

# Metadata Report

## Clear Creek, Idaho post-fire debris flow erosion

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### Summary

An unnamed catchment burned in the 2016 Pioneer Fire produced a debris flow in October 2016. The deposit, main channel, and tributary channels were surveyed using Structure from Motion in June 2017 to quantify the eroded volume.

## Personnel

- PI(s)

Nicholas Ellett

- Field Engineer with contact info

Nicholas Ellett, [nicholasellett@u.boisestate.edu](mailto:nicholasellett@u.boisestate.edu) or [nick.lost.river@gmail.com](mailto:nick.lost.river@gmail.com)

- Additional team members

Lucas Spaete, Kerri Spuller

## Site Information

- Site description

An unnamed 0.95 km<sup>2</sup> catchment contributing to Clear Creek in Boise County, Idaho. Catchment was burned at moderate to high severity in 2016 Pioneer Fire. Underlain by Cretaceous biotite-granodiorite, elevations 1775-2325 m, mean slope 26.2 degrees, maximum slope 45 degrees. Catchment outlet is located at 44.21589, -115.47905.

- Site conditions

Early morning, late afternoon, and overcast conditions were prioritized to minimize shadows and ensure high-quality images.

- Date/time spent at each site

Flights were conducted on 6/20/2017 (~10 AM), 6/23/2017 (~7 AM), 6/26/2017 (~7 PM), 6/27/2017 (~7 AM), and 6/30/2017 (~12 PM). Each covered a section of the deposit, eroded main channel, or eroded tributary channels.

## Survey Results

- Equipment and collection methods used

886 images were acquired using a DJI Phantom 4 Pro drone with the stock 20 megapixel camera and fixed 8.8 mm focal length. Most images were acquired from ~30 m altitude at nadir, some were oblique. Camera positions and orientations were controlled manually. Camera settings (e.g. focus, shutter speed, f-stop) were controlled automatically. Images were processed into a point cloud using Agisoft Photoscan Professional. See below for further processing details. Ground control was provided by rebar installed in various locations (n=20) with orange bucket lids for visibility in images. GCPs were surveyed with a TopCon Hiperv real time kinematic GPS unit with base station (logged >2 hours) and rover. Points were post processed using NGS Online User Positioning Service in UTM North Zone 11, WGS84 datum, g2012bu1 geoid: see below. Bolded GCPs were covered by imagery and used to georeference SfM point cloud.



- Errors

Overall point cloud error (x,y,z dimensions) was 0.076 m using all 20 available GCPs. GCP error was ~0.004 m (horizontal) and ~0.008 m (vertical).

## Products

- Coordinate system of datasets

Point cloud, DEM and orthomosaic are UTM North Zone 11, WGS84 datum. (EPSG::32611)

- Spatial resolution

Point cloud density is variable. DEM is 5 cm resolution. Orthomosaic is 4 cm resolution.

- Horizontal Accuracy

0.076 m (see "Errors" section above)

- Vertical Accuracy

0.076 m (see "Errors" section above)

- Data formats

Raw point cloud is provided in .LAZ format. DEM and orthomosaic are provided as geotiff. Images are provided as .JPG.

- Data processing notes

Point cloud was classified into ground and non-ground classes using Agisoft's tools. Orthomosaic was generated by Agisoft with 0.04 m pixel size. DEM was generated using "ground" classified points only with 0.05 m pixel size.

## Misc Notes

Please send any questions about the dataset collection, processing, or analyses to:

[Nicholasellett@u.boisestate.edu](mailto:Nicholasellett@u.boisestate.edu) or [nick.lost.river@gmail.com](mailto:nick.lost.river@gmail.com)

