USING GROUND BASED TERRESTRIAL LASER SCANNING TO MODEL ANTECEDENT TOPOGRAPHY

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OUTLINE

- THE LARGER PROJECT: Structural controls on antecedent topography and geomorphic container at The Coral Pink Sand Dunes

- THE METHODS: Terrestrial Laser Scanning (TLS) in the field and in the lab

- THE RESULTS: DEMs and the model for antecedent topography at the Coral Pink Sand Dunes
EXPLANATION

CPSDSP = Coral Pink Sand Dunes State Park

- Normal fault, bar & ball on down-thrown side
- G - Gunlock fault
- P - Paragonah fault
- T - Toroweap, W - Washington
- H - Hurricane fault
- GW - Grand Wash fault
- Pa - Paunsaugunt fault
- RR - Reef Reservoir fault

- State lines
- Province boundaries

Ford et al. 2010
STUDY AREA
CORAL PINK SAND DUNES, UTAH

Upper Dune Field
Sevier Normal Fault
Lower Dune Field
CORAL PINK SAND DUNES

HYPOTHESIS

TILTED BLOCK

FAULT SPLAY/GRABEN
DUNE FIELD ANTECEDENT TOPOGRAPHY
PREVIOUS STUDIES

Ewing and Kocurek, 2008
Yang, et al. 2011
1. Use Terrestrial Laser Scanning (TLS) to create high resolution DEM and ArcGIS to model geomorphic container and antecedent topography.

2. Use Ground Penetrating Radar (GPR) to image dune-bedrock interface and identify structural controls.

3. Determine relationships between antecedent topography, geomorphic container, and dune patterning.
METHODS

1. Use Terrestrial Laser Scanning (TLS) to create high resolution DEM and ArcGIS to model geomorphic container and antecedent topography

2. Use Ground Penetrating Radar (GPR) to image dune-bedrock interface and identify structural controls

3. Determine relationships between antecedent topography, geomorphic container, and dune patterning
TERRESTRIAL LASER SCANNER
IN THE FIELD

Transmitter/Receiver

RTK GPS

1,400 m range

RIEGL VZ-1000
TERRESTRIAL LASER SCANNER
IN THE FIELD
TERRESTRIAL LASER SCANNER
IN THE FIELD
TERRESTRIAL LASER SCANNER
SCAN POSITIONS
TERRESTRIAL LASER SCANNER
IN THE LAB
RiSCAN Pro

- Deviation Filter – removes least accurate returns
- 1 cm Octree Filter – removes redundant points
- Total Points: 259,464,196
Boise Center Aerospace Lab LiDAR Tools

- ENVI Image Processing Software
- Height Filter to remove vegetation
- Rasterize at 5 m, 1 m, 50 cm
RESULTS
BARE EARTH DIGITAL ELEVATION MODELS

1-m resolution DEM

5-m resolution DEM
ArcGIS Focal Statistics Analysis

- Wedge-shaped window
- Radius = 150 pixels = 150 m
- MINIMUM

FINDING THE TREND OF ANTECEDENT TOPOGRAPHY
NEXT STEP
GROUND PENETRATING RADAR

Star Dune
The Coral Pink Sand Dunes may be contained in a graben and this structural control may contribute to dune patterning.

TLS is capable of producing high-resolution DEMs for small scale dune fields.

GPR is looking promising for locating structural controls.

For more GPR fun see my poster at AGU!
THANK YOU!

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QUESTIONS?