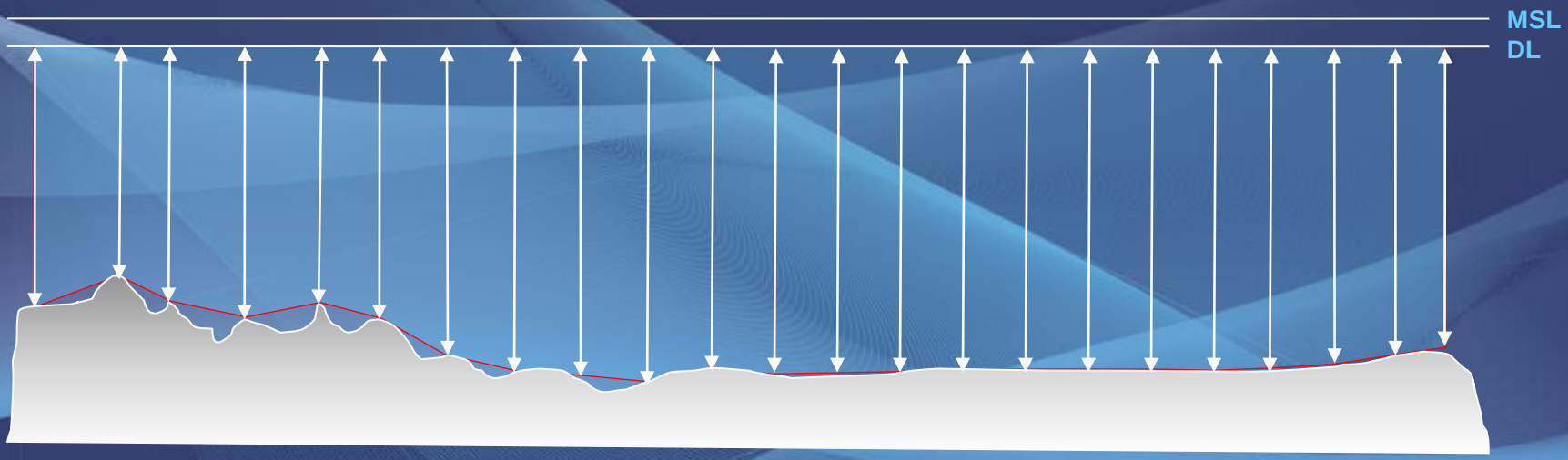
Is Your Bathymetry REAL?

Background

- Most hydrographical survey deliverables are designed for navigational safety
- They can't represent real sea floor topology, because of
  - Shoal biased scheme
  - Referenced on DL (not Mean Sea Level)



Background

- Many other fields need sea floor topology
  - Numerical modeling on ocean states
  - Coastal development
  - Resource management
  - Various coastal GIS applications
- But, depth in nautical chart is not real bathymetry
- Real bathymetry data is too huge to handle

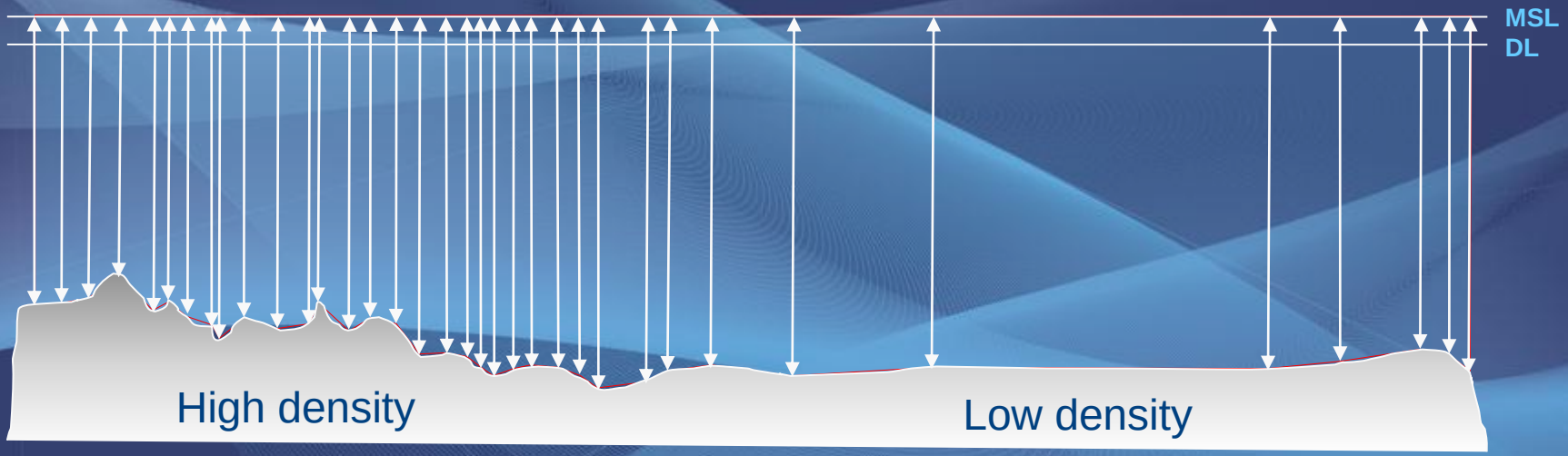
- → We need proper model of bathymetry which trade off real bathymetry and amount of data

