

RIPPLE MIGRATION AT GRAND FALLS DUNE FIELD, NORTHERN AZ. A. L. Gullikson¹, T. N. Titus¹, K. E. Williams¹, G. Cushing¹ ¹USGS Astrogeology Science Center (2255 N. Gemini Dr., Flagstaff, AZ 86001, agullikson@usgs.gov).

Introduction: Grand Falls dune field (GFDF) is located on the Navajo Nation, ~70 km NE of Flagstaff, AZ. This active dune field displays a range of morphologies, including barchans, smaller dunes, and ripples, and is bimodal in composition. The felsic component is likely derived from the Little Colorado River, and the mafic component (basaltic grains) is locally sourced from nearby cinder cones [1].

GFDF is an excellent analog site for both active dunes on Mars and other planetary bodies that have dune-like features (e.g., Venus and Titan). By studying this active bimodal dune field, we will be able to record, and place better constraints on, atmosphere-surface interactions. Results will be used to help in correlating wind velocity and ripple migration characteristics.

Methods: We have set up a meteorological station within the dune field that records temperature, barometric pressure, relative humidity, wind direction, wind speed, solar radiation, and precipitation. Data are collected every 15 minutes. We have also set up cameras near an active ripple field (Figs. 1-3) that take images every 15 minutes to monitor its movement.

Preliminary results: A wind event occurred on 12/28/2020 from 1:00 pm till 4:45 pm. During this time interval, wind speeds (2 m above ground level) ranged from 2 to 9.5 m/s, with gusts up to 14 m/s. At the onset of the wind event, wind was from the NE and transitioned over time to predominantly coming from the SW. At the end of the event, wind shifted to blowing from the NW. Figures 1-3 are images taken during this wind event. Large ripples in the foreground of the figures migrated ~8.6 cm to the NW (dashed colored lines), and smaller ripples in the troughs were seen to both form and dissipate (solid colored lines).

Continued work: Data will continue to be collected over the next year, at 15 minute intervals. We plan to characterize ripple migration and quantify their movement with respect to atmospheric conditions, with the goal in mind to place better constraints on surface-atmospheric interactions at an active dune site.

Acknowledgments: Fieldwork on the Navajo Nation was conducted under a permit from the Navajo Nation Minerals Department. Any persons wishing to conduct geologic investigations on the Navajo Nation must apply for and receive a permit from the Navajo Nation Minerals Department, P.O. Box 1910, Window Rock, Arizona 86515, telephone # (928) 871-6587.



Figure 1. Image taken on 12/28/2020 at 1:27 pm. Rose diagram represents wind direction measurements taken at 1:00 and 1:15 pm. Blue dashed lines trace the crests of two ripples. Solid blue lines trace the crest of smaller ripples located in the troughs. Crest-to-crest distance of large ripples in the foreground is ~86 cm.

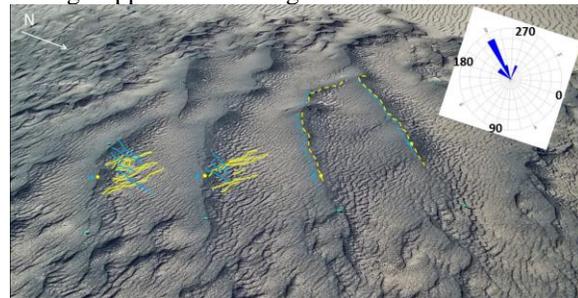


Figure 2. Image taken on 12/28/2020 at 3:07 pm. Rose diagram represents data acquired every 15 minutes, from 1:30 to 3:00 pm. Yellow dashed lines trace the new location of the crests, solid yellow lines trace the smaller trough ripples. Blue lines from Figure 1 are overlain to show the ripple migration.

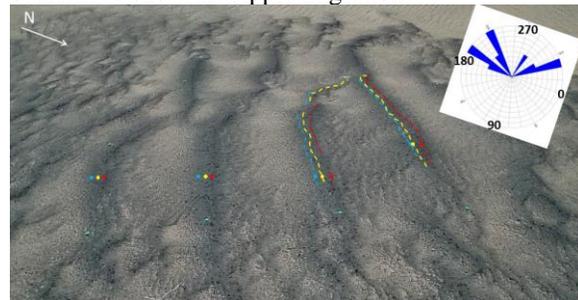


Figure 3. Image taken on 12/28/2020 at 5:37 pm. Rose diagram represents data acquired from 3:15 to 5:30 pm. Red dashed lines trace the new location of the crest; blue and yellow lines are the two previous crest locations. Smaller trough ripples no longer have defined crests, therefore are not traced. Colored points also are placed along ripple crests.

References: [1] Hayward, R. K. et al. (2010) *2nd Int. Plan. Dunes Wrkshp.*, Abstract #2004.