

## **Photogrammetric velocity measurements on Unteraargletscher by grey scale correlation**

Spichtig, S., Bauder, A. and Eller, J.

Versuchsanstalt für Wasserbau, Hydrologie und Glaziologie (VAW), ETH Zürich, Switzerland

Dynamics of glaciers are closely related to flow conditions. Observed flow motion at the surface of a glacier is composed of ice deformation and basal motion, known to be variable at different time scales. However, hardly no observations of long-term variations of surface velocity do exist. Aerial photogrammetry is a well established tool not only for mapping of surface geometry but also for surface displacement in a dense and high spatial resolution.

Digital image processing by methods of grey scale correlation (Dost et al. 2002) has been successfully used for displacement analysis. A commercial code of grey scale correlation (VEDDAC) has been applied to determine the horizontal components of surface displacement from repeated orthophotos. A procedure was implemented and tested in areas of various coherence through comparison with results from analytic photogrammetric methods (Flotron 1924-1998, Bauder 2001).

Surface velocity fields were evaluated for three one-year time periods 1970-71, 1982-1983 and 1997-98, respectively. The spatial distribution as well as temporal variations were analysed. The measurements clearly reflect ongoing retreat of the Unteraargletscher over the last 30 years. The implemented strategy has been assessed in terms of quality of the obtained results and differences to the analytic methods.

### REFERENCES

- Bauder, A. (2001): Bestimmungen der Massenbilanz von Gletschern mit Fernerkundungsmethoden und Fliessmodellierungen – Eine Sensitivitätsstudie auf dem Unteraargletscher. Mitteilungen der Versuchsanstalt für Wasserbau, Hydrologie und Glaziologie ETH Zürich Nr. 169.
- Dost, M., Kieselstein, E. & Erb, R. (2002): Displacement Analysis by Means of Grey Scale Correlation at Digitised Images and Image Sequence Evaluation for Micro- and Nanoscale Applications. Micromaterials and Nanomaterials vol. 1: 30-35.
- Flotron (1924-1998): Vermessung der Aaregletscher. Jährliche Berichte im Auftrag der Kraftwerke Oberhasli (unveröffentlicht).