TITLE: The investigation of active Martian dune fields using very high resolution photogrammetric measurements

ABSTRACT BODY:
Abstract (2,250 Maximum Characters): At the present time, arguments continue regarding the migration speeds of Martian dune fields and their correlation with atmospheric circulation. However, precisely measuring the spatial translation of Martian dunes has succeeded only a very few times—for example, in the Nili Patera study (Bridges et al. 2012) using change-detection algorithms and orbital imagery. Therefore, in this study, we developed a generic procedure to precisely measure the migration of dune fields with recently introduced 25-cm resolution orbital imagery specifically using a high-accuracy photogrammetric processor. The processor was designed to trace estimated dune migration, albeit slight, over the Martian surface by 1) the introduction of very high resolution ortho images and stereo analysis based on hierarchical geodetic control for better initial point settings; 2) positioning error removal throughout the sensor model refinement with a non-rigorous bundle block adjustment, which makes possible the co-alignment of all images in a time series; and 3) improved sub-pixel co-registration algorithms using optical flow with a refinement stage conducted on a pyramidal grid processor and a blunder classifier. Moreover, volumetric changes of Martian dunes were additionally traced by means of stereo analysis and photoclinometry.
The established algorithms have been tested using high-resolution HIRISE time-series images over several Martian dune fields. Dune migrations were iteratively processed both spatially and volumetrically, and the results were integrated to be compared to the Martian climate model. Migrations over well-known crater dune fields appeared to be almost static for the considerable temporal periods and were weakly correlated with wind directions estimated by the Mars Climate Database (Millour et al. 2015). As a result, a number of measurements over dune fields in the Mars Global Dune Database (Hayward et al. 2014) covering polar areas and mid-latitude will be demonstrated.

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