GNSS monument. This provides highly accurate point observations, but does not describe the land motion on a broader scale which limits the ability of Pacific Islands to make informed decisions about coastal planning and management.

Mr Suprianta presented on integrating land and sea data for coastal planning purposes, Mr Suprianta highlighted that Spatial planning requires decision making based on information about the land, sea, coast and air space, however, management domains is regulated by a separate laws. Indonesia has recently adopted new laws which regulate the integration of land and sea technical content into one spatial planning product.

Ms Cayapan presented on a case study on the Philippines where there is an increasing demand and growing effort by national agencies to develop, generate and utilize land and marine geospatial information. The absence of a national spatial data infrastructure (NSDI) policy in the Philippines and governing body impact all other strategic pathways. The government recognizes the modernization of the Philippine Geodetic Reference System (PGRS) as vital to the seamless development of land and marine SDI and is working towards a fully modern GRS in the coming years

Mr Widyantoro spoke about the work the Indonesian government is doing to monitoring sea level rise and land subsidence. The combination of land subsidence and sea level rise causes a compounding impact of tidal flooding in inundation areas, which has social, environmental and economic impacts. Land subsidence is measured using a network of 473 Global Navigation Satellite Systems Continuously Operating Reference Stations (GNSS CORS) as well as Synthetic Aperture Radar. Sea level is observed with a national scale network of 290 tide gauges each with three sensors.

3rd Session: Joining Land and Sea using the geoid

Moderator: Nicholas Brown (Head of Office, UN-GGCE)

Speakers:

- *Nicholas Brown (Head of Office, UN-GGCE)*
- *Jennifer Coppola (Senior Geospatial Specialist for Land Information New Zealand)*
- *Ibnu Sofian (Deputy Chair of Infrastructure of Geospatial Information, BIG)*
- *Leni Sophia Heliani (Universitas Gadjah Mada, Indonesia)*

Mr Brown provided an introduction to elements of physical geodesy and relayed to the audience that this is a difficult topic. This is why the workshop is important; to explain these difficult concepts, and to also build up a network of colleagues who can assist each other when they are having challenges. Although understanding height datums is hard, it is also important as it underpins our ability to understand water flow which can only be done with measurements of gravity and cannot be done solely using GNSS. Mr Brown emphasized that the geoid should be used as the primary height reference surface and all other height datums (e.g. ellipsoid, MSL, HAT, LAT, MDT …) should be “linked” to the geoid as it is the only physically meaningful surface which exists on shore and offshore.

Ms Coppola demonstrated a vision from New Zealand for seamless mapping across the land and seabed for integrated datasets and improved modelling. To realize this vision, Ms Coppola described the need for datasets to be blended together by referencing them to the same datum. The land information team within the New Zealand government is working together with the National Institute of Water and Atmospheric Research who are developing the NZ tidal model which includes offshore surfaces including (HAT, MHWS, MHW, MHWN, LAT, MLWS, MLW and MLWN). New Zealand is looking to ‘stitch’ tidal surfaces to the land datums via 200 coastal ‘link’ sites where sea level observations are available from tide gauges, tsunami sensors (in the ocean) and hydrographic surveys. Ms Coppola also noted that global models are available for mean sea surface to ellipsoid values including DTU21, AVISO, however they are only reliable from about 30 km offshore and further. The global models are less accurate close to the coastline.

Mr Sofian presented on the Indonesian Digital Elevation Model including the topographic and bathymetric components and introduced the applications of the separate datasets. In the future, Indonesia plan to develop a physics based numerical model for assessing coastal hazards and a coastal vulnerability assessment to meet planning and climate adaptation needs.

4th Session: Summary and discussion

Moderator: Nicholas Brown (Head of Office, UN-GGCE)

Open discussion on:
Other examples of joining land and sea projects from other parts of the world?

