Conclusions

While the results of this study do agree with models proposed to explain the smoothness of the Vastitas Borealis terrain on Mars, they do not seem to agree with a stochastic diffusion-type model of landscape development as proposed by Pelletier and Turcotte (1999). In fact, all Martian terrains studied here show different ranges of power-law behavior in frequency space.

The source mechanism that produces the roughness observed at large scales is not known for the polar caps of Mars. However, one might argue that non-Newtonian ductile flow acting on an initially self-affine landscape would preferentially smooth longer wavelength features with power-law intensity and thus offer an explanation for the observed spectral break in slope. Newtonian flow smoothing of topography is not consistent with observed results because it produces an exponential (not power-law) drop-off in frequency content at the low frequencies which correspond to long wavelength fluctuations in topography of the ice cap. Likewise, diffusive surficial smoothing of short wavelength topography would also explain the break in slope provided that its intensity were power-law in frequency.