

Camera lens distortions

f = focal length

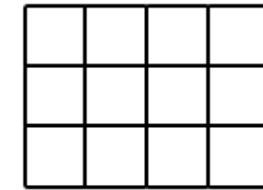
c_x = principal point x coordinate

c_y = principal point y coordinate

$k_n = n^{\text{th}}$ radial distortion coefficient

$p_n = n^{\text{th}}$ tangential distortion coefficient

skew coefficient between the x and the y axis.

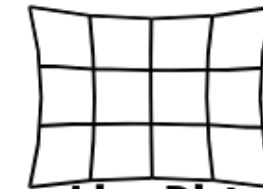


No Distortion



$$k_1 < 1$$

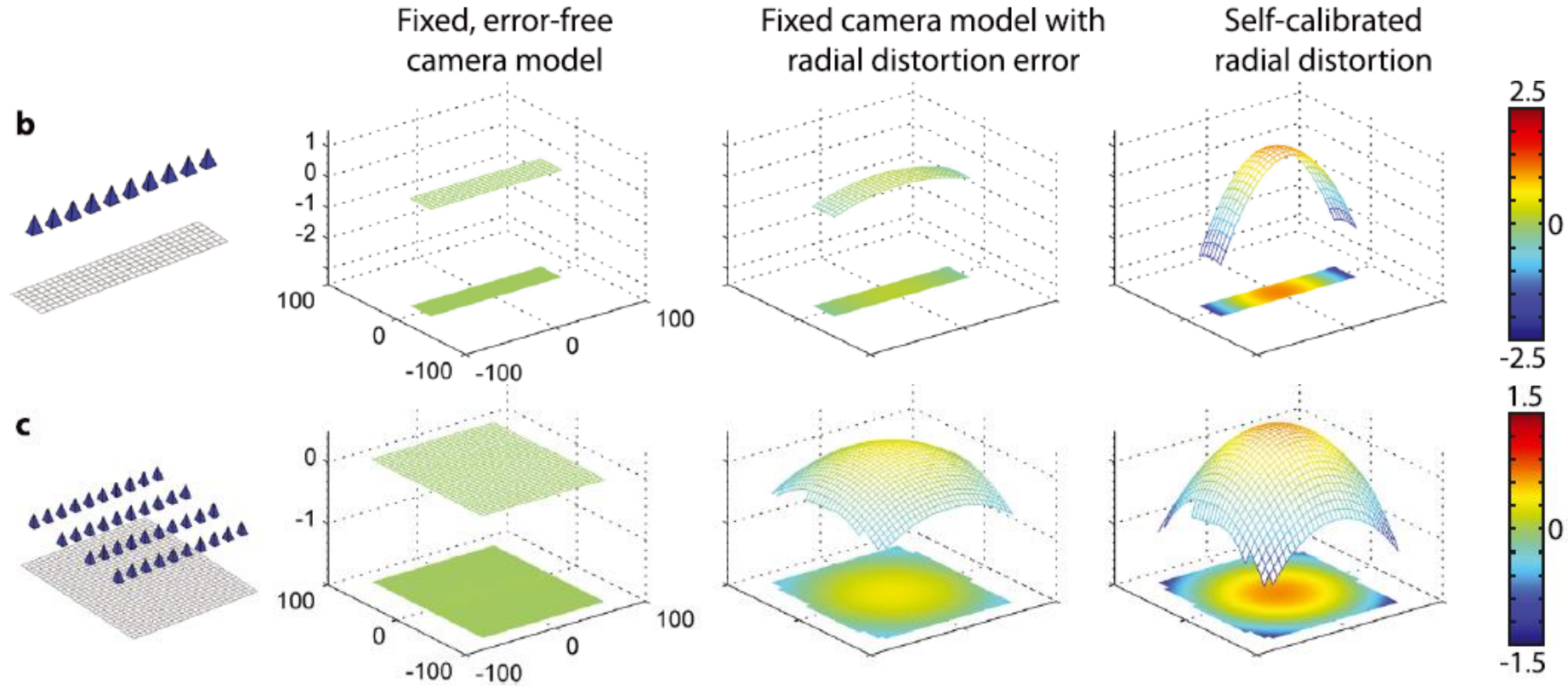
Barrel Distortion



$$k_1 > 1$$

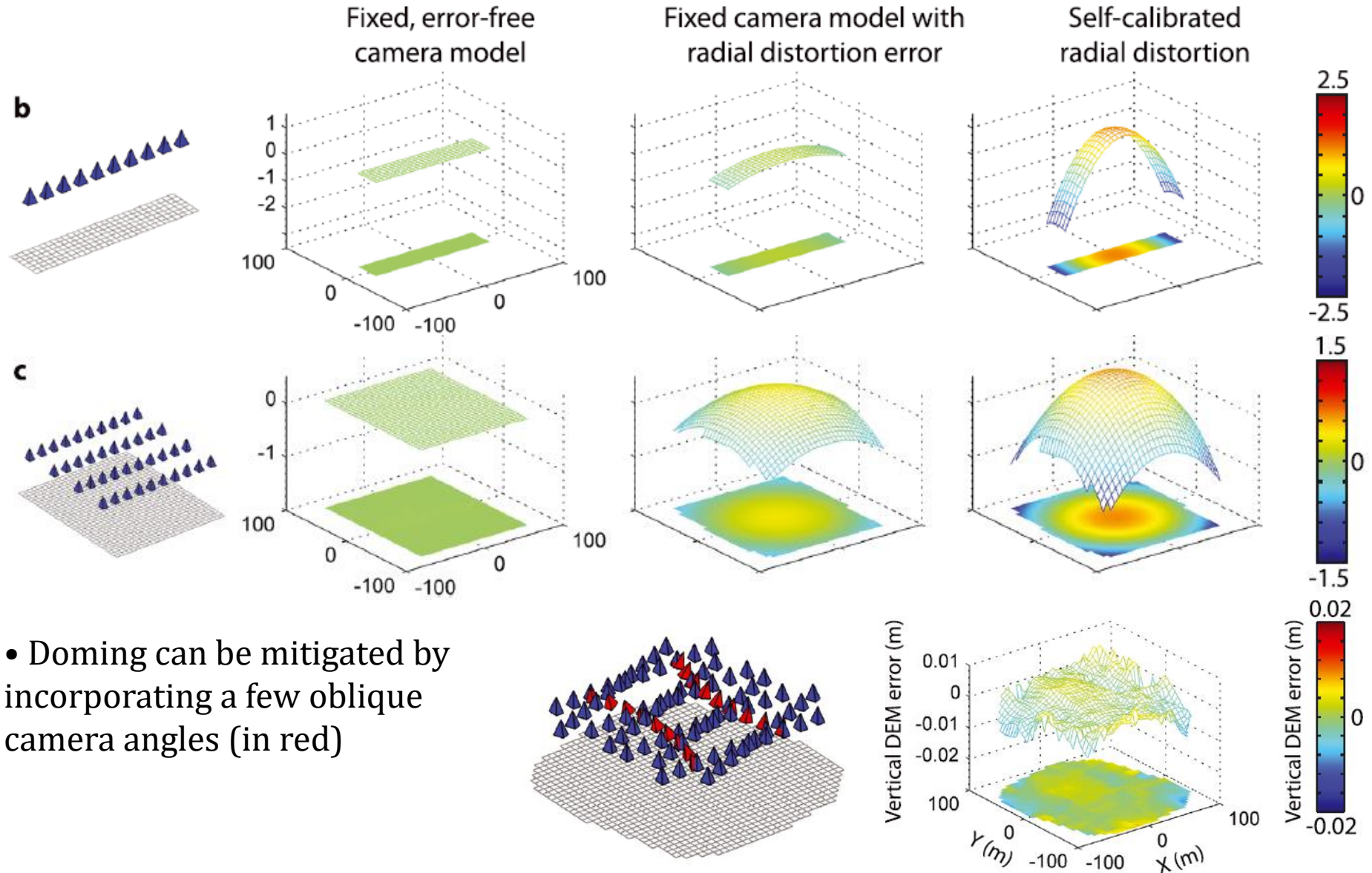
pincushion Distortion

Camera lens distortions



- A trade-off between lens radial distortion term and computed surface form can lead to “doming”

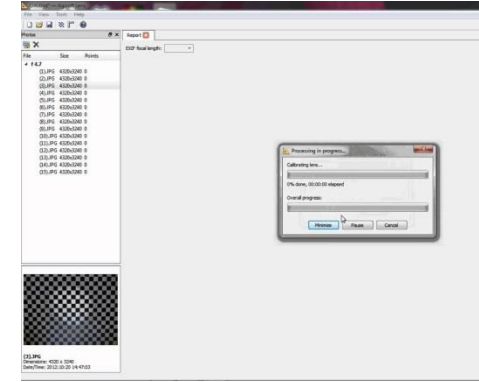
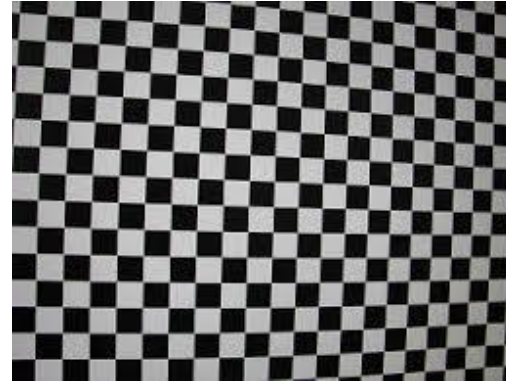
Camera lens distortions



