Geophysical Research Abstracts
Vol. 17, EGU2015-4983, 2015
EGU General Assembly 2015

The Mars Express High Resolution Stereo Camera (HRSC): Mapping Mars and Implications for Geological Processes

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After 10 years of ESA's Mars Express orbiting the planet its High Resolution Stereo Camera (HRSC) covered about 90 % of the surface in stereo and color with resolutions up to 10 m/pixel. Digital elevation models of up to 50 m grid spacing [1], generated from all suitable datasets of the stereo coverage, currently cover about 40 % of the surface [2]. The geomorphological analysis of surface features, observed by the HRSC indicate major surface modifications by endogenic and exogenic processes on all scales. Endogenic landforms (e.g., tectonic rifts, small basaltic shield volcanoes) were found to be very similar to their equivalents on Earth, suggesting that no unique processes are required to explain their formation. Volcanism may have been active up to the very recent past or even to the present, putting important constraints on thermal evolution models [e.g., 3]. The analysis of diverse landforms produced by aqueous processes revealed that surface water activity was likely episodic, but ranged in age from very ancient to very recent [e.g., 3]. Particularly important is prominent glaciation and periglacial features at several latitudes, including mountain glaciers [e.g., 3]. The identification of aqueous alteration minerals and their geological context has enabled a better understanding of paleoenvironmental conditions and pedogenetic processes [e.g., 4]. Dark dunes contain volcanic material and are evidence for the significantly dynamic surface environment, characterized by widespread erosion, transport, and redeposition [e.g., 3, 5]. Since basically all geologic interpretations of extraterrestrial features require profound knowledge of the Earth as key reference, studies of terrestrial analogues are mandatory in planetary geology. Field work in Antarctica, Svalbard and Iceland [e.g., 6] provided a basis for the analysis of periglacial and volcanic processes, respectively.

References: [1] Jaumann et al., 2007, PSS 55, 928-952; [2] Gwinner et al., 2010, EPSL 294, 506-519; [3] Jaumann et al., 2015, PSS, in press, [4] Jaumann et al., 2014, PSS 98, 128-145; [5] Tirsch et al., 2011, JGR 116, doi: 10.1029/2009je003562; [6] Hauber et al., 2011, Geol. Soc. Am. 483, 111-131