



**2012 – 2016**

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#### Commission I – Terms of Reference

- Data acquisition and pre-processing
- On-board pre-processing of data and autonomous systems
- Systems and media for recording sensor data, auxiliary data (time, position, attitude, etc.)
- Image technologies and data transfer standards
- Integration of various imaging sensors with other relevant systems
- Design and realization of digital aerial and spaceborne missions for Earth observation
- Design, construction, characterization, and installation of imaging and non-optical imaging sensors (including optical, IR, SAR, IfSAR, LiDAR, etc.)
- Standardization of definitions and measurements of active and passive imaging sensor parameters
- Geometric and radiometric properties, quality standards,

and factors affecting data quality

- Testing, calibration and evaluation of imaging and non-optical imaging sensors (including laboratory, in-flight /in-situ, inter-calibration and test fields)
- Integrated platform guidance, navigation, direct georeferencing (positioning and orientation) and integrated sensor orientation

#### WG I/1 - Standardization of Airborne Platform Interface

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#### WG I/1 Terms of Reference

- Discussion and coordination with international partners (new or current) on activities which foster cooperation to include ways on improving transnational or interagency access
- How the working group standard formats, developed by the previous working group, are being implemented for use on their national airborne platforms and instrument operations; including suggested improvements or new standards to explore
- National airborne platform inventory of research science aircraft
- Promotion of education and outreach programs by their airborne science community
- The expert workshops (platform or instrument that they supported or established)

#### WG I/2 - LiDAR, SAR and Optical Sensors for Airborne and Spaceborne Platforms

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#### WG I/2 Terms of Reference

- Assessment of active sensor systems for airborne and spaceborne platforms
- Data quality and performance validation of SAR, LIDAR and

optical systems for DEM generation

- Investigation and evaluation of systems integrating LiDAR, SAR and optical data
- Evaluation of Multi-pulse and full-waveform LiDAR
- Address challenges in low-frequency spaceborne SAR system design and data processing
- Address challenges and applications of high-resolution spaceborne SAR systems (e.g. TerraSAR-X, TanDEM-X, Cosmo Skymed)
- Evaluation of Multi-frequency SAR, polarimetric InSAR systems
- Liaison with external groups such as CEOS, IGARSS and EuroSDR
- Associations to other professional societies:
- German Society for Photogrammetry, Remote Sensing and Geoinformation (DGPF), e.g. Working Group Sensors and Platforms

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- System calibration of multi-sensor data acquisition systems (sensor and inter-sensor calibration)
- System calibration of land-, air-, and space-borne imaging and ranging systems
- In-situ calibration of multi-unit mapping systems
- Stability analysis of system calibration parameters
- Standards for the QC of the system calibration and stability analysis
- Collaborate with EuroSDR in the development of commonly accepted standards procedures for multi-platform and multi-sensor system calibration and testing
- Liaison with EuroSDR COM I

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**WG I/4 Terms of Reference**

- Geometric/radiometric calibration/evaluation of optical airborne and space borne sensors including laboratory and in-flight calibration activities (connections to CEOS working group IVOS)
- Comparison of existing and evolving algorithms for geometrical modeling of optical remote sensing images
- Analysis of available direct sensor orientation and modeling changes during sensor lifetime

- Evaluation of line sensors for DEM generation (cooperation with WG VII/x Digital Elevation Models by Radar)

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**WG I/5 Terms of Reference**

- Algorithmic aspects of direct georeferencing of active and passive sensors used in marine, land, airborne, and spaceborne environments
- Navigation technology and the methods of sensor orientation in urban, indoor and forested environments
- Co-registration of heterogeneous data sets for

integrated sensor navigation,  
orientation and calibration

- Georeferencing by integrated sensor orientation: models and adjustment procedures
- Investigate challenges and implementation issues of real-time georeferencing
- Navigation redundancy, robustness and reliability: impact of system integration
- Standards and protocols in direct georeferencing and sensor orientation.

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#### ICWG I/Va Terms of Reference

- Exploration, development, and demonstration of multi-sensor integrated scanning and imaging systems onboard land-based, waterborne and indoor mobile platforms for geospatial data collection with emphasis on the accuracy, reliability and standardization of orientation, calibration and georeferencing procedures;
- Development and evaluation of innovative algorithms and software tools towards real-time scanning and imaging data processing onboard mobile platforms;
- Development and evaluation of algorithms and software tools for automated extraction of spatial information from point clouds and images acquired by various mobile scanning and imaging systems;
- Development and evaluation of novel applications in 3D mapping of transportation infrastructure, open-pit mines, shorelines/waterways, heritage sites, and indoor scenes;
- Cooperation with ICA Commission on Mapping from Remote Sensor Imagery, IAG Commission 4 on Positioning and Applications, FIG Commission 4 on Hydrography, FIG Commission 5 on Positioning and Measurement, IEEE Geoscience and Remote Sensing Society, EuroSDR Commission 1 on Sensors, Primary Data Acquisition and Georeferencing, mainly for joint events, publications and reference data archives.

#### ICWG I/Vb - Unmanned Vehicle Systems (UVS): Sensors and Applications

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#### ICWG I/Vb Terms of Reference

- UVS navigation and position/orientation determination in outdoor and indoor environments
- UVS platforms, payloads and instruments for photogrammetry and remote sensing
- UVS swarm formations and sensor fusion
- UVS as a tool for remote sensing instrument prototyping
- UVS as a tool for teaching all aspects of photogrammetry [&] remote sensing
- Document and compare UVS systems in photogrammetry and remote sensing, in terms of cost, performance, application and quality
- Remote sensing and photogrammetry applications of UVS (Scientific Research, Commercial, Defense)
- Liaison with Com III, VIII, EuroSDR and robotic mapping communities

## Commission II - Theory and Concepts of Spatial Information Science

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### Commission II Terms of Reference

- Fundamentals of spatial information science: spatio-temporal modeling, spatial data structures, spatio-temporal databases structure, spatio-temporal querying;
- Spatial analysis and spatial data mining;
- Spatial reasoning and spatial decision support systems;
- Spatial data and model quality;
- Aggregation, generalization, abstraction and rendering of field-based and object-based spatial data;
- Processing, analysis and modeling of multi-dimensional spatial data;
- Interoperability of heterogeneous spatial information systems and system integration;
- Semantic and geometric integration of heterogeneous spatial information.
- Communication, dissemination and visualization of spatial data;
- Geostatistics, computer graphics and cloud computing for spatial data and information.