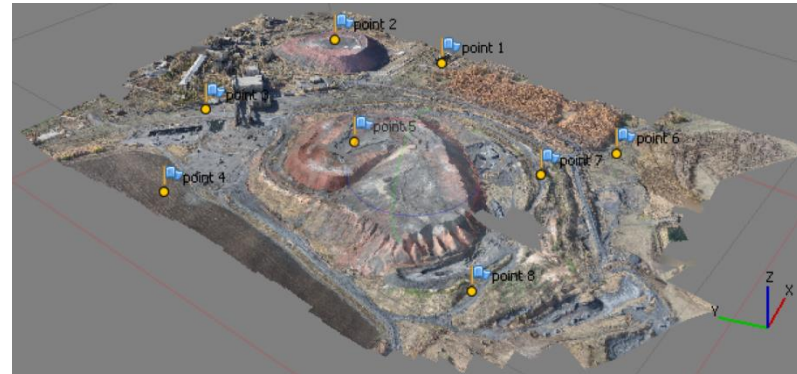
James & Robson (2014), Mitigating systematic error in topographic models derived from UAV and ground-based image networks, *Earth Surface Processes and Landforms*

Camera lens distortions

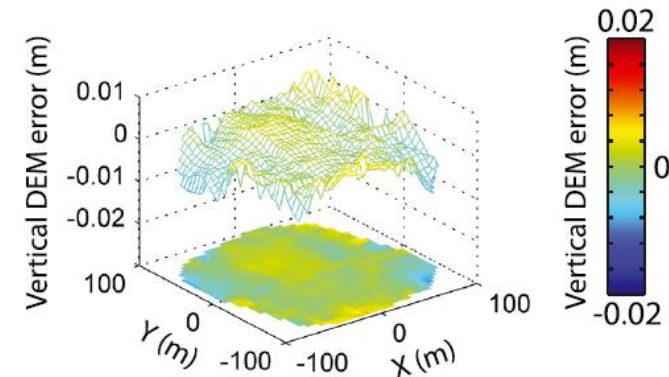
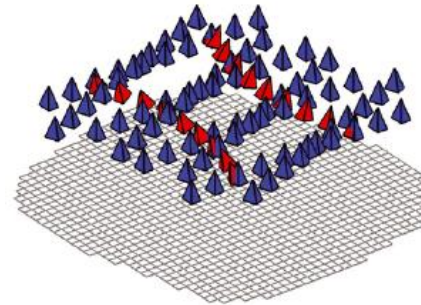
- Doming can be mitigated by calibrating the camera parameters by photographing a calibration target



- Doming can be mitigated by georeferencing using ground control points



- Doming can be mitigated by incorporating a few oblique camera angles (in red)

