Chapter 5

FUTURE WORK

There is more work is planned for these projects. Some of the proposed future work fell out of the questions and problems that arise while first attempting to solve a problem. Some of it was originally intended to be encompassed in the thesis work, but work at an earlier stage grew to dominate the project as a result of the sheer volume of data available.

Many questions were left unanswered in the work described in Chapter 4. It is not clear why the MM5 does not predict the secondary winds that clearly must exist in the current wind regime. These winds do not appear in GFDL GCM model runs, and they may not exist in any current atmospheric model. It is possible that they are produced by rare storms (*i.e.,* storms that occur once a decade or century), and I would like to look into the possibility of observing or predicting these storms.

The MM5 also does not predict winds strong enough to lift basaltic grains into saltation. This may simply be a problem of model resolution, and it is not a difficult prospect to run the model at a higher resolution and/or to output the strongest hourly winds at each grid point rather than the winds at the top of each hour. There is also the problem that the MM5 is meant to hold subgrids that are no more than three times smaller than their parent grids – and yet our model runs at a scale of 10 km were more than an order of magnitude higher resolution than the parent grid. It is unlikely that this large resolution step caused serious error in model output. However, for the sake of thoroughness, it would be wise to nest grids with proper resolution steps in order to be certain that winds are modeled correctly.

One planned extension of Chapters 3 and 4 involves looking beyond just Proctor Crater to the surrounding region. This part of the research was funded by the MDAP, so it must be completed in any case. The study of Proctor Crater alone proved to be so interesting and fruitful that I never had a chance to look far beyond Proctor Crater, although I did spend a good amount of time preparing topographic maps and processing images for this task. A quick glance at these images reveals that the dunes in nearby craters (Kaiser, Rabe, etc.) are of similar size, composition, and complexity as those in Proctor Crater. The orientations of these dune slipfaces are similar to those of Proctor Crater, although the relative strengths of these winds (*i.e.,* their prevalence in the dunefield) vary from crater to crater. A regional study will reveal spatial trends in dune morphology, wind circulation patterns, sand sediment volumes, and possibly sand source locations. This work will benefit from the detailed study of Proctor Crater, which may be regarded as a single precise and well-defined reference for the many points of interest in a regional study.

Finally, mesoscale models are rarely put to use for the study of terrestrial dunefields. Even the models focusing on dust lifting are done so ultimately to better constrain the radiative effects of atmospheric dust, not for estimates of surface erosion or deposition. I would like to apply the terrestrial MM5 to the area over a few well-studied dunefields to determine how realistic the modeled stress and wind orientations are. First it should be applied over a simple barchan field, where deviations from the expected results may be more easily understood. Then it may be applied over a dunefield with atmospheric conditions similar to the convergent wind regime of the Proctor Crater dunes. A prime and well-studied example is the Kelso Dunefield in California, which are reversing transverse dunes like those of Proctor Crater, and situated in a valley that experiences two or three opposing winds. Projects such as these will clear up a number of gaps in our understanding of how atmospheric models translate to another planet, and how our interpretations vary from one case to another.

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