60. Satellite Photogrammetry for Multitemporal Monitoring in Alpine Environments: Ground Control Network Design, Implementation, and Accuracy Assessment

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Alpine valleys are particularly sensitive to climate change, which intensifies glacier retreat, slope instability and hydrogeological hazards, threatening ecosystems, water resources, communities and infrastructure. Their continuous monitoring is essential for environmental management and risk assessment. Very-high-resolution satellite photogrammetry can support this task by providing spatially continuous observations over extensive and hardly accessible mountain areas. Within the MOHYCAM project (Modified HYdrogeological hazards under complex ClimAte and environmental conditions: Monitoring activities and mitigation strategies), an in-track Pléiades Neo stereo pair acquired in July 2026 was used to investigate the upper Anzasca Valley, including Macugnaga and the Belvedere Glacier. The panchromatic images have a nominal Ground Sampling Distance (GSD) of 0.30 m and cover approximately 100 km². A field campaign provided accurately surveyed natural and artificial ground-reference points with homogeneous planimetric and altimetric coverage. The study assessed how the number of Ground Control Points (GCPs) affected Rational Polynomial Coefficient (RPC)-based image orientation in two off-the-shelf softwares, namely CATALYST Professional and Agisoft Metashape. The influence of the numerosity of GCPs on the orientation accuracy was assessed against a fixed subset of independent Check Points (CPs). Both workflows showed that most of the improvement was achieved with the first few GCPs, with planimetric accuracy approaching a plateau at three well-distributed points. Once stabilized, both software packages achieved CP errors below twice the nominal GSD. The results demonstrate the potential of Pléiades Neo photogrammetry for accurate 3D geometric monitoring in complex alpine environments and highlight the importance of GCP distribution and software-specific RPC refinement strategies.