- It was noted by the representative of Fiji that their country had a driver to change the datum because of business needs for more accurate and reliable positioning capability and the hydrography community demanded it.
- One of the use cases which carried weight in some governments was that subsidence was an issue, and better land and sea monitoring was essential for coastal management and planning (e.g. sea wall construction).
- Using the mean dynamic topography (MDT) to correct MSL observations at tide gauges allows to correct vertical datums errors and tilts. Aviso and DTU are examples of MDT models which are freely available. Australia already corrected its vertical datum by this method and preliminary studies are currently in progress in France.

Tools, products or guidance material which would be helpful for countries?

- Some Member State representatives asked the UN-GGCE for assistance on the development of guidance material to develop a modern datum for land and sea and how to best integrate data across these domains.
- A framework needed could include information such as:
    - how to develop the necessary datums to accurately observe information and,
    - how to transition between these datums to enable accurate and reliable integration of land and sea data.
- A framework such as that described above is not known to exist.
- Some Member State representatives asked for clearer guidance on the recommended standards to transform between different datums and to store data in.
- Others spoke of the need for enhancing standards to ensure that data can be integrated across the land – sea border. A representative from the Open Geospatial Consortium mentioned the active work program investigating this (https://www.ogc.org/requests/ogc-seeking-sponsors-for-federated-marine-spatial-data-infrastructure-pilot-2024-connecting-land-sea/)

Other discussion topics

- Capacity building is required across all the domains
    - How do we engage young and early career networks
- Translating complex science into a language that can be understood by the general public and describes the cost vs. benefits of investment in all domains is necessary.
    - Tools, graphics and animations to reach out to people could be helpful
- One of the biggest challenges we face is governance because in many countries, the organizations that manage a country's marine areas are often separate from those that manage the land. This has led to not just technical challenges, but competition between government departments.

Day 2 – Tuesday 3 December - Workshop Panel Session

5th Session: Challenges and Issues

Moderator: Mr. Victor Khoo (Chair of the Expert Group on Land Administration and Management, Singapore)

Speakers:

- *Dan Roman (The National Geodetic Survey, USA)*
- *Matthew Ellis (Geoscience Australia)*
- *Basara Miyahara (UN-GGIM Asia-Pacific Working Group on Geodetic Reference Frame)*
- *Sugeng Pribadi (Head, Division of Tsunami and Earthquake Survey of Meteorological, Climatological, and Geophysical Agency, Indonesia)*

The speakers in this session identified a number of challenges and issues relating to integrating land and sea data including:

Governance

- In some countries there are a range of different agencies who have the mandate to management land, cadastre, marine, navigation, air space, water ways etc. When coordination across these different government agencies is poor or the roles and responsibilities are not clear, this creates a lot of confusion, duplication of effort and in some cases inaction because one agency thinks the other is responsible
- Historical separation of maritime and terrestrial domains causes stovepipes or siloing of problems which leads to mismanagement.

Link to geodesy

- Geodetic control in fundamental to all the datasets built on it, but this is often not recognised or known by the people in other domains.

Fit for purpose

- Member States should develop fit for purpose solutions to joining land and sea problems based on the requirements of their countries. For example, Australia is a large land mass which focussed on creating a 250 m seamless bathytopo product that valued the accuracy of the shape rather than the accuracy of position. In doing so, they ensure that the product is released with disclaimers that the product is not to be used for navigation purposes, but instead for planning of offshore wind projects, UNCLOS baseline detection and tsunami risk modelling.
- In other cases, such as Japan, Mr Miyahara spoke of a desire to have a more accuracy product, but this came with challenges such as understanding the offset between the MSL and geoid in regions where ocean currents can cause this to vary over time by up to 1 m.
- In Indonesia, Mr Pribadi noted that making absolute tsunami maps requires high resolution topo-bathy maps, land cover, MSL lines, and a number of nested modelling grids. The future challenges of creating such high resolution maps require fast and robust processing so the existence of an HPC-GPU is very important. Fast means that tsunami warnings become more specific (tsunami height, land area) and mitigation becomes more planned.