Purpose

- KHOA tried to develop new bathymetry dataset, which have 2 major properties
  - Reduce amount of data to 1% level
  - Maintain precision of sea floor topology
- Acquire automation tools for generating new bathymetry dataset from MBES data

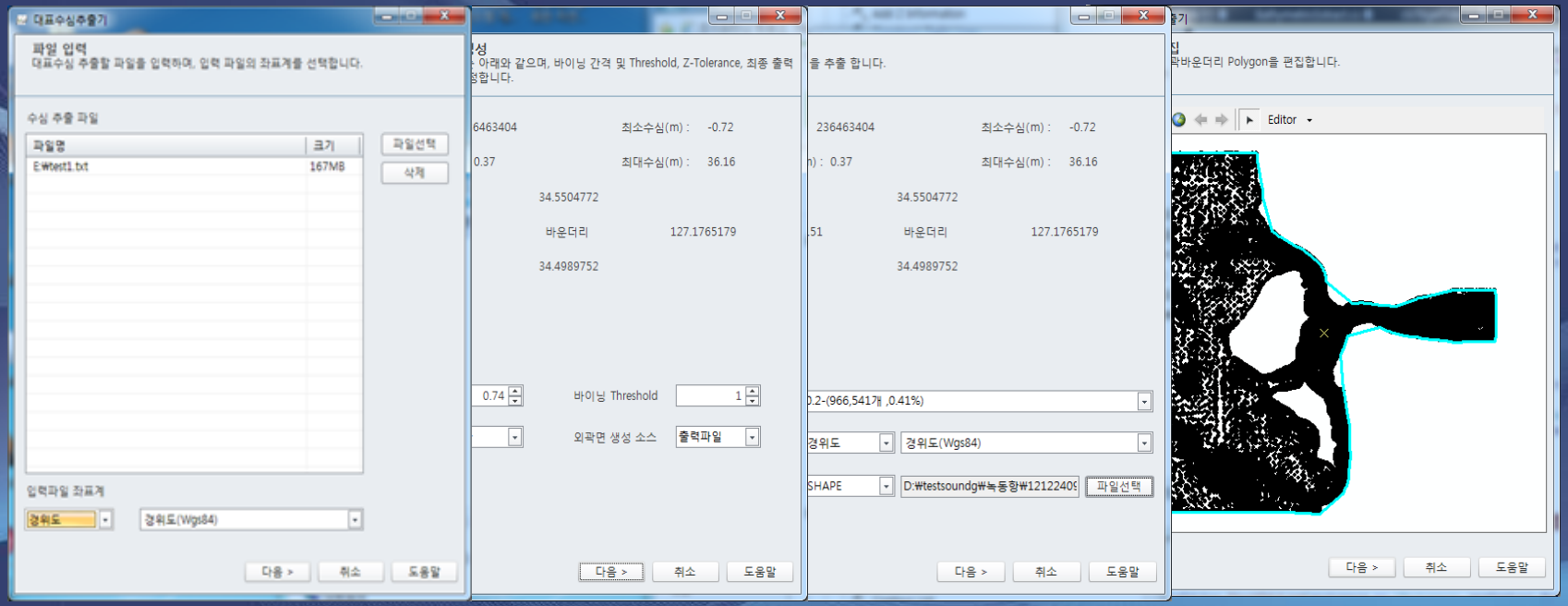
Logic

- Key idea of KHOA Bathymetry Dataset
  - Variable resolution model which support proportional data density based on complexity of topology
  - High complexity, high data density
  - Low complexity, low data density
- It based on Hierarchical Delaunay Triangulation and support directly sampled data from MBES