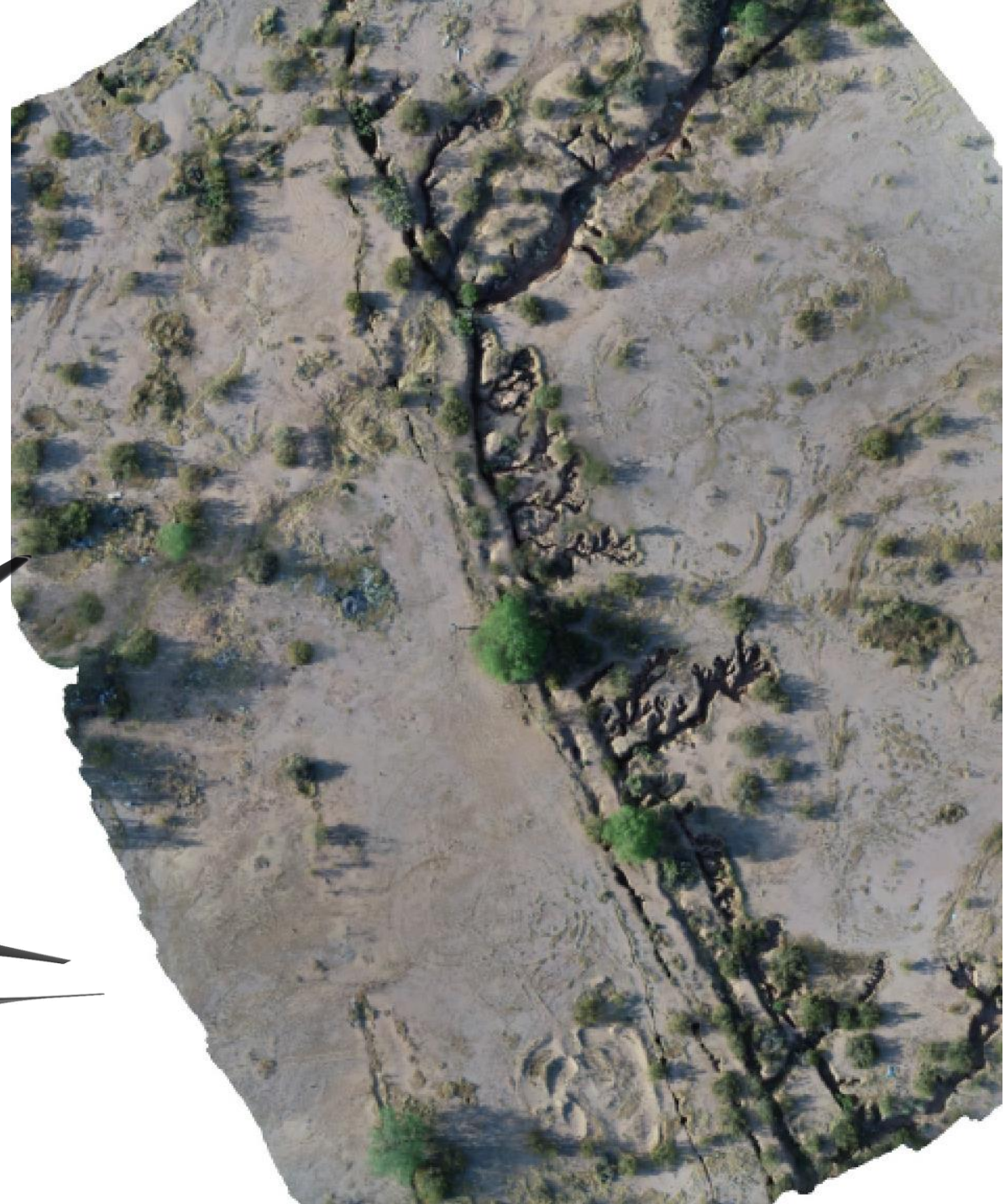


Spring 2019 “fly off”—
Earth Fissures in
Apache Junction, AZ
with Alan Deino and
David Feary (+others)

DJI Mavic Pro (Deino)



*DJI Inspire 2 + ZenMuse
camera (Feary)*



DEM Comparison: No GCPs, only on board GPS

Map Algebra expression

Layers and variables

- 20190410_AD_all_4cm_DEM_shd.tif
- 20190411_DAF_all_5cm_DEM_shd.tif
- 20190411_DAF_all_5cm_DEM.tif
- 20190410_AD_all_4cm_DEM.tif

7	8	9	/	==	!=	&
4	5	6	*	>	>=	
1	2	3	-	<	<=	^
0	.	+	()	~	

Conditional

Con
Pick
SetNull

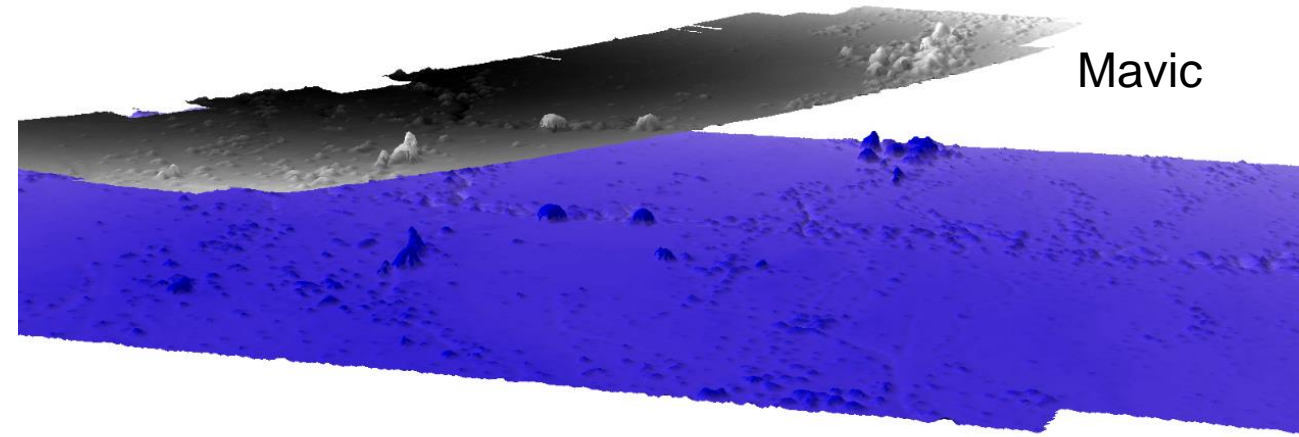
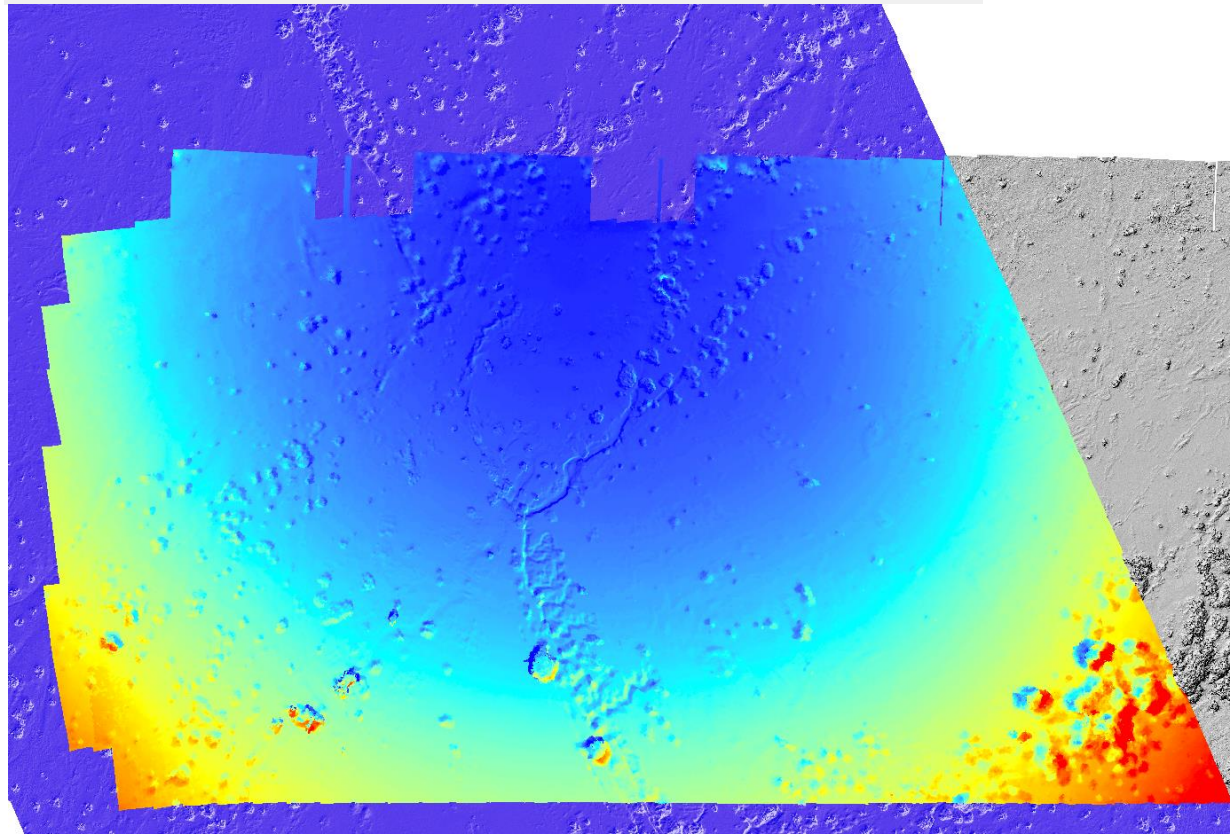
Math

Abs
Exp
Exp10
Exp2

"20190411_DAF_all_5cm_DEM.tif" - "20190410_AD_all_4cm_DEM.tif"

Output raster

C:\Users\ramon\Google Drive\+S_Active_Items\2019GSA\2019GSA_SfM_course\AJ\DAF-AD.tif



Mavic

Inspire + ZenMuse

Table of Contents

Layers

DAF-AD.tif

Value

High : -26.9012

Low : -46.3043

- 20190410_AD_all_4cm_DEM_shd.tif
- 20190411_DAF_all_5cm_DEM_shd.tif
- 20190411_DAF_all_5cm_DEM.tif
- 20190410_AD_all_4cm_DEM.tif

Notice the magnitude and sign of the “doming”

Grey surface is the Mavic

Blue surface is the Inspire + ZenMuse