6th Session: Standards, Policies and Legal

Moderator: Mr. Parry Oei

Speakers:

- *Dan Roman (The National Geodetic Survey, USA)*
- *Moh. Arief Syafi'i (Deputy Chair of Basic Geospatial Information, BIG)*
- *Ilaria Tani (Adjunct Professor of International Law of the Sea, Universitia degli Studi di Milano-Bicocca)*
- *Chris Body (Open Geospatial Consortium)*

Mr Roman presented on a range of standards used in the land and sea domains and highlighted some issues for Member States to consider including:

- The issues relating to the use of WGS84 given that it is a low accuracy ensemble datum that is not as clearly defined as realizations of ITRF and therefore doesn't have transformation parameters which are as well defined or accurate.
- The Joint Report from ISO, IHO and OGC titled "Implementation and adoption of standards for the global geospatial information community" in UN-GGIM 14 which highlighted a number of areas where the three standards bodies collaborate on integration of land, cadastre and maritime information.

Mr Syafi'I presented on the national policies of Indonesia for the integration of land and sea data. In his presentation he explained:

- The urgency of tackling this integration problem in a holistic way in Indonesia due to assist with climate change adaptation, integrated coastal management, disaster risk reduction and better understanding the impacts of land subsidence.
- Indonesia have moved to a single basemap by measuring each tidal benchmark with ellipsoid, gravity and tidal datum. These become 'tie points' between the techniques. The geoid is the single height reference for land, sea and coastline for 17,000 islands.
- Some applications do not require integration of land and sea geospatial data, such as marine navigation, fisheries management, marine habitat conservation, oceanographic research, aquaculture development, etc.
- Regardless of the vertical reference system used by an application, its geospatial data must be able to be integrated into a single vertical reference system. Store your data in the most accurate form possible, and when it needs to be integrated, use the geoid as the single reference system.
- Integration should be done at data level *(land elevation and bathymetric data)* instead of end product level *(maps)* to create seamless land and sea geospatial data.

Ms Tani addressed the implications of joining land and sea data from the legal perspective and introduced:

- The recent UN General Assembly resolution which noted with concern the impacts of climate change on the ocean and cryosphere including extreme sea level events and sea level rise, to which low-lying islands, in particular SIDS are exposed.
- The discussions in the UN on sea level rise in relation to international law and the complexities of realising international boundaries which are rarely based on a list of geographical coordinates.

Mr Body introduced the participants to the work of the Open Geospatial Consortium described the long running work of the OGC to bridge land and sea data using standards. Currently OGC are running the

Federated Marine Spatial Data Infrastructure Pilot 2023 - Connecting Land and Sea for Global Awareness (FMSDI 2023) pilot which is designed to evaluate the key features and benefits of a standards-based approach to data discovery and application in support of stakeholders vested in the changing coastal environments of the Canadian Arctic, the Caribbean islands, and the Republic of Singapore. Of keen interest is the integration of distinct data products in a manner representing the coastal environment as a seamless transition from the ocean floor to the land surface.

7th Session: Geoid and Sea Level Modelling

Moderator: Khafid (Director, Directorate of Boundary Mapping and Geographical Names, BIG)

Speakers:

- *Anna Riddell (Geoscience Australia)*
- *Dudy Darmawan Wijaya (Institut Teknologi Bandung, Indonesia)*
- *Masanao Sumiyoshi (International Hydrographic Organization)*

Ms Riddell presented on the Australian geoid models including the AUSGeoid2020 model (combined gravimetric+geometric model) and the Australian Gravimetric Quasigeoid (gravimetric only) model. The AGQG model supports direct heighting with GNSS and has an uncertainty of between 1-8 cm with the lower uncertainties being in regions where the model has been augmented with airborne gravity data. The AUSGeoid2020 model is accurate to between 8-13 cm because of bias and distortion errors in the geometric component mainly due to the levelling data. Geoscience Australia have made their software available for computing regional geoid models in GitHub (https://github.com/GeoscienceAustralia/analysis-ready-gravity-data-workflow). Work is also underway to develop a AusHydroid model to defining the surface separation between the national ellipsoid (GRS80) and chart datum (LAT) to facilitate the connection of land and maritime domains.

Mr Wijaya spoke about the development of the Indonesian geoid model which is based on terrestrial, airborne and space-borne gravity and has an uncertainty of ~0.3 m. Plans to improve the geoid model to achieve an uncertainty of ~0.1 m include introducing more gravity data (including ocean altimetry), refining the numerical methods and densifying the GNSS / levelling datasets. Mr Wijaya mentioned that connecting to local sea level is still a big challenge and options to resolve this are to use MDT models or hydrodynamic levelling to deal with this challenge.

Mr Sumiyoshi from the International Hydrographic Organization presented on the sea level model development for hydrographic surveys in Japan. He described how vertical datums in nautical charts can vary based on local water levels and can vary based on the point of interest. For example, depth is referenced to LAT / MLLW / NLLW, a lighthouse height is reference to MSL and bridges are referenced to HAT / MHW / NHHW. In Japan they are researching ellipsoidal referenced hydrographic surveys to take advantage of the efficiency of GNSS and then using models to transform the ellipsoidal heights to physical heights. These types of surveys are heavily reliant on accurate models. To create higher quality chart datum model, it is necessary to consider regional characteristics such as crustal deformation and oceanic effects, as well as to use high-precision geoid model.

Mt Windupranata introduced the development of the Indonesian tide model. The motivation for the model is to develop a national model more accurate that the global tide models which have uncertainty greater than 15 cm in shallow waters and coastal areas. Improvement was made using along track altimetry data.

8th Session: Advancing Geodesy for Coastal Protection

Moderator: Evert Mulder (Geomatics Manager, Geodesy & National Mapping, Singapore Land Authority)

Speakers:

- *Alex Lăpădat (Mathematical Geodesy & Positioning group, TU Delft, NL)*
- *Feng Lujia (The Earth Observatory of Singapore, NTU, SG)*
- *Ooi Seng Keat (Tropical Marine Science Institute, NUS, SG)*

Mr Lăpădat advocated for the use of integrated geodetic stations to observe vertical land motion and sea level change. Mr Lăpădat introduced the range of techniques used in the land and sea domains including levelling, GNSS, tide gauges, gravity, InSAR and extensometry; and the challenges associated with tying this data together due to the difference in datums, timing of observations. By establishing continuously monitored physical benchmarks and methods for technique integration, it would not only be easier to study vertical land motion and sea level changes seamlessly, but at the same time it would also enable the separation of these two phenomena.

Ms Feng discussed the benefits of using coastal GNSS stations as 'absolute' tide gauges to join land and sea data. Using this method, the signal-to-noise ratio (SNR) data of GNSS signals which bounce off the ocean surface and then arrive at the GNSS antenna can be utilized to measure and monitor sea level height, while at the same time adopting the direct signals to measure and monitor the land height.

Mr Ooi spoke of how he has used data in Singapore for inter-tidal flood models – datums, models and resolution. The data typically used to fill the coastal gap between land and sea includes extending land survey methods towards the sea at extreme low tides and extending hydrographic survey methods towards the shore at high tides, introducing gaps and inconsistencies. In shallow areas it is possible to integrate drone data with topographic survey data as ground truth. With respect to issues related to datum integration, in Singapore, you can potentially utilize a:

- Single value for conversion based on location (i.e., to adopt the parameters from the nearest TG), date and need.
- (Main) Island-focused.
    - Linear interpolation between stations which can be converted to one based on splines / curves at complicated areas.
    - This spline interpolation can be further extended through a gridded interpolation method to a limited distance off the main island. This method has issues as our offshore islands have different SHD-CD differences at the same gridded distance away from main island.
- Domain-focused. (a form of this is used by UKHO)
    - Extend the SGeoid09 to create a surface that extends through all the known points and interpolate from that surface.
    - Requires transfer of both **mean sea level and tidal range** to all offshore islands before this can be properly utilized.

