

## Preface: Technical Commission I (Sensor Systems)

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Sensor systems constitute the foundation of geospatial data acquisition and are undergoing a profound transformation driven by advances in sensing technologies, intelligent algorithms, and computing infrastructures. Modern sensor systems are becoming increasingly integrated, autonomous, and intelligent, enabling the acquisition of high-quality geospatial information across spaceborne, airborne, mobile, and terrestrial platforms. The fusion of multi-sensor technologies, artificial intelligence, and digital infrastructures is creating new opportunities for photogrammetry, remote sensing, mapping, and spatial information services.

ISPRS Technical Commission I serves as an international platform for the advancement of sensor systems and their applications in geospatial sciences. The commission promotes research on the design, calibration, modelling, integration, and validation of imaging and non-imaging sensors, including optical, hyperspectral, thermal, LiDAR, SAR, and emerging sensing technologies. It also fosters innovation in multi-sensor systems, positioning and navigation technologies, intelligent perception, and geospatial information production.

This volume of the ISPRS Annals presents peer-reviewed papers accepted in the ISPRS Congress related to TC I following a rigorous double-blind review process. The contributions reflect recent progress across the full spectrum of sensor system research and demonstrate how advances in sensing technologies are driving innovation in geospatial data acquisition, processing, and analysis. A prominent theme throughout the volume is the continued advancement of active sensing technologies. Several studies investigate new methodologies and applications of SAR and InSAR systems for deformation measurement, geohazard monitoring, and terrain modelling, highlighting the growing operational value of next-generation radar missions. Significant contributions also address LiDAR technologies, including point cloud processing, reflectance modelling, bathymetric mapping, environmental monitoring, and autonomous navigation, demonstrating the expanding role of laser sensing in both natural and built environments.

Another major focus is the integration of heterogeneous sensors and positioning technologies. Research on LiDAR-camera calibration, image-to-LiDAR correspondence extraction, visual-inertial navigation, GNSS-assisted positioning, and urban localization illustrates the increasing importance of multi-sensor fusion for achieving robust and accurate geospatial perception in complex environments. These developments are closely linked to emerging applications in intelligent systems, robotics, and autonomous operations.

The volume also highlights the growing impact of artificial intelligence on sensor systems. Contributions explore AI-assisted geometric correction, semantic scene understanding, foundation-model-driven mapping, and advanced 3D reconstruction techniques such as Neural Radiance Fields and Gaussian Splatting. These studies demonstrate how data-driven approaches are enhancing the capability of modern sensing systems to extract meaningful information from increasingly large and complex datasets.

Beyond methodological advances, several papers showcase innovative applications spanning environmental monitoring, forestry, coastal observation, cultural heritage documentation, agriculture, and spatiotemporal analysis. Collectively, the contributions illustrate the ongoing convergence of advanced sensing technologies, intelligent data processing, and application-oriented geospatial solutions.

We would like to express their sincere gratitude to all authors for their valuable contributions, and to the reviewers and members of the Scientific Committee for their dedication and professional comments. We also thank the ISPRS Congress organizers and local hosts for their hard work. We hope that this volume will provide a valuable reference for researchers worldwide and contribute to continued innovation and collaboration in the field of sensor systems.