

## 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.

Data Set	Average num-	Uncertainty		
	ber of points	Average	Maximum	St. Deviation
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
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
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
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
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
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
	Data Set DS 1 DS 2 DS 3 DS 1 DS 3 DS 1 DS 2 DS 3 DS 1 DS 1 DS 3 DS 1 DS 3 DS 1 DS 3 DS 1 DS 1 DS 1 DS 1 DS 3 DS 1 DS	Average num- ber of points   DS 1 1.3   DS 2 3   DS 3 7   DS 1 2.5   DS 2 10.1   DS 3 18   DS 1 7.0   DS 2 40   DS 3 68   DS 1 26.5   DS 2 157   DS 3 265   DS 2 161   DS 3 963   DS 1 1600   DS 2 622   DS 3 3700   DS 1 6190	Average num-   ber of points Average   DS 1 1.3 Failed CUBE cor   DS 2 3 Failed CUBE cor   DS 3 7 0.108   DS 1 2.5 0.192   DS 2 10.1 0.124   DS 3 18 0.141   DS 1 7.0 0.217   DS 2 40 0.155   DS 3 68 0.138   DS 1 26.5 0.193   DS 2 157 0.134   DS 3 265 0.128   DS 2 161 0.168   DS 3 963 0.115   DS 1 1600 0.114   DS 2 622 0.161   DS 3 3700 0.112   DS 1 6190 0.109	Average num- Uncertainty   ber of points Average Maximum   DS 1 1.3 Failed CUBE computation due to   DS 2 3 Failed CUBE computation due to   DS 3 7 0.108 5.27   DS 1 2.5 0.192 4.10   DS 2 10.1 0.124 4.49   DS 3 18 0.141 3.61   DS 1 7.0 0.217 2.43   DS 2 40 0.155 2.70   DS 3 68 0.138 1.82   DS 1 26.5 0.193 1.41   DS 2 157 0.134 1.45   DS 3 265 0.128 1.08   DS 2 161 0.168 0.98   DS 3 963 0.115 0.80   DS 1 1600 0.114 0.71   DS 2 622 0.161 0.78   DS 3 3700 0.112 0.76   DS 1 6

**TABLE 1.** Summary of the Results

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.