# Agisoft PhotoScan

Processing Report

15 January 2019



# Survey Data

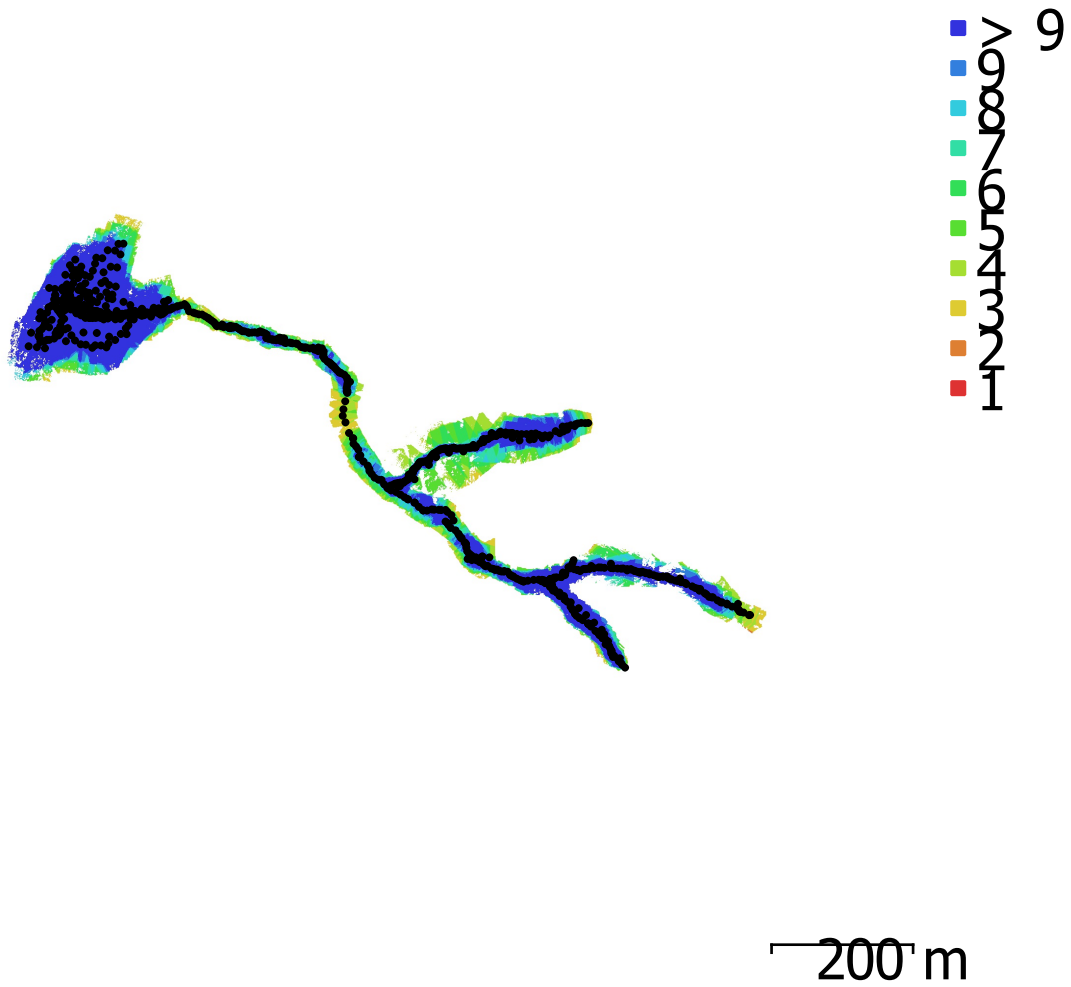


Fig. 1. Camera locations and image overlap.

Number of images:	886	Camera stations:	837
Flying altitude:	29.6 m	Tie points:	947,968
Ground resolution:	7.33 mm/pix	Projections:	2,951,472
Coverage area:	0.0878 km <sup>2</sup>	Reprojection error:	0.656 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
FC6310 (8.8mm)	5472 x 3078	8.8 mm	2.53 x 2.53 $\mu$ m	No

Table 1. Cameras.

