Table 1
The orientation of ice-related flow features as a function of latitude. In each hemisphere, flow direction is dominantly pole-facing equatorward of 45°. Poleward of 45°, flow is observed on more equator-facing slopes, yielding more "concentric" flow.

Latitude band	Ice-related flow features mapped	Pole-facing (%)
45–50N	54	57.4
40–45N	178	68.5
35–40N	207	76.3
30–35N	138	89.1
25–30N	31	87.1
25–30S	52	88.4
30–35S	122	89.3
35–40S	338	87.9
40–45S	289	83.7
45–50S	106	58.5

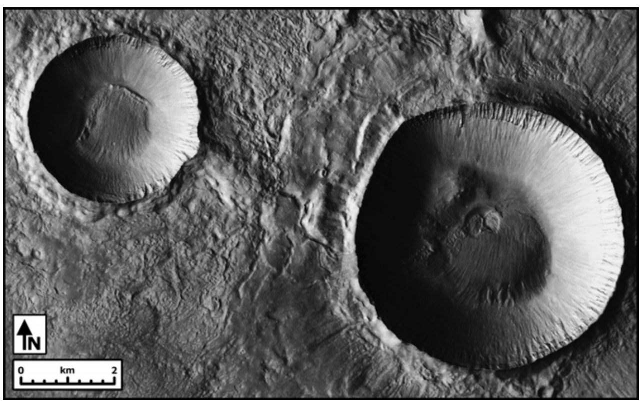

Fig. 5. Neighboring craters in the northern mid-latitudes (34.8°N) showing identical flows, each flowing from south to north (towards the pole) (subframe of CTX orbit P17_007619_2153).

that show evidence for ice-related flow (e.g., LVF, LDA or CCF). Flow in the latitude range examined is typically confined to latitudes poleward of 30° in each hemisphere, with exceptions in northern Hellas and in Arabia Terra. Ice-related flow features may have formed poleward of 55°, but these surfaces are obscured by a late Amazonian mantling unit that is interpreted as ice-rich itself (Kreslavsky and Head, 2000; Mustard et al., 2001; Head et al., 2003). Ice-related flow in the northern hemisphere is concentrated in regions of steep topography (Deuteronilus Mensae, Protonilus Mensae, Acheron Fossae, Phlegra Montes, Kasei Vallis, etc.; Fig. 3a). Steep walls provide rockfall and hence a debris source to protect ice, in addition to shaded slopes that provide microclimates conducive to the preservation of ice. In the southern hemisphere, where steep slopes are far more abundant (Kreslavsky and Head, 2000), ice-related features are observed at nearly all locations between 30° and 50°S.

The distribution of ice-related flow features confined to the interior of impact craters (Fig. 3b) is very similar to the distribution of all ice-related flow features in the mid-latitudes of Mars (Fig. 3a). More individual flow features were mapped in the southern hemisphere (910) compared to the northern hemisphere (690), and the majority are found between 30° and 45° latitude (north = 75.8%; south = 82.3%). Within the 30–45° latitude band, there is a dominant pole-facing slope trend that is observed in each hemisphere (Figs. 1c, d, 2a, b, and 4). Of ice-related flow features between 30° and 45°N, 77.1% are oriented towards the pole, as are 86.5% of ice-related flow features between 30° and 45°S (Table 1). Frequently, neighboring craters of similar size show identical orientations of flow (Fig. 5). The few flow features observed equatorward of 30° in each hemisphere also show this preference.

In both hemispheres, this preference for pole-facing slopes recedes at higher latitudes. Poleward of 45°, more equator-facing flow features are found (Figs. 1a, b, 2c, d, and 4), such that in each hemisphere between 45° and 60°, there is a near split in orientation preference (58.5% pole-facing in the southern hemisphere, 57.4% pole-facing in the northern hemisphere). Hence, use of the term "concentric" should also be modified to reflect this latitude-dependence for symmetry: true "concentric" flow within craters is not observed equatorward of ~45°. This transition from pole-facing to concentric flow appears to occur at a slightly lower latitude in the northern hemisphere than in the south: in the 40–45°N lat-

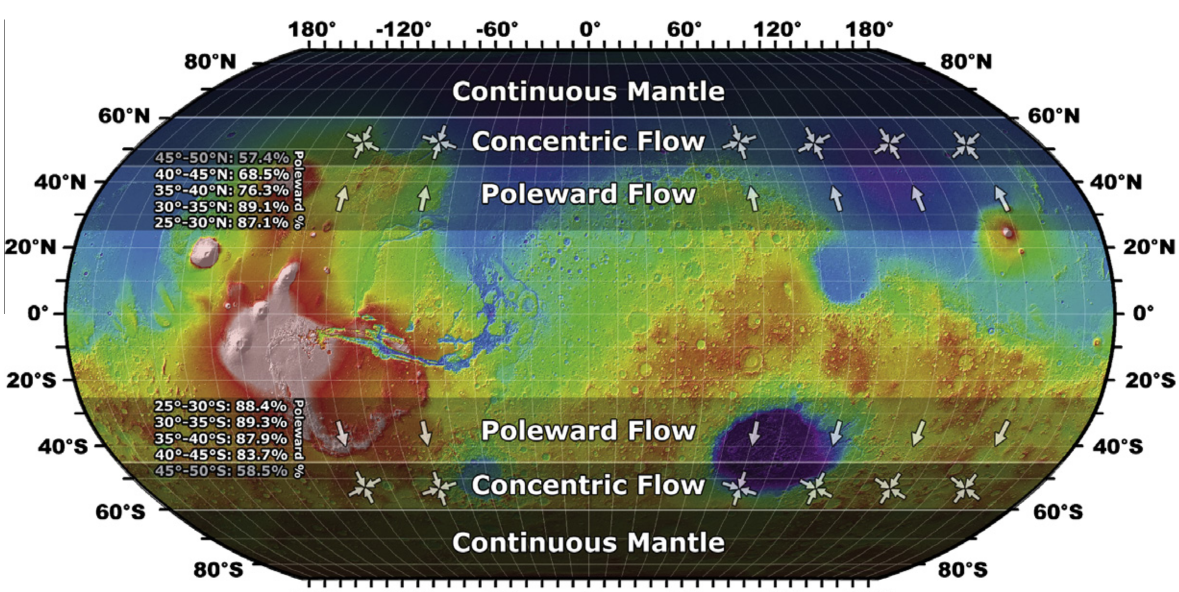

Fig. 6. The distribution of flow orientations as a function of latitude on Mars. In the lower mid-latitudes of each hemisphere (<45°), flow is dominantly pole-facing, suggesting that ice accumulates and/or is better preserved on steep, cold pole-facing slopes. In the higher mid-latitudes (45–60°), conditions are cold enough to allow for flow emanating from all orientations, providing concentric flow of ice within impact craters. In the polar regions (>60°) a young ice-rich mantle (Mustard et al., 2001) blankets the terrain and inhibits measurements of orientation.