**Introduction**: Gullies show morphologic features that indicate the presence of a flowing liquid in the forming process [1]. However, the current climate in the northern hemisphere does not allow the existence of liquid water over long periods of time. Therefore, the exploration of gullies is a valuable key in order to understand the youngest climatic history of Mars. We evaluated HRSC and MOC data covering the northern hemisphere to analyze distribution and orientation of gullied slopes. MOC data additionally allowed a morphologic age classification of gullies.

**HRSC data**: Images of the High Resolution Stereo Camera (HRSC) with a resolution of up to 10 m/pixel [2] cover wide parts of the northern hemisphere. For this reason it is possible to measure the orientation of identified gullies representatively. In 50 of 230 evaluated HRSC images north of 30°N (orbits 32-1644) we identified approximately 2300 gullies (Fig. 1). High densities of occurrences are found between 35°N and 60°N. The preferred flow direction of all analysed gullies is southeast. However, the analysis of gullies on crater walls is more representative, because impact craters are at first order circular features. They have a point symmetry and there is a uniform azimuthally distribution of slopes, which is ideal when investigating the influence of insolation on the distribution and development of landforms. Approximately 1500 of all identified gullies are situated on crater walls and their orientation changes with respect to latitude (Fig. 3). Between 30°N and 40°N gullies occur at poleward facing slopes and between 40°N and 60°N at all slope directions.

**MOC data**: Images of the Mars Orbiter Camera (MOC) cover small areas of the northern hemisphere, but with a much higher resolution when compared to HRSC data (up to 1.4 m/pixel [3]). MOC-NA images taken during sub-phases AB – S04 covering the northern hemisphere were evaluated. In approximately 320 of ~35,000 MOC images (0°N - 90°N) ~3200 gullies were detected (Fig. 2). High densities of occurrences of gullies are found between 30°N and 55°N. Just like HRSC evaluation it is more representative to analyse only the orientation of gullies located on impact crater walls. ~2600 of all identified gullies on MOC images are positioned on crater walls. Similar to HRSC results, orientation of gullies changes with latitude (Fig. 3). Between 30°N and 40°N most of the gullies are situated on poleward facing slopes. North of 40°N the gullies occur usually on slopes facing towards the equator.

**Analysis of orientation data**: For a better interpretation of gully orientation, results of HRSC and MOC surveys were merged. That way a higher number of gullies for the statistical analysis of orientation is obtained and the influences of different illumination conditions and resolutions of the two camera instruments were minimized. Orientation of all detected gullies changes with latitude. Between 30°N and 40°N most of the gullies occur on poleward facing slopes. North of 40°N the gullies occur usually on slopes facing towards the equator (Fig. 3).

**Age classification**: The higher resolution of MOC images allows a relative age classification based on the morphology of gullies. Differences in orientation and distribution could indicate different climatic forming conditions. We classified the gullies into pristine, degraded and cratered gullies [4]. Pristine gullies show sharp edges and are not covered by dust. They overlay small dunes or young features like polygonal patterns. Degraded gullies are affected by erosion or sedimentation. For instance, they can be covered or filled by dust. Gully aprons can also be eroded partially. Another indicator for this class are cracks, which cut the channels or aprons. Cratered gullies exhibit impact craters on alcoves, channels or aprons. Superimposed craters indicate that these gullies are older than pristine gullies. Additionally, cratered gullies show similar erosion and sedimentation features like degraded gullies. It is possible, that potential impact craters are covered or wiped out by erosion. Therefore, it is possible that degraded and cratered gullies belong to the same class. Approximately 2700 of ~3200 individual gullies were classified. ~2200 of them are positioned at impact crater walls. In contrast to the southern hemisphere [4], there is no difference between the latitudinal orientations of younger and older gullies, which may indicate equal or similar climatic conditions for their formation.

Figure 1: Distribution of gullies found in HRSC survey in the northern hemisphere.

Figure 2: Distribution of gullies found in MOC survey in the northern hemisphere.

Figure 3: Orientation of craterwall gullies from HRSC and MOC surveys: (A) Orientation of all craterwall gullies in the northern hemisphere. (B) Orientation of all craterwall gullies sorted by latitude. (C) Orientation of craterwall gullies from HRSC survey sorted by latitude. (D) Orientation of craterwall gullies from MOC survey sorted by latitude. In B, C and D only data between 30°- 60°N is displayed because of the low number of craterwall gullies outside this band.