Analysis of the CUBE Node Spacing on its Uncertainty Values

By Ivan Izaak

There is a good question from one of our customers about the effect of the CUBE node spacing on the uncertainty values in each node.

I used different node spacing (0.3m, 0.5m, 1m, 2m, 5m and finally 10m) for three different data sets:

- **Data Set 1** – Data collected by Reson 8101 MBES with OCTANS III MRU and DGPS over the Odessa approaching channel, Ukraine back in 2007.
- **Data Set 2** – Data collected by Kongsberg EM2040 with HYDRINS IMU RTK over the Jujny Port approaching channel, Ukraine, 2013.
- **Data Set 3** – Data collected by Reson 7125 MBES with Applanix POS/MV RTK over the Missouri river with the bridge basements in the upper area, USA, 2013.

For my tests, I used the ***XYZ Distribution*** utility, which is a hidden utility in HYPACK® under the *\HYPACK 2013\Support\Utilities* folder.

I have computed the average number of soundings in the cells in all three data sets at different cell sizes by saving **XYZn** inside the 64-bit HYSWEEP® EDITOR, where Zn is the number of soundings.

Then I loaded all the data sets into HYSWEEP® CUBE with different Node Spacing and saved XYZu files, where Zu is uncertainty in each node. I also loaded the resulting **XYZu** files into the XYZ Distribution utility to compute the average, maximum uncertainty values as well as their standard deviation.

TABLE 1. *Summary of the Results*

Node Spacing	Data Set	Average number of points	Uncertainty		
			Average	Maximum	St. Deviation
0.3 m	DS 1	1.3	Failed CUBE computation due to lack of data		
	DS 2	3	Failed CUBE computation due to lack of data		
	DS 3	7	0.108	5.27	0.139
0.5 m	DS 1	2.5	0.192	4.10	0.226
	DS 2	10.1	0.124	4.49	0.160
	DS 3	18	0.141	3.61	0.126
1 m	DS 1	7.0	0.217	2.43	0.176
	DS 2	40	0.155	2.70	0.163
	DS 3	68	0.138	1.82	0.101
2 m	DS 1	26.5	0.193	1.41	0.138
	DS 2	157	0.134	1.45	0.118
	DS 3	265	0.128	1.08	0.08
5 m	DS 2	161	0.168	0.98	0.112
	DS 3	963	0.115	0.80	0.088
	DS 1	1600	0.114	0.71	0.074
10 m	DS 2	622	0.161	0.78	0.104
	DS 3	3700	0.112	0.76	0.085
	DS 1	6190	0.109	0.59	0.072

Based on the above computations, I might say that the more data in a cell (i.e. the more data for analysis), the less uncertainty. But at some point, when there is not enough data for statistics (as in Data Set 3 at 0.3m or Data Set 1 and 2 with the cells of 0.5m size), this rule does not work – in these cases, the average uncertainty is less than at the cell of bigger size.