# Camera Calibration

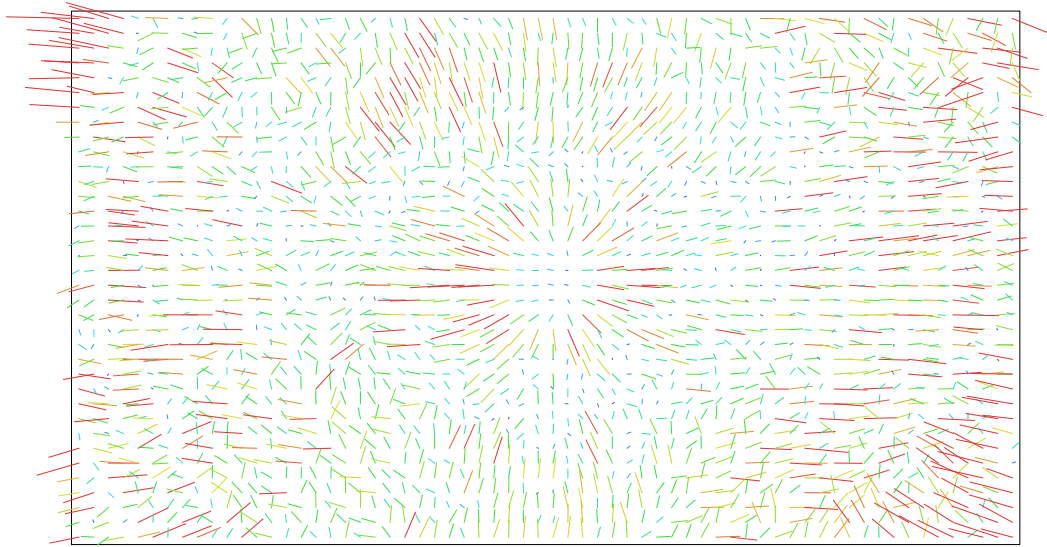


Fig. 2. Image residuals for FC6310 (8.8mm).

## FC6310 (8.8mm)

886 images

Type  
Frame

Resolution  
5472 x 3078

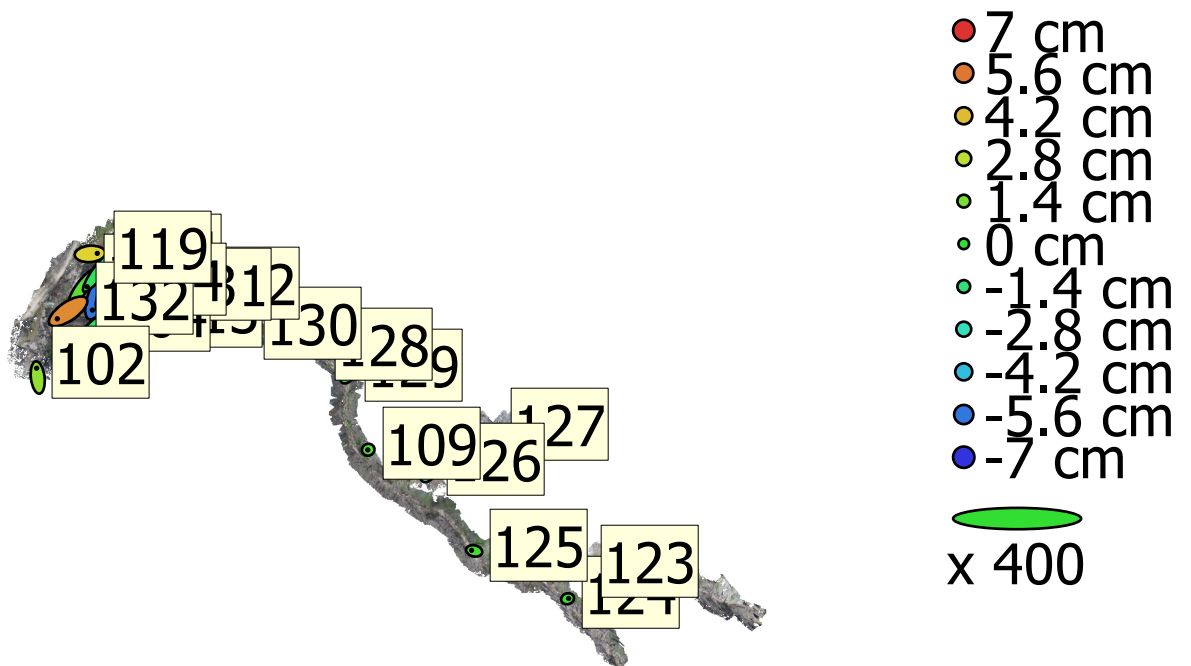
Focal Length  
8.8 mm

Pixel Size  
2.53 x 2.53  $\mu\text{m}$

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>3675.73</b>	0.027	1.00	0.05	-0.36	-0.18	0.19	-0.17	0.04	-0.13
<b>Cx</b>	<b>34.9888</b>	0.025		1.00	-0.00	0.00	0.00	-0.00	0.86	0.03
<b>Cy</b>	<b>19.3697</b>	0.024			1.00	-0.03	0.01	-0.00	-0.02	0.75
<b>K1</b>	<b>0.00345091</b>	2e-05				1.00	-0.95	0.88	0.02	-0.02
<b>K2</b>	<b>-0.0139872</b>	6.3e-05					1.00	-0.98	-0.01	-0.01
<b>K3</b>	<b>0.0146189</b>	6.1e-05						1.00	0.02	0.01
<b>P1</b>	<b>0.00380873</b>	1.9e-06							1.00	0.00
<b>P2</b>	<b>0.00253303</b>	1.7e-06								1.00

Table 2. Calibration coefficients and correlation matrix.

