Geophysical Research Abstracts
Vol. 13, EGU2011-5750, 2011
EGU General Assembly 2011


# Detection, mapping, classification, and statistics of mass movements on Mars

Maria Teresa Brunetti (1), Goro Komatsu (2), Paolo Mancinelli (3), Kazuhisa Goto (4), Michele Santangelo (1,3), Hitoshi Saito (5), Federica Fiorucci (1,3), Mauro Cardinali (1), and Fausto Guzzetti (1)

(1) CNR, IRPI, Perugia, Italy (mariateresa.brunetti@irpi.cnr.it), (2) IRSPS, Università G. d'Annunzio, Pescara, Italy, (3) Università degli Studi di Perugia, Perugia, Italy, (4) Planetary Exploration Research Center, Chiba Institute of Technology, Chiba, Japan, (5) Tokyo Metropolitan University, Tokyo, Japan

On Earth, detection and mapping of landslides is obtained mainly through the visual analysis of stereoscopic aerial photographs obtained at scales ranging from 1:5,000 to 1:75,000. Alternatively, very-high-resolution monoscopic images taken by optical sensors onboard satellite platforms can be used. The space-borne sensors have typically a spatial resolution of 1 meter or less for panchromatic mode, and of 5 meters or less for multispectral mode, allowing for visual detection and mapping of the majority of slope failures on Earth. Adopting a similar approach, and using the same visual interpretation criteria used by geomorphologists to map terrestrial landslides, we have attempted to detect, map, and classify landslides on Mars using monoscopic high and ultra-high-resolution imagery obtained by (i) the High-Resolution Stereo Camera (HRSC) onboard Mars Express and (ii) the HiRISE camera onboard Mars Reconnaissance Orbiter. These images have spatial resolutions (up to $\sim$ 30 cm for HiRISE and up to $\sim$2 m for HRSC). These are sufficient to detect and map mass movements on Mars with unprecedented spatial details, allowing for compilation of nearly complete inventories, above a minimum size threshold. In our preliminary work, using a THEMIS image mosaic with HRSC and HiRISE images where available and MOLA-derived topography, we detected and mapped 180 landslides (including escarpments, source areas, and deposits) in a $4\times10^4$ km$^2$ area of the western section of the Valles Marineris rift system. Along the slopes of this very prominent canyon with a local relief exceeding 7 km, we visually identified a significantly larger number of slope failures than previously reported (Quantin et al., 2004), with areas of the individual failures $1.3\times10^5 < A_L < 2.6\times10^9$m$^2$. The obtained inventory is considered nearly complete for landslides with $A_L > 1.5\times10^6$ m$^2$. A further reconnaissance of the planetary surface through visual analysis of the same mosaic of THEMIS images, and locally HRSC and HiRISE images where available, allowed to detect and map several mass movements at other locations, including: (i) scarps in Bahram and Nilokeras, (ii) along steep slopes of some craters (e.g. Zunil crater), (iii) at the toe of Olympus Mons, and (iv) near the planet's north pole cap. Adopting a classification commonly used to classify terrestrial mass movements, all the slope failures detected and mapped on Mars were classified in six main types, including: slide, slide/flow, flow, debris flow, lateral spread, and rock avalanche. Features similar to rock glaciers were also recognized and mapped locally. For the Valles Marineris study area, for which a sufficiently large inventory of mass movements was obtained, we determined the statistics of landslide size, and we compared them to similar statistics available for terrestrial landslides.

References

Quantin, C., Allemand, P., Delacourt, C.: Morphology and geometry of Valles Marineris landslides. Planetary and Space Science 52, 1011–1022, 2004.