In the discussion it was highlighted that, there is a need to improve the global geodesy supply chain including geodetic infrastructure and geodetic products (ITRF, gravity field, glacial isostatic adjustment, tropospheric delay), in order to reduce the sea level rise error budget and meet international requirements for global, regional and local sea level rise monitoring.

Day 3 – Wednesday 4 December – Technical visit

9th Session: Technical visit to BIG office

The technical visit to the BIG office began with an overview of the Directorate of Geospatial Reference Systems, presented by Belinda Arunarwati Margono (Principal Secretary, BIG) and Bayu Triyogo (Acting Director, Directorate of Geospatial Reference Systems, BIG). Participants then explored the Geodetic Processing Centre and visited key facilities, including the GNSS and CORS data processing centre, the tide gauge testing station, and the gravity laboratory. During the visit, they engaged with technical experts to understand the workflows and monitoring systems of the stations.

The group also visited the land subsidence monument in the Old City of Jakarta, which highlights the alarming rate of subsidence in the region, exceeding 10 cm per year in some areas.

The team then visited the Angke Kapuk Nature Tourism Park, which serves as a mangrove conservation area in North Jakarta and rapidly expanding to mitigate coastal erosion and land subsidence.

Day 4 – Thursday 5 December – Closing

Summary and next steps

Chair: Nicholas Brown (Head of Office, UN-GGCE)

In this summary session, the participants discussed actions which can be taken to assist Member States. Mr Brown presented a range of subheadings to lead the discussion as summarised below:

1. **How to Join Land and Sea data – practical guidance for Member States**
    - Including the following information:
        - **Reference Levels** and how to create them (e.g. geodetic datum, geoid model, tidal model)
            - Include a description of the infrastructure and data required
        - **Connections** (e.g. models to convert between the ellipsoid and tidal model) with uncertainty values
    - Provide a range of options so Member States can choose a 'fit for purpose' approach.
    - Provide examples and points of contact for further information.
    - Look to have a phased approach to help Member States understand which work should be prioritised.
    - Consider including the air domain as well, as this has potential to expand on the benefits which can be realised by having linked up data.
    - Reference the UN-Integrated Geospatial Information Framework (and IGIF-H and FELA) as appropriate.
    - The information should not be too detailed as it must be recognised that every integration piece is complex and will likely require prioritising one particular use case over another.
    - Include information about the software, tools and services which could be used.
    - The audience for this guidance material would be government staff from the land and sea domains.
    - It would include advice on standards to be used for each reference level and connection.
    - Reference Levels including:
        - Geodetic Datum which can be aligned with ITRF with sufficient accuracy
        - Geoid model

  - Land Height Datum
  - Tidal model / Hydroid model (referenced to the ellipsoid / geoid)
  - Bathymetry height layer
  - Topographic height layer
- Highlight the importance of storing data in the most accurate form and then transforming data as required.
- Address what standards should be used, and which standards need development to solve Member State problems.
- Address international legal guidance.

2. Communications materials

- Development of communication material with stories that politicians and user communities can understand. Consider including worst case scenarios and their impacts as well as best case scenarios (e.g. cost benefit analysis);
- Consider which champions or ambassadors we can use to tell our stories.
- Consider connections to the Sustainable Development Goals.
- Include simplified graphics or videos explaining the complex reference layers and connections.

Draft Decisions

The participants of the meeting:

Resolve to:

- Develop guidance material for Member States on joining land, sea and airspace data which will be presented to the Committee of Experts at the 15th session of UN-GGIM.
- Undertake a questionnaire to better understand how Member States are integrating data across domains
- Develop communications material to explain the importance of joining land and sea.

Recognise the:

- Importance of the Global Geodesy Supply Chain as being a foundation to accurate and reliable land and sea data collection needed by governments to manage and mitigate climate change and natural disasters.
- Need to grow the “next generation” of geospatial professionals.
- Need to build awareness on the importance of strong geospatial foundations in terms that policy makers and the public can understand.
- Importance of connection people together so they have a network of people to help them.