# Ground Control Points



• Control points    † Check points    — 200 m

Fig. 3. GCP locations and error estimates.

Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.

Estimated GCP locations are marked with a dot or crossing.

Count	X error (cm)	Y error (cm)	Z error (cm)	XY error (cm)	Total (cm)
20	4.44456	5.43785	2.93959	7.02313	7.61351

Table 3. Control points RMSE.

X - Easting, Y - Northing, Z - Altitude.

<b>Label</b>	<b>X error (cm)</b>	<b>Y error (cm)</b>	<b>Z error (cm)</b>	<b>Total (cm)</b>	<b>Image (pix)</b>
124	0.723898	0.230539	0.132204	0.771138	0.206 (14)
123	-0.262847	-0.213985	-0.0425666	0.341599	0.552 (11)
125	-1.83897	0.42852	0.292391	1.91074	0.324 (17)
127	0.52981	-1.59986	1.0974	2.01111	0.767 (17)
126	1.69201	3.43086	-3.14273	4.95081	0.282 (7)
109	-0.309247	-0.130887	0.721556	0.795869	0.174 (6)
129	-1.71753	-2.43697	-1.16805	3.20204	0.571 (7)
128	1.80525	1.09617	0.54344	2.18079	0.453 (10)
130	-0.678622	1.21064	1.0198	1.72226	0.658 (6)
113	7.94263	6.56197	-0.0249308	10.3027	1.008 (16)
112	-7.51938	-2.67246	-2.86811	8.47993	0.766 (6)
131	1.95349	-5.59025	6.17718	8.55714	0.835 (9)
135	-3.87932	-10.1379	-5.67103	12.2469	0.580 (44)
133	-6.1942	-8.76599	0.862176	10.7682	0.462 (41)
134	-8.17058	-11.0274	-0.816004	13.7487	0.734 (26)
104	6.67787	8.04329	-1.12077	10.514	0.735 (39)
114	2.82326	7.02261	-5.68809	9.46796	0.768 (19)
132	-7.65389	-5.25915	5.20617	10.6464	0.509 (40)
102	-0.75183	6.60759	1.98407	6.93988	0.468 (4)
119	5.08613	0.403957	3.71648	6.31222	0.374 (19)
<b>Total</b>	<b>4.44456</b>	<b>5.43785</b>	<b>2.93959</b>	<b>7.61351</b>	<b>0.610</b>

Table 4. Control points.  
X - Easting, Y - Northing, Z - Altitude.