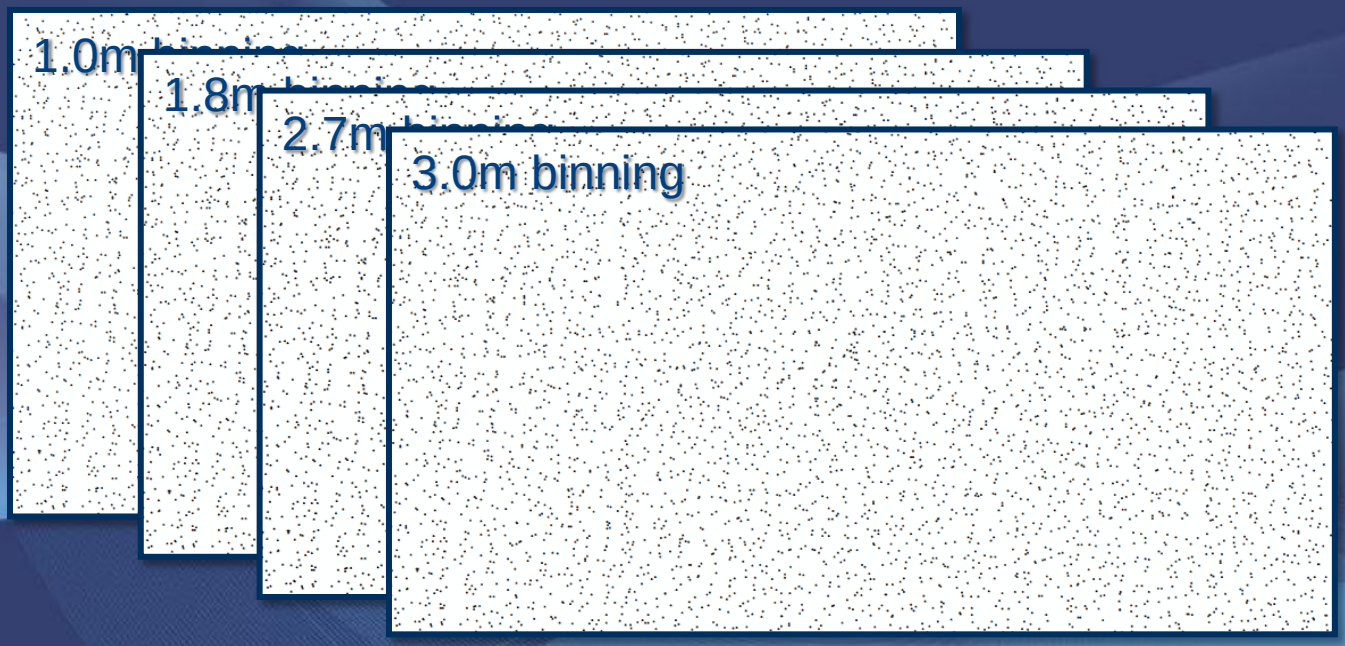
Tools

- We developed wizard style automation software, take advantage of ArcGIS Engine
  - Multi resolution terrain dataset based on TIN method
  - Support 2 type of pyramid(binning, z-tolerance)



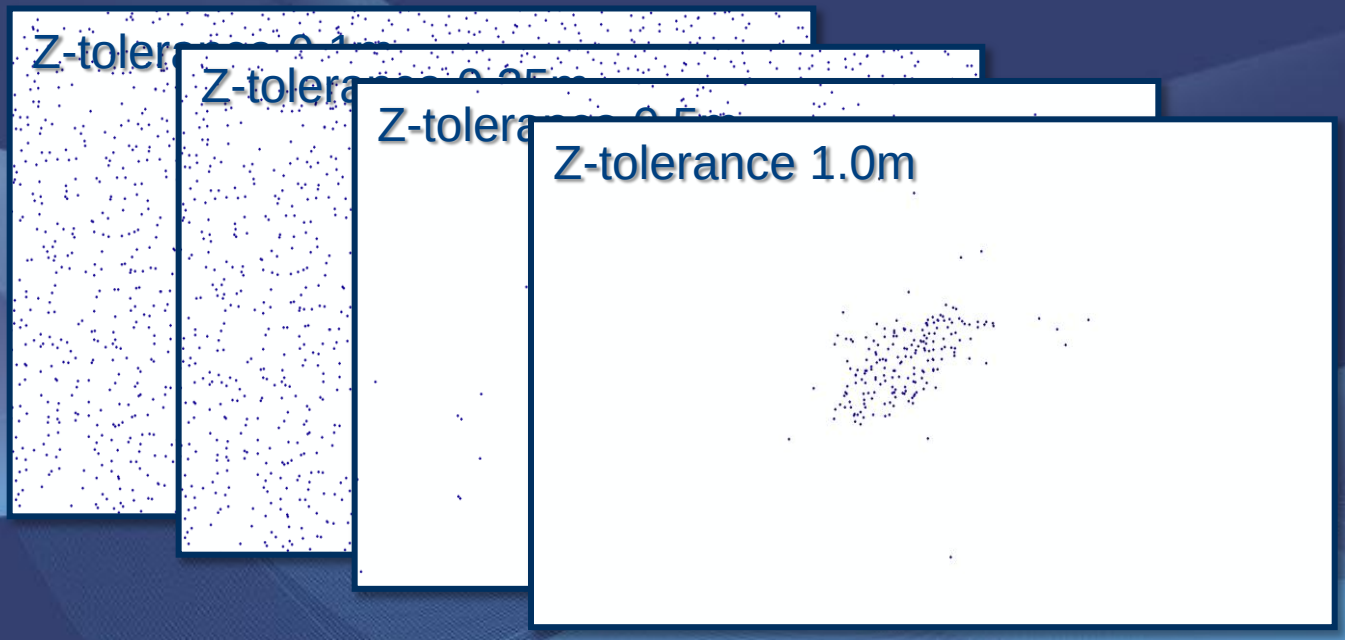
Optimal binning size

- Various binning size was tested to find out optimal size
  - Optimal binning sizes are different accordantly scale of sea floor complexