CORBIN KLING – NORTH CAROLINA STATE UNIVERSITY RALEIGH

STATEMENT OF PURPOSE:

This presentation illustrates how having multiple scales of topographic data from the global to the field scale can be utilized for research within the geosciences, and specifically, the planetary sciences. It also highlights how the use of unmanned aerial systems (drones) can be used to enhance topographic studies on Earth by combination of drone, lidar and NASA satellite data. Many of the features we see on Mars and other rocky bodies (e.g. faults, craters, pit craters) are all very large which makes the planetary scale topographic data appropriate in most cases, which allows for study of regional processes. In some cases where finer resolution is needed, HiRISE data for Mars is available which can provide sub meter resolution for digital terrain models. This fine scale data in conjunction with some of the large scale global or regional topographic data sets allows for in depth study of those features on Mars, but what about analog structures we find on earth? On Earth, we see many of the same features, but they are smaller due to erosion, or other processes dimming their topographic signals. The best global Earth topography data is often ~ 10 meters in resolution, so better than global data for Mars, but still quite coarse for the smaller scale of the features we use for Mars comparison. Drones make it easier to investigate these similar features with great resolution and relatively minimal cost compared to manned aircraft alternatives or in conjunction with manned aircraft data. This presentation will illustrate a couple of ways that I use 3D data to investigate structural geology problems and track changes in aeolian environments that we regularly acquire data for with drones. The presentation starts with a look at locations on earth in which we study lavas, pit craters, and sand dunes, illustrating large scale global terrain as well as the fine scale terrain with the help of lidar and drone topographic datasets. Because the drone data have high resolution, even field scale visualizations (think VR) can be displayed. This unprecedented resolution allows for immerse fly throughs and visualizations of these sites. These sites include Craters of the Moon National Monument and Preserve in Idaho, Jockey's Ridge state park in North Carolina, the Simpson Desert in Australia, Hawaii, and Iceland. The presentation then looks at the same three features but in 3D visualizations of Mars, where most of my work is focused. Mars topography can be illustrated globally, regionally, and in centimeter scale also (thanks to HiRise images). This part of the presentation will present the same three types of features, pit craters, dunes, and lavas across Mars, but mostly focuses on Noctis Labyrinthus, one of the study sites for my Ph.D. created from an amalgamation of pit craters and normal faulting that is very enigmatic and topographically astonishing. The presentation will illustrate how comparative planetology is enhanced by having multiple scales of topographic data available for both Earth and Mars, including high resolution drone data from multiple planetary analogs on Earth.

DESCRIPTION OF DATA SETS:

The data sets used in this presentation are a combination of NASA satellite data sets in conjunction with manned airborne lidar data and unmanned airborne topographic and video datasets. The NASA data being used for visualization are: High Resolution Imaging Science Experiment (HiRise) imagery and digital terrain models (DTMs), Mars Orbiter Laser Altimeter (MOLA) global Mars topography data, 3) Context camera (CTX) imagery for Mars, High Resolution Stereo Camera data for Mars (HRSC), Shuttle Radar Topography (SRTM) data for Earth, and various satellite imagery sensors for Earth. Lidar data acquired through opentopography.com are used to supplement Earth based study locations in addition to unmanned aerial systems (UAS, or drones). All drone data were collected with research permits via state or federal agencies (and can be provided if needed). Handheld photography and 3D models made from those images are used for study sites within the Hawaii Volcanoes National Park to supplement lidar for the area.