# Digital Elevation Model

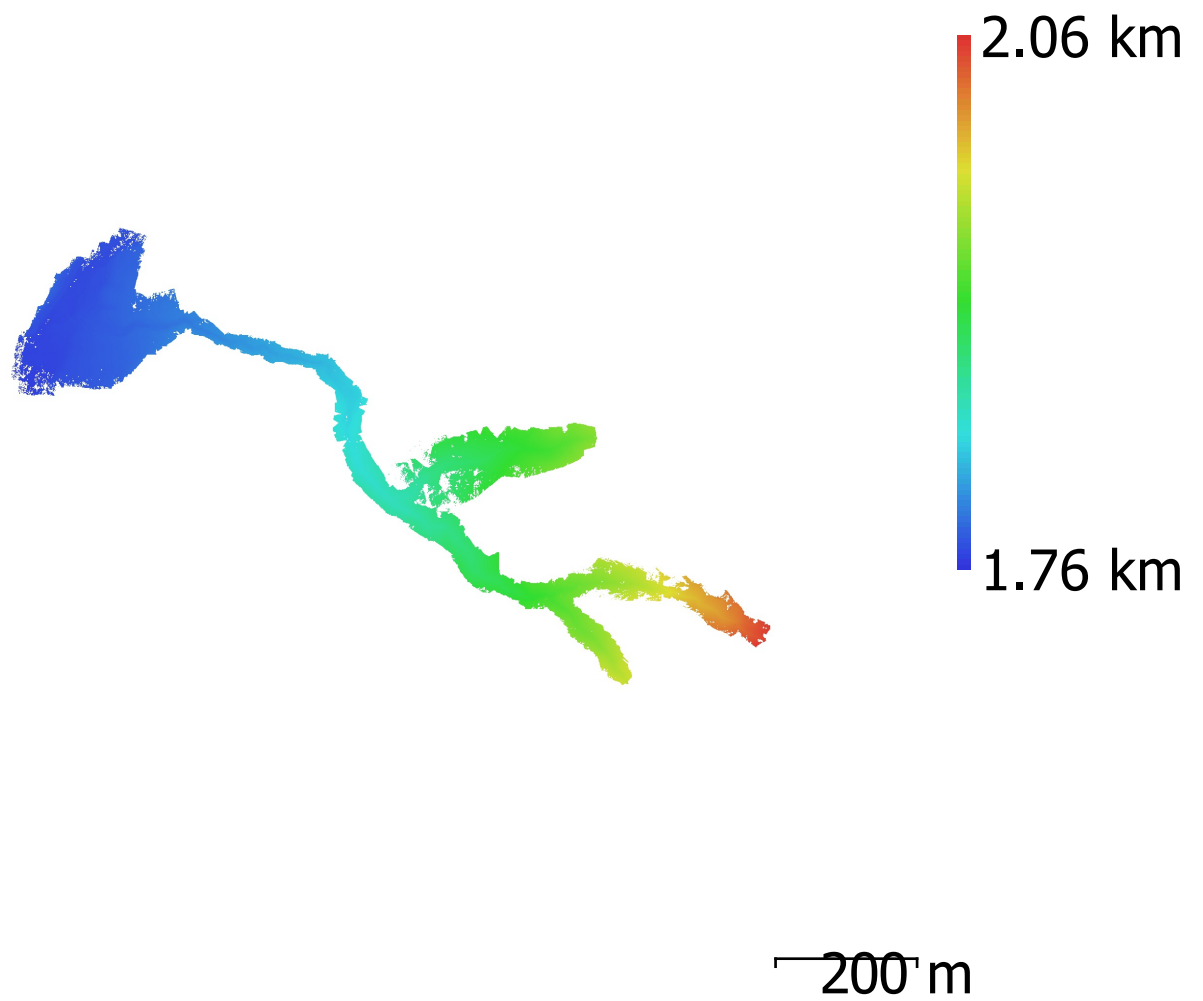


Fig. 4. Reconstructed digital elevation model.

Resolution: 2.93 cm/pix  
Point density: 11.6 points/cm<sup>2</sup>

# Processing Parameters

## General

Cameras	886
Aligned cameras	837
Markers	20
Coordinate system	WGS 84 / UTM zone 11N (EPSG::32611)
Rotation angles	Yaw, Pitch, Roll

## Point Cloud

Points	947,968 of 1,102,082
RMS reprojection error	0.201566 (0.656002 pix)
Max reprojection error	1.77026 (36.1156 pix)
Mean key point size	3.02985 pix
Point colors	3 bands, uint8
Key points	No
Average tie point multiplicity	3.23381

## Alignment parameters

Accuracy	High
Generic preselection	Yes
Reference preselection	Yes
Key point limit	40,000
Tie point limit	4,000
Adaptive camera model fitting	No
Matching time	5 hours 18 minutes
Alignment time	56 minutes 1 seconds

## Optimization parameters

Parameters	f, cx, cy, k1-k3, p1, p2
Adaptive camera model fitting	No
Optimization time	57 seconds

## Dense Point Cloud

Points	121,858,072
Point colors	3 bands, uint8

## Reconstruction parameters

Quality	Medium
Depth filtering	Moderate
Depth maps generation time	2 days 12 hours
Dense cloud generation time	1 hours 6 minutes

## DEM

Size	54,358 x 38,131
Coordinate system	WGS 84 / UTM zone 11N (EPSG::32611)

## Reconstruction parameters

Source data	Dense cloud
Interpolation	Disabled
Processing time	3 minutes 59 seconds

## Orthomosaic

Size	47,233 x 30,809
Coordinate system	WGS 84 / UTM zone 11N (EPSG::32611)
Colors	3 bands, uint8

## Reconstruction parameters

Blending mode	Mosaic
Surface	Mesh
Enable hole filling	Yes
Processing time	29 minutes 13 seconds

## Software

Version	1.4.3 build 6529
Platform	Windows 64



## Project Summary

Project name: clearcreek

Surveyor: Nicholas Ellett

Comment: Base 2 logged 3 hours. Base 3 logged 2 hours.

Linear unit: Meters

Projection: UTMNorth-Zone\_11 : 120W to 114W

Datum: WGS84

Geoid: g2012bu1

## Point Summary

Name	Grid Northing (m)	Grid Easting (m)	Elevation (m)	Code
100	4897063.357	621488.362	1777.864	MS
101	4896887.234	621445.059	1768.843	
<b>102</b>	<b>4896887.228</b>	<b>621445.065</b>	<b>1768.861</b>	
103	4896863.98	621494.814	1774.186	
<b>104</b>	<b>4896954.063</b>	<b>621532.607</b>	<b>1778.479</b>	
105	4896898.5	621580.55	1789.806	
106	4896869.315	621848.211	1836.972	
107	4896675.044	621965.402	1877.924	
108	4896750.185	622002.296	1876.116	
<b>109</b>	<b>4896771.841</b>	<b>621912.769</b>	<b>1848.35</b>	
110	4896926.846	621860.014	1824.284	
111	4897010.394	621766.688	1825.629	
<b>112</b>	<b>4896987.971</b>	<b>621626.256</b>	<b>1791.718</b>	
<b>113</b>	<b>4896959.037</b>	<b>621607.247</b>	<b>1789.078</b>	
<b>114</b>	<b>4897004.116</b>	<b>621550.872</b>	<b>1781.048</b>	
115	4897000.241	621436.031	1786.977	
116	4897259.999	621644.859	1787.566	
117	4897313.996	621755.386	1786.54	
118	4897079.69	621676.065	1791.492	
<b>119</b>	<b>4897049.479</b>	<b>621530.656</b>	<b>1773.078</b>	
120	4897017.406	621500.392	1770.162	
121	4896280.148	622481.721	2099.757	
122	4896540.387	622525.63	2078.129	
<b>123</b>	<b>4896605.619</b>	<b>622221.733</b>	<b>1941.247</b>	
<b>124</b>	<b>4896562.058</b>	<b>622196.427</b>	<b>1931.468</b>	
<b>125</b>	<b>4896630.06</b>	<b>622059.45</b>	<b>1887.086</b>	
<b>126</b>	<b>4896750.357</b>	<b>622002.399</b>	<b>1876.156</b>	
<b>127</b>	<b>4896793.076</b>	<b>622097.093</b>	<b>1901.558</b>	
<b>128</b>	<b>4896913.516</b>	<b>621847.234</b>	<b>1819.616</b>	

<b>129</b>	<b>4896873.844</b>	<b>621881.619</b>	<b>1827.11</b>
<b>130</b>	<b>4896942.818</b>	<b>621746.615</b>	<b>1806.657</b>
<b>131</b>	<b>4896975.968</b>	<b>621621.941</b>	<b>1789.371</b>
<b>132</b>	<b>4896957.049</b>	<b>621474.305</b>	<b>1770.073</b>
<b>133</b>	<b>4896983.04</b>	<b>621496.143</b>	<b>1772.485</b>
<b>134</b>	<b>4897002.341</b>	<b>621516.53</b>	<b>1773.184</b>
<b>135</b>	<b>4896969.399</b>	<b>621523.81</b>	<b>1776.708</b>
Base2	4897063.237	621486.655	1778.327
Base3	4897001.6	621435.464	1787.182

RTK Obs Quality

<b>Name</b>	<b>Horz RMS (m)</b>	<b>Vert RMS (m)</b>
Base2-100	0.004	0.006
Base2-101	0.007	0.007
Base2-102	0.005	0.005
Base2-103	0.005	0.005
Base2-104	0.005	0.005
Base2-105	0.004	0.005
Base2-106	0.004	0.006
Base2-107	0.003	0.005
Base2-108	0.004	0.006
Base2-109	0.004	0.006
Base2-110	0.005	0.007
Base2-111	0.005	0.007
Base2-112	0.004	0.007
Base2-113	0.004	0.006
Base2-114	0.004	0.007
Base2-115	0.004	0.009
Base2-116	0.004	0.008
Base2-117	0.004	0.008
Base2-118	0.004	0.009
Base2-119	0.004	0.008
Base2-120	0.004	0.008
Base3-121	0.005	0.01
Base3-122	0.005	0.006
Base3-123	0.004	0.005
Base3-124	0.004	0.006
Base3-125	0.006	0.009
Base3-126	0.004	0.009
Base3-127	0.004	0.009
Base3-128	0.004	0.008
Base3-129	0.004	0.008
Base3-130	0.004	0.008
Base3-131	0.003	0.006

Base3-132	0.004	0.007
Base3-133	0.003	0.007
Base3-134	0.004	0.008
Base3-135	0.003	0.007