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#### WG II/1 Terms of Reference

- Concept and theory of modelling dynamics
- Spatio-temporal data models and structures
- Dynamic data models and structure
- Spatio-temporal and dynamic topology and relationships
- Spatio-temporal data indexing and query for field- and object-based spatial data models
- Computational geometry for spatio-temporal modelling
- Modelling change detection

### WG II/2 - Multiscale n-dimensional Spatial Data Representations, Data Structures and Algorithms

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**WG II/2 Terms of Reference**

- Topological and geometric data structures for multi-scale data handling, analysis and generalization
- Topological and geometric data structures for representing, handling and analysing n-dimensional spatial data
- Multi-scale modeling and representation of image data- Algorithms for 2D/3D/nD spatial data analysis generalization at multiple scales
- Multiple scale representation: conceptual, logical and physical data modelling and database design, model generalization
- N-dimensional representation: conceptual, logical and physical data modelling and database design - Data enrichment for context aware generalization: extraction of topological structure and semantic information
- Continuous generalization: incremental streaming of multi-scale spatial data
- Multi-scale modeling and representation of image data
- Collaboration with other communities, such as computational geometry, databases, location-based services

**WG II/3 - Spatial Analysis and Data Mining****Chair****Yaolin Liu**

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**WG II/3 Terms of Reference**

- Spatial analysis models and methods, and GIS modeling
- Knowledge discovery from spatial databases
- Semantic enriched analysis and mining in cooperation with ICWG II/IV
- Spatial analysis and data mining applications
- Spatial-temporal data analysis and mining

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**WG II/4 Terms of Reference**

- Understanding uncertainties in spatial data collected with earth observation techniques and stored in information systems.
- Statistical quality assessment for spatio-temporal data
- Modeling error propagation in spatial analysis
- Issues of scale in spatial objects
- Quality of deterministic model output in space and time
- Trust in spatial data and modeling
- Issues of sampling and monitoring relate the quantified quality of the input to the fitness for use

**WG II/5 - GeoComputation and GeoSimulation****Chair****Tao Cheng**

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**WG II/5 Terms of Reference**

- Geocomputational methods and algorithms for processing spatio-temporal data

- Machine learning methods (Neural networks, Statistical Learning Theory, Genetic algorithms, and Evolutionary computing, etc.)
- Agent-based simulation and cellular automata modeling
- Geostatistics and spatial econometrics
- High performance computation (cloud computing and grid computation)
- Applications in urban studies of geodemographics, health, criminology and transport; in environmental, ecological and biological modeling and analysis; and in modeling mobile, wireless, and location-based service networks

#### **WG II/6 - Geovisualization and Virtual Reality**

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#### **WG II/6 Terms of Reference**

- Enhanced communication of geographical data, information, and knowledge
- Geographical visualisation of multi-dimensional data
- Novel methods and tools for exploring and visualizing geographical decision spaces
- Geovisual analytics for usability testing and exploring big data
- Platforms to supporting geographical visualisation including the web and mobile devices
- Geographical visualisation of crowd sourced, social media, and government databases
- Development and application of immersive and semi-immersive virtual reality
- Virtual Reality and augmented reality representations of space, place and time.

#### **WG II/7 - Intelligent Spatial Decision Support**

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#### **WG II/7 Terms of Reference**

- Theory, concepts, design and development of Spatial Planning Support Systems (SPSS) and Spatial Decision Support Systems (SDSS);
- Theory, concepts, design and development of Integrated Planning and Decision Support Systems (IPDSS);
- Design and development of Collaborative Spatial Decision Support Systems (CSDSS), considering various modelling techniques and requirements of different user-groups (style, functionality, etc.);
- Theory, concepts and application of Spatial Multiple Criteria Decision Analysis (SMCDA) in single and group environment;
- Multi-dimensional, multi-thematic and multi-resolution spatial information for spatial decision support systems;
- Spatial decision modeling, collaborative and exploratory data analysis, and decision visualization;
- GeoSocial networks, crowdsourcing and public participatory spatial decision support;
- Data-intensive computing and computational intelligence for spatial decision support;
- Web-based and cloud-based spatial decision support systems

#### **WG II/8 - Mobility: Tracking, Analysis and Communication**

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**WG II/8 Terms of Reference**

- Acquisition methods for tracking moving objects
- Spatio-temporal data modelling and analysis of moving objects
- Querying and reasoning about movement data

- Generalizing movement data
- Graphical and verbal communication of movement data
- Applications in traffic or wildlife monitoring, emergency management including evacuation, and transportation

**ICWG II/IV - Semantic Interoperability and Ontology for Geospatial Information**
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**ICWG II/IV Terms of Reference**

- Semantic interoperability of geospatial databases
- Knowledge representation and formal languages for Geospatial ontologies
- Semantic mapping and semantic enrichment of geospatial concepts
- Semantic interoperability of web services
- Semantic interoperability in ad-hoc networks of geospatial databases
- Real-time semantic interoperability
- Geospatial semantic Web
- Semantic sensor web and linked data
- Semantics of Volunteered Geographic Information

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**Terms of Reference**

- Algorithms for geometric analysis of image data regardless of scale;
- Geometric analyses of IR, SAR, IFSAR and LIDAR;
- Automated feature and attribute extraction techniques and methodologies from multi-sensor, multi-resolution, multi-spectral, hyperspectral, and multi-temporal imagery;
- Fundamental research into image understanding for object detection, recognition, identification and reconstruction;

- DEM generation and integration of three-dimensional modeling concepts into image analysis processes;
- Integration of spatial information systems and object models for object recognition;
- Sensor pose determination (including auxiliary information);
- Projective and multi-view geometry;
- Image sequence analysis;
- Algorithms for including features in the orientation processes;
- Spatial, spectral and temporal properties of natural and human-formed objects.

#### **WG III/1 - Orientation and Surface Reconstruction**

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##### **WG III/1 - Terms of Reference:**

- Camera pose estimation
- Calibration and orientation without artificial targets
- Multi-view matching and surface reconstruction
- Evaluation of performance, reliability and generality of methods
- Robustness of orientation and matching

#### **WG III/2 - 3D Point Cloud Processing**

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##### **WG III/2 - Terms of Reference:**

- Scene understanding from aerial, mobile, terrestrial and indoor point cloud data
- Change detection and map updating using multi-temporal point clouds
- Information extraction from point clouds, including segmentation and classification
- Registration of point clouds
- Machine learning algorithms in point cloud processing
- High performance computing for massive point data processing and analysis
- Analysis of full-waveform lidar data

#### **WG III/3 - Image sequence analysis**

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#### **WG III/3 - Terms of Reference:**

- Camera and camera network calibration from image sequences including cameras with non-standard geometry and variable frame rates
- Models and methods to determine ego-motion, for navigation, georeferencing and object reconstruction
- Detection, reconstruction, classification and tracking of single and multiple objects in image sequences
- Event reconstruction and analysis from image sequences, and from single and multiple video streams
- Quality assessment techniques for calibration, orientation and object detection from image sequences, including but not limited to time-series analysis at different epochs and resolutions
- Benchmarking of calibration, orientation and object detection with image sequences
- Change detection in time-series of images or 3D point clouds, including the analysis of landscape or object evolution
- of huge heterogeneous data sets

#### **WG III/4 - 3D Scene Analysis**

##### **Chair**

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#### **WG III/4 - Terms of Reference:**

- Models and techniques for extracting objects (buildings, roads, cars, vegetation etc.) from aerial, spaceborne and terrestrial image, laser, and (In)SAR data
- Generation and update of high-resolution 3D city models and road databases
- Interpretation of terrestrial, aerial and spaceborne sensor data, possibly together with information from traditional cartographic products, CAD models, and urban GIS.
- Tools and models for integrating information about multiple object classes and their relations within complex scenes.
- Automatic and semi-automatic generation of urban models with level-of-detail (LOD) and attributes
- Analysis of the trade-off between geometry and radiometry / texture for visualization
- Assessment of efficiency and quality, and of their dependence on the quality of the input data

#### **WG III/5 - Computer Graphics and Remote Sensing**

##### **Chair**

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#### **WG III/5 - Terms of Reference:**

Rendering / Visualization :

- Image-based rendering : geolocalized and calibrated images as plenoptic function samples, with or without possibly uncertain 3D cues (3D-models, 3D point clouds...).
- Point-based rendering : Datastructures and processing
- Algorithms for Augmented Reality and Interactive Environments
- Algorithms for Web Visualization (e.g. HTML5 Canvas, WebGL)
- Out-of-Core rendering large 3D-scenes, large models, and point clouds
- Physical simulation of the radiative transfer involved in image or Lidar



acquisition (relighting, generation of synthetic datasets for analysis)

- Spatial data structures and geometric algorithms

Inverse Rendering / Analysis :

- Reflectance estimation for physical or non-physical image relighting (eg: shadow removal)
- Reflectance estimation as a material feature for subsequent analysis (eg: classification)
- Use of graphics hardware (GPU) for solving computationally expensive problems

### ICWG III/I - Sensor Modeling for Integrated Orientation and Navigation

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#### ICWG III/I - Terms of Reference:

- General rigorous modeling of positioning and attitude sensors.
- Modeling of MEMS sensors for photogrammetric orientation.
- Stochastic Differential Equations in orientation and calibration for photogrammetric applications.
- Spatial and temporal modeling of non-standard sensors (low-cost, new-geometry, combined-geometry configurations).
- Block adjustment-oriented modeling of hybrid orientation and calibration systems
- Photogrammetric/LiDAR orientation and calibration: measurement techniques and models.

#### ICWG III/VII - Pattern Analysis in Remote Sensing

#### Chair

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#### ICWG III/VII - Terms of Reference:

- Automatic identification and learning of 2D and 3D patterns in uni-modal and multi-modal remote sensing data, e.g. multi-scale aerial and satellite data; multi- and hyperspectral data; SAR-, radargrammetric and SAR-tomography data
- Automatic identification and learning of temporal patterns in remote sensing data, e.g. image-based flow estimation and learning from InSAR data (traffic, glaciers, currents, etc.); analysis-by-synthesis approaches for motion and deformation modeling with passive and active sensors

Integration of radiometry and radiometric models into pattern recognition; radiometrically enhanced object models for range-intensity images and sequences; integration of SAR-simulation into SAR-image and analysis

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**Terms of Reference**

- Development, access, management and retrieval of large-volume, spatio-temporal databases;
- Spatial data infrastructures and cyberinfrastructures;
- Image-based, point cloud and crowdsourced updating of geospatial databases;
- Access to remote data sources, including metadata and open source digital data standards;
- Web-based access, retrieval and dissemination of spatial data, including location-based services, dynamic phenomena and moving objects;
- Integration of spatial information systems and image analysis for GIS-driven
- change detection, data capture and updating;
- Dynamic spatial information systems, spatial data revision and versioning;
- Rapid mapping for disaster management;
- Interfacing urban and engineering 3D models with spatial information systems;
- Digital landscape and urbanscape modeling and visualization;
- Extraterrestrial spatial databases and spatial information systems;
- Analysis of systems and their components for automated and semi-automated digital mapping and geoinformation systems;
- Analysis of industry, government and social needs and design of systems for production and update of geospatial information.

**WG IV/1 - Methods for the Update and Verification of Geospatial Databases****Chair**

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**WG IV/1 Terms of Reference**

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- change detection, data capture and updating;
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- Interfacing urban and engineering 3D models with spatial information systems;
- Digital landscape and urbanscape modeling and visualization;
- Extraterrestrial spatial databases and spatial information systems;
- Analysis of systems and their components for automated and semi-automated digital mapping and geoinformation systems;
- Analysis of industry, government and social needs and design of systems for production and update of geospatial information.

**WG IV/2 - Global Status of Mapping and Geospatial Database Updating****Chair****Vladimir A. Seredovich**

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**WG IV/2 Terms of Reference**

- To collect information on the global status of mapping and its updating in databases. This is of particular importance for countries with large areas for which imagery has provided interim information.
- Investigate and eventually test potentials and possibilities for fast, efficient and accurate means to acquire global basic topographic map information at various scale levels and to maintain and updating it. This shall include governmental and industry efforts.

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**WG IV/3 Terms of Reference**

- Review technical progress on global DEM data fusion methods and outcomes
- Review technical progress on creation of bathymetry of the Earth's continental shelves and data fusion with coastal zone co-ordinate systems, topography and shorelines from spaceborne EO data
- Discuss the temporal aspects of DEMs including per gridpoint time-tagging, change assessment (e.g. ice-sheets, open-cast mining, landslides, etc..)
- Discuss best methods for bare earth retrieval from Earth Observation-derived Global DEMs and subsequent assessment of global biomass (in association with the IC II/IV on Global land cover)
- Establishment of open source software for evaluation/validation of global DEMs
- Establishment of open source database for evaluation of global DEMs (e.g. Runways, CCPs (Canopy Control Points) ICESat from NASA-GSFC (waveform processed for retrieval of ToC (Top of Canopy) and Bare Earth (DTM))
- Discuss best methods for interoperability through OGC-compliant protocols

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**WG IV/4 Terms of Reference**

- Development and management of multi-level (national, regional and global) geospatial databases
- Highly efficient data acquisition and processing from multi-sources, including field surveying, remote sensing, real-time sensors and crowdsourcing;
- Synchronization of disparate geospatial resources to provide a useful, usable, and enabling framework that can be integrated with environmental and socio-economic data for research, discovery and web services characterized by broad access and "end-to-end" coordination
- Methods, strategies and techniques for sustained, dynamic and incremental updating and versioning of the database. And maintain the consistence of multi-scale and multi-resolution datasets in the process of updating.
- Cooperation and liaison with international efforts (GEOSS, Digital Earth, UNSDI, INSPIRE and GMES),

and organizations (GSDI, WGISS, ICA, W3C, and EuroSDR)

- Cooperation with organizations working on interoperability standards and specifications, such as OGC and ISO. Contribution towards open source principles, metadata and open standards of service, system architectures, and geospatial information

#### **WG IV/5 - Web and Cloud Based Geospatial Services and Applications**

##### **Chair**

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#### **WG IV/5 Terms of Reference**

- Design, development and evaluation of web and cloud based architectures, services and applications for intelligent mapping, multiple geospatial web services, geoweb semantics and ontologies, geospatial analytics, spatiotemporal analysis and online GIS

- Design and development of mobile and ubiquitous geospatial services and applications with adaptive and context-aware processing and multidimensional visualisation
- Design and development of virtual and collaborative geospatial environments and services for crowdsourced spatiotemporal data
- Integration of open source solutions and open standards/specifications
- Development and use of virtual globes for geospatial data integration, visualization and analysis
- Investigation of social and organizational issues related to web and cloud-based services and collaborative environments
- Research into novel online 3D/4D visualization and virtual reality technologies for representing and analysing dynamic phenomena to provide collaborative services in a web and cloud based environment.
- Cooperation with related working groups and organizations including ISPRS WG II/6 and WG II/7, ICA (Commission on Maps and the Internet, Commission on Geovisualization), WGISS, FIG, OSGeo, OGC, etc.

#### **WG IV/6 - Sensor Web and Internet of Things**

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#### **WG IV/6 Terms of Reference**

- Advance and evaluate interoperable Sensor Web standards, algorithms, and system architecture
- Investigate efficient ways to connect, access, and task resource-constrained Internet of Things devices and sensors
- Advance sensor data stream processing algorithms and architecture
- Design, develop, and evaluate innovative Sensor Web and Internet of Things applications
- Design, develop, and benchmark implementation interfaces for the abstract ISO standards
- Collaborate with the large photogrammetric companies to develop and evaluate XML-definitions and software libraries
- Attend and collaborate with the related OGC working groups (e.g., SWE DWG, IoT SWG, etc.), ISO/TC-211 meetings as well as ISPRS WG II/8.

#### **WG IV/7 - 3D Indoor Modelling and Navigation**

##### **Chair**

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#### WG IV/7 Terms of Reference

- 3D reconstruction of indoor environments integrating different types of sensors;
- 3D data structures, algorithms and standards for integration of BIM, CAD and GIS models for seamless (indoor/outdoor) navigation and evacuation.
- Automated semantic description of indoor environments.
- Automated 3D modelling of dynamic indoor environments
- Benchmarking of indoor reconstruction of and semantic algorithms.
- 3D data models for management of geo-sensor data and their integration with other 3D information.
- Data models allowing for efficient 3D visualization and assisted navigation of indoor models

- Promote integrated processing of dynamic sensor data and simulation model data for quick emergency response.
- Analysis of 3D disaster management and environmental modelling needs for production and updating of spatial information.

#### WG IV/8 - Planetary Mapping and Spatial Databases

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#### WG IV/8 Terms of Reference

- Development of advanced techniques in data acquisition, processing, and analysis pertaining to the mapping of celestial bodies
- Definition or evaluation of reference systems, coordinate systems, map sheet definitions, etc. and their standardization
- Development of spatial information systems to support extraterrestrial exploration and science
- Web based delivery of extraterrestrial map products and GIS data
- Cooperation with related working groups viz. IAU, NASA, ESA, ISRO, JAXA and other space organisations and liaisons with the ICA Commission on Planetary Cartography

#### ICWG IV/II - Computing Optimization for Spatial Databases and Location based Services

#### Chair

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#### ICWG IV/II Terms of Reference

- Reduce the response time for SDB and LBS given specific computing infrastructure
- Optimize Distributed Computing for Enabling Computability of Geosciences and Digital Earth
- Mining and Utilizing spatiotemporal principles to improve cloud computing and other new computing paradigms for SDB and LBS
- Modern hardware and software Accelerating Technologies for GIS
- Spatiotemporal Index for Geosciences and other science domains

#### ICWG IV/II/VIII - Global Land Cover Mapping and Services

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#### ICWG IV/II/VIII Terms of Reference

- Identify scientific/technological/application challenges related to GLC mapping and monitoring
- Utilize new sensor data, SAR data, and longer and denser time-series data for GLC mapping and monitoring
- Identify test sites and develop methods for the validation of GLC datasets at various spatial resolutions
- Develop web services for GLC data sharing, updating, processing and validation
- Collaborate with GEO tasks related to GLC (e.g., SB-02)

## Technical Commission V - Close-Range Sensing: Analysis and Applications

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##### Terms of Reference

- Vision metrology systems for industrial applications
- Photogrammetric techniques for architectural, archaeological and cultural heritage applications
- Systems and algorithms for real-time imaging and mobile mapping data processing

- Integration and fusion of multiple data sources for advanced automated object extraction, recognition and modeling
- Laser scanning, range imaging, low-cost gaming sensors and other active imaging techniques for 3-D representation of static and dynamic objects and scenes
- Vision-based techniques for visualization, simulation, robotics and animation
- Photogrammetric techniques for close range morphological measurements in earth sciences
- Photogrammetric techniques in biomedical engineering and human motion studies
- Functional algorithms for close range photogrammetric orientation and object modelling

#### WG V/1 - Vision Metrology

##### Chair

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#### WG V/1 - Terms of Reference:

- Performance evaluation of active and passive systems
- Definition of accuracy and best practice
- Contribution to international standards

- System developments and industrial applications
- Very close range and large volume measurement applications
- Camera-controlled robot and machine guidance
- Strengthen co-operation and involvement of industrial partners in ISPRS activities

#### **WG V/2 - Cultural Heritage Data Acquisition and Processing**

##### **Chair**

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#### **WG V/2 - Terms of Reference:**

- Development and promotion of photogrammetric measurement techniques and spatial information systems applicable to cultural heritage
- Integration of measurement techniques supporting metric and remote sensing survey, monitoring and valorisation requirements of the archaeology, architecture, conservation, restoration and archiving communities
- Development and dissemination of best practice protocols to aid

appropriate application across related cultural heritage fields

- Development and promotion of low-cost, rapid, innovative, automated, commercial and open-source approaches for metric and remote sensing survey of heritage assets
- Close co-operation with related disciplines, national / international groups (e.g. CIPA) and other ISPRS working groups

#### **WG V/3 - Terrestrial 3D Imaging and Sensors**

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#### **WG V/3 - Terms of Reference:**

- Characterization (radiometric and geometric), calibration and evaluation of active and passive sensors for terrestrial applications
- Automated and robust methods for point cloud registration, feature extraction, object recognition, and scene classification (in cooperation with

WG III/2, WG V/4 and ICWGV/I on "Mobile Scanning and Imaging Systems for 3D Surveying and Mapping")

- Evaluation of new 2D and 3D imaging sensors, including gaming and low-cost sensors
- Processing methods for 3D imaging sensors
- Integrated sensors and data fusion on static and kinematic platforms for surveying and 3D modeling applications (in cooperation with ICWG V/I and WG V/2, V/4, V/5)
- Involvement of system manufacturers, developers and service providers

#### **WG V/4 - Terrestrial 3D Modelling: Algorithms and Methods**

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**WG V/4 - Terms of Reference:**

- Stimulate the development of algorithms and software tools for (automated) geometric and appearance modelling using different data sources
- Promote integrated processing of point clouds (in collaboration with WG V/2, WGV/3, ICWG I/V and WG III/2), image and video data for the generation of realistic 3D models usable in the heritage field and for virtual environments, animations, BIM, etc.
- Benchmark the quality of terrestrial 3D modelling methods and outputs as well as creation of best practice protocols and examples
- Seek co-operation and involvement in the BIM domain (in collaboration with WG IV/7)

**WG V/5 - Close-range Measurements for Biomedical Sciences and Geosciences**

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**WG V/5 - Terms of Reference:**

- Research and development in close-range techniques and systems for 3D reconstruction in the fields of geomorphology, earth science, hydrology, glaciology, climatology, hazard monitoring, geology, medical imaging, body/sports measurement and modeling, etc.
- Identify and promote different camera geometries and networks suitable for different scales of enquiry
- Educate and inform “non-geomatics” users of the existence and benefits of involvement with ISPRS
- Involve Geomatics experts in organizations involved with bio- and geoscience
- Establish and make freely available “best-practice” guidelines for non-expert users of consumer grade digital cameras and terrestrial laser scanners
- Establish collaboration with TC VIII activities on hazard monitoring and forest biomass analyses

## Technical Commission VI - Education, Technology Transfer and Capacity Development

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**Terms of Reference**

- Support, promote, and stimulate education and training at fundamental, advanced and professional levels;
- Support, promote, and stimulate technology transfer, considering regional needs and resources;
- Support, promote, stimulate, and initiate development and provision of computer - assisted

teaching training and distance learning methods and materials;

- Promote, support, and stimulate the ISPRS students consortium activities;
- Initiate, promote, and support regional capacity development activities;
- Develop and support joint activities with regional organizations;
- Stimulate and support regional and local initiatives for summer schools, courses, and workshops;
- Provide tutors and educational material and support;
- Organize, initiate, promote, support, and stimulate regional and international summer students schools or seminars, workshops and tutorials.

**WG VI/1 - Web-based Resource Sharing for Education and Collaborative Research**

**Chair**



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**WG VI/1 Terms of Reference**

Promote web-based sharing of  
geographic information resources  
for education, research and  
collaboration. The goal is to  
reinforce the capacity building to  
promote the sharing of various  
resources through Web Service  
technology within ISPRS and  
beyond. Resources for sharing  
include but not limited to:

- Online or offline test data (RS images, vector, statistic data, documents);
- Sensor Resources;
- Online algorithms provided by Web Services;
- Geoprocessing knowledge (Geoprocessing workflow model);
- Teaching materials including courseware for teaching;
- Open sources software (middle ware, tools);

## • Others.

Cooperative efforts and contributions are sought to establish and maintain such an education resource sharing platform.

The platform supports user management. Users can register and form groups. Registered users can upload, search, collect, and manage online use resources shared in this platform.

**WG VI/2 - E-Delivery of Education Services****Chair****Anjana Vyas**

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**WG VI/2 Terms of Reference**

Exchange information and expertise and stimulate the development of e-delivery of educational services with emphasis on the following topics:

- Investigation of the role of e-learning in modern education and training.
- Development, assessment, evaluation and recommendation of e-learning methodology in (or for) Geoinformatics.
- Denominate best e-learning practice examples.
- Organize e-learning contest CATCON for promotion and dissemination of educational resources.
- Collecting, uploading and sharing e-learning resources through web-based sharing platform maintained by WG VI/1

**WG VI/3 - Promotion of International Collaborative Education Programs****Chair****Le Wang**

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#### **WG VI/3 Terms of Reference**

Exchange information and  
expertise and stimulate the  
development of cross-border  
educational services with  
emphasis on the following topics:

- Promote the inventory & evaluation of joint educational programs (JEPs);
- Development of core curricula & educational modules;
- Multi-linguistic problems in JEPs;
- Best practices for joint education programs.

#### **WG VI/4 - Promotion of Regional Cooperation and Regional Capacity Development in Geoinformatics**

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#### **WG VI/4 Terms of Reference**

- Further support existing ISPRS initiated projects of capacity building and Technology transfer in the fields of Photogrammetry,

Remote Sensing, Spatial  
Information, EO and mapping at  
Universities in the Region;

- Support, promote, stimulate and initiate capacity building and knowledge dissemination efforts such as: Seminars, tutorials, workshops, symposia, e-bulletins and other mechanisms & tools, in various levels aiming for: Researchers, PhD, MA, Undergraduate, Engineers, Technicians and other professionals;
- Cooperate with other working groups within commission VI and other ISPRS commissions, on how to synchronize the efforts and how to cooperate in launching seminars and workshops ;
- Initiate and support: e-learning and remote teaching activities; development and integration of high-tech elements and tools in teaching and training;
- Cooperating with other Geo-societies on issues of: common themes and goals; mobilizing lecturers; adopting efficient ways for planning and running the seminars; and how to share and cut expenses;
- Cooperate with regional universities, organizations, and societies in order to stimulate them to cooperate, provide facilities, share local know how and offer a base for future further cooperation;
- To look for institutes and individuals that will reiterate the WG Seminars and other knowledge dissemination projects, in other regions.

#### **WG VI/5 - Promotion of the Profession to Young People**

##### **Chair**

##### **Fuan Tsai**

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#### WG VI/5 Terms of Reference

To promote a healthy profession  
to young people:

- Promote sharing and exchange of the information of academic positions and the information of young scholars within ISPRS;

- Provide potential tutorial or skill training for young scholars in teaching or doing research work;
- Promotion of international mobility for young researchers, making use of international funding capabilities, like EU research programs, and encouragement of relevant organizations to facilitate international visitings;
- Create adequate conditions and platforms for broader and more efficient involvement of youth into ISPRS activities, including financial aspects, facilitating their ISPRS participation and activities, and support by sponsors;
- Promote and provide supervision to the Student Consortium (SC);
- Organize summer schools through cooperation with WG VI/4 and VI/6;
- Organize Youth Forum through cooperation with SC;
- Further develop the cooperation with the organizations for young professionals of ISPRS sister societies.

#### WG VI/6 - Technology Transfer and Capacity Development

#### Chair

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#### WG VI/6 Terms of Reference

- Knowledge and technology transfer by initiating and organizing seminars, tutorials and workshops with special consideration of the needs of under-developed and developing countries;
- Support of events with strong participation of young scientists and students;
- Knowledge transfer to the industrial and private sector, based on continuous professional development (CPD);
- Development of teaching material for mobile, caravan-type teaching and training projects;
- Solicitation of support from potential sponsors (system manufacturers, government agencies, NGO/NPOs, foundations etc.) for the projects and activities

### Technical Commission VII - Thematic Processing, Modeling and Analysis of Remotely Sensed Data

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#### Terms of Reference

- Relationship between spectral, radiometric and temporal properties of objects and surfaces, their physical and chemical properties and their variabilities;
- Image classification and analysis methodologies;
- Analysis of characteristics of multi-spectral, hyperspectral, multi-sensor, microwave and multitemporal image data for extraction of attribute information;
- Methodologies of computer-assisted interpretation and analysis of remotely sensed data;
- Validation of data and information using laboratory and in-situ methodologies
- Improving atmospheric modeling for radiometric correction;
- Multi-source data fusion and integration techniques;
- Modeling of satellite data derived parameters
- Global databases and determination of indicators of change for global modeling, monitoring and sustainable development
- Integration of remote sensing and GIS techniques;
- Aerosol and particulate detection and identification.

#### **WG VII/1 - Physical Modelling and Signatures in Remote Sensing**

##### **Chair**

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#### **WG VII/1 - Terms of Reference:**

- Study the relationship of spectral, directional, temporal and polarimetric properties of objects, as well as their physical and chemical properties and variations
- Research on advanced quantitative, physical based retrieval of biophysical and biochemical parameters
- Research of methods based on full spectral signatures using assimilation and inversion
- Study spectrodirectional ('the combination of multiple view angles with imaginary spectrometers') data acquisition potential and subsequent retrieval methods

#### **WG VII/2 - DEM Generation and Surface Deformation Monitoring from SAR Data**

##### **Chair**

##### **Uwe Soergel**

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#### **WG VII/2 - Terms of Reference:**

- Generation and accuracy assessment of DEM from SAR imagery
- Object extraction from InSAR data
- Differential SAR Interferometry and Persistent Scatterer Interferometry
- Ground based SAR Interferometry

#### **WG VII/3 - Information Extraction from Hyperspectral Data**

##### **Chair**

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#### WG VII/3 - Terms of Reference:

- Optical, NIR, SWIR and thermal imaging spectroscopy for the retrieval of geo- and bio-physical parameters
- Ground based validation and radiometric calibration of hyperspectral data
- Atmospheric parameter retrieval and atmospheric corrections
- Operationalisation and standardization of (pre-)processing and methodological approaches
- Preparation for upcoming satellite missions: Simulation tools, multiscale analyses, predicted accuracies of thematic products
- Data and sensor fusion for improved parameter retrieval: combination with other remote sensing data (lidar, SAR, multi-angular, thermal) and a priori information

#### WG VII/4 - Methods for Image Classification

#### Chair

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#### WG VII/4 - Terms of Reference:

- Image classification techniques and new algorithms for the extraction of thematic information including pixel-based classification, object-based classification, and artificial intelligent based classification, and synergism between classification approaches
- Image analysis methodologies for thematic information extraction including context analysis, texture analysis, image segmentation, and other analysis
- Advanced and practical methodologies of Computer Assisted Interpretation (CAI) and analysis of remotely sensed data, including expert systems and knowledge based tools to

help the human interpretation of images

- Enhanced methodologies for thematic data extraction using emerging sensor data sources, multiple view sensors and thermal sensors
- New methodologies for classification quality assessment

#### WG VII/5 - Methods for Change Detection and Process Modelling

#### Chair

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#### **WG VII/5 - Terms of Reference:**

- Analysis of the characteristics of multitemporal data for extraction of attribute information
- Methodologies of computer assisted interpretation and analysis of multitemporal data
- Temporal pattern recognition and time series analysis and Modelling
- Methodologies for global monitoring, Modeling and prediction
- Methodologies for extracting essential climate variables from long-term satellite observations
- Algorithms and methods for monitoring and tracking changing objects
- Data integration and change detection for updating

#### **WG VII/6 - Remote Sensing Data Fusion**

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#### **WG VII/6 - Terms of Reference:**

- Automatic registration, error assessment, or other geometric aspects of fusion with images from different spatial, spectral, and temporal resolutions, or acquisition modes
- Pixel-, feature- and decision-level fusion algorithms and methodologies
- Integration of images and products from satellite, airborne, and terrestrial sensor systems, as well as in-situ measurements
- Data fusion applications in the fields of mapping and monitoring natural resources, natural hazards, and environmental security
- High performance computing techniques in remote sensing data fusion

#### **WG VII/7 - Synergy in Radar and LiDAR**

##### **Chair**

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#### **WG VII/7 - Terms of Reference:**

- Synergetic use of lidar and radar for retrieval of geophysical parameters
- Experiments using both radar and lidar
- Multi-temporal radar and lidar remote sensing
- Terrestrial measurements for validation and calibration
- Upscaling and error processing in lidar and radar measurements
- Scaling in radar and lidar remote sensing
- Physical radar and lidar backscatter models

### **Technical Commission VIII - Remote Sensing Applications and Policies**

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#### Terms of Reference

- Information support for disaster and risk reduction: Early warning systems, impact assessment, monitoring, resilience and risk reduction
- Space based inputs for health services: disease epidemiology, predictive modelling and decision support systems
- Environmental pollution: assessment and impacts
- Improvements in space based geo-physical products: Radiative forcing, weather forecasting and climate change analyses
- Hydrologic modelling: Improved parameterization, scaling from river basin to micro-watershed, water and energy cycle, including interactions
- Integration of remotely sensed inputs on Geology, Geomorphology and Pedology with the Earth Science Applications
- Multi-scale crop monitoring for growth and stress for sustainable agricultural

production and Conservation agriculture

- Integration of spatio-temporal satellite data products for analyses on climate change / variation
- Global and regional dynamics of land use / land cover, bio-diversity, nexus of degradation, desertification and drought, bio-geo-chemical cycles
- Carbon fluxes in soils, vegetation and inland, coastal and ocean waters
- Physical and biological oceanographic parameters and assimilation in coupled models
- Geophysical products for Cryospheric studies: Status, response and trends
- Data Policies on sharing, access and outreach, Collaborate with GEO tasks and other select international programmes on the Earth observation applications, wherever applicable

#### WG VIII/1 - Disaster and Risk Reduction

##### Chair

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#### WG VIII/1 - Terms of Reference:

- Generation of vulnerability and hazard zone maps for different type of disasters, such as forest fire, cyclone, floods, drought, volcano eruptions, earthquakes, landslides etc. and identification & assessment of potential risk zones
- Integrate remotely sensed observations and communication strategies with enhanced predictive modelling capabilities for disaster detection, early warning, monitoring, damage assessment and response
- Development of disaster management plans for pre, during and post disaster situations and enhance support for early warning systems, emergency events mitigation and decision making.
- Collaborate with ISPRS TC 1 & other relevant Working Groups as well as international bodies such as GEO, CEOS, IGOS & ICSMD

#### WG VIII/2 - Health

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#### WG VIII/2 - Terms of Reference:

- Integrate Earth observation products with predictive models for environmental health tracking and early warning, and for disease surveillance in cooperation with other international, national, and regional organizations and activities.
- Collaborate with the International Council of Scientific Unions (ICSU) to support initiatives of mutual interest.
- Contribute to the GEO Health Societal Benefit Area
- Bridge the Earth observing communities of practice and health communities of practice by including health professionals in ISPRS sanctioned technical sessions, workshops, and symposia
- Provide scholarly contributions to advance knowledge and practice of Earth observation for public health through collaboration among working group members
- Build capacity to enhance interdisciplinary research collaborations in the fields of remote sensing and public health.

#### WG VIII/3 - Weather, Atmosphere and Climate Studies

##### Chair

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#### WG VIII/3 - Terms of Reference:

- Enhance retrieving and monitoring status and effects of clouds and aerosols.
- Enhance retrieving and monitoring status and effects of atmospheric greenhouse gases, like carbon dioxide, methane, etc.
- Enhance retrieving and monitoring capabilities of atmospheric minor constituents and aerosols both in stratosphere and troposphere.
- Enhance the monitoring capabilities of atmospheric winds.
- Increase the accuracy of atmospheric radiative forcing to contribute to the climate models.
- Increase the knowledge of atmospheric processes to improve the climate models.
- Improve the quality of remote sensing data input to numerical weather forecast system to increase the accuracy of weather forecasting and now-casting.
- Collaborate with GEO and take part in GEO task where appropriate

#### WG VIII/4 - Water

##### Chair

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#### WG VIII/4 - Terms of Reference:

- Early warning systems for natural disaster like droughts and floods.
- Upscaling/Downscaling the soil moisture and latent heat retrieved from the satellites.
- Improvement in the hydrological/soil parameterization by using the satellite products.
- Global and regional dynamics of desertification and drought.
- Assimilation of satellite data into a crop/hydrological model.
- Collaborate with GEO and take part in GEO task where appropriate.

#### WG VIII/5 - Energy & Geological Applications

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#### WG VIII/5 - Terms of Reference:

- Generation of spectral library of rock forming minerals, rock types, metaliferous host rocks and the alteration zones, integrating ground based spectral reflectance data and multi-sensor satellite data
- Adoption of multi- sensor, multi-resolution and hyper spectral remote sensing data and GIS based 3D visualization of deep seated mineral Deposits to the exploration of non Renewable Resources, radioactive and geothermal resources
- 3 dimensional visualization of probable hydro carbon / Gas bearing deep seated geological structures, growth faults

connecting such deep seated structures to the surface expressed active faults and detection of zones of degasification along such active faults using Digital elevation models of geophysical, bore hole lithological and surface topographical data.

- Elucidation of tectonic evolution offolded mountains using structural trends and the fractures interpreted from satellite stereo images and the shaded relief out puts
- Employ remotely sensed data, mapping lithological, tectonic, geomorphic and hydrologic Anomalies and construct post collision tectonic models and evaluation of their impacts and Control Over mineral, aquifer systems, hydrocarbon, natural disasters and the eco systems.
- Modeling of river basins with special reference to their life histories including erosional-depositional dynamics, catchment erosion /youthful stage behavior, delta building activity and deduction of interface dynamics between the river flow dynamics and the active tectonics, sea level changes, palaeo flood cycle, palaeo climate etc and finally evolve plans for soil conservation, flood rhythmicities and forecasting, secondary minerals, ground water targeting, recharge, command area development, Engineering geology projects etc.
- Remote sensing, analysis of ETOPO data and coastal morphotectonic and morphodynamic modeling Leading to natural resources based, ecosystem sustainable and disaster protective and predictive Developmental planning.
- Application of satellite stereo images, generation of shaded relief maps in mapping the fracture systems and spatio-linear modeling of fractured aquifer systems.
- Help facilitate the development of geological and geomorphological product standards and related error

assessment derived from remote sensing data

- Foster technology transfer through the sharing of convincing geological and geomorphological case histories derived from remote sensing data
- Collaborate with other ICSU GeoUnions; collaborate with GEO and take part in GEO task where appropriate.

#### **WG VIII/6 - Cryosphere**

##### **Chair**

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##### **WG VIII/6 - Terms of Reference:**

- Develop remote sensing data for assimilation in models of sea ice cover, glaciers, permafrost and ice sheets.
- Assess errors in the retrieval of satellite cryospheric parameters.
- Develop historical records of polar parameters and non-polar glaciers for trend studies.
- Assess glacier and ice sheet mass loss..
- Study the asymmetry in the changes of sea ice in the Arctic and Antarctic regions.
- Study trends and changes in albedo at high latitudes and relationships with changes in snow cover and melt patterns.
- Monitor surface temperature and snow cover changes in permafrost regions.
- Collaborate with GEO and take part in GEO task where appropriate.

#### **WG VIII/7 - Forestry, Natural Ecosystems & Biodiversity**

##### **Chair**

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##### **WG VIII/7 - Terms of Reference:**

- Development of the Monitoring, Recording and Verification (MRV) system for REDD using RS/GIS.
- VHRS images, Lidar and Photogrammetry 3D point cloud for modeling and mapping forest Biomass/Carbon stock.
- Modeling carbon emission from forest fire using RS/GIS
- Advanced Mapping and Monitoring Deforestation and Forest Degradation using latest Development of RS Sensor, Methods and Techniques.

#### **WG VIII/8 - Land Cover and its Dynamics, Including Agricultural & Urban Land Use**

##### **Chair**

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#### WG VIII/8 - Terms of Reference:

- Advance remote sensing of land cover land use change (LCLUC);
- Develop methods, protocols, and algorithms for remote sensing of global cropland monitoring, mapping, and modelling;
- Promote journal articles and special issues pertaining to global LCLUC, agriculture, and water issues;
- Conduct, promote, participate in remote sensing workshops and symposiums on issues pertaining to global LCLUC, agriculture, and water;
- Address issues pertaining to global food security through remote sensing data, products, models, and maps;
- Assessment and modelling of biodiversity by remote sensing methods;

- Modelling of renewable energy resources using remote sensing;
- Enhancement of remote sensing for LCLUC, agriculture, water knowledge and risk assessment through use of advanced tools: hyperspectral, hyperspatial, advanced multispectral, radar, Lidar, thermal, and a combination of these satellites and sensors;
- Collaborate with GEO, GEOSS, CEOS, GEOGLAM, and other International and National forums.

#### WG VIII/9 - Coastal and Ocean Applications

##### Chair

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#### WG VIII/9 - Terms of Reference:

- Measure, characterize, understand, and predict, the storage and transport of momentum, heat, water (salinity), and greenhouse gases in the ocean and the surface signatures (temperature, salinity, dynamic topography) of the ocean's response to surface forcing (wind stress, fresh water, turbulent and radiative heat flux) from diurnal to decadal time scales, and from coastal to open oceans.
  - Understand the ocean's role in the changes and interaction amongst the biological, chemical, and energy/water cycles in the oceans and their influence on terrestrial and cryospheric changes.
  - Work towards an understanding of uncertainty in terms of the satellite data, ancillary data used in the processing and in-situ data used for validation.
  - Aid in the coordination of present and future space missions related to ocean observations, and the calibration, validation, and dissemination of the resulting data.
- Collaborate with international activities such as GEO, GHRST, IOCCG etc and take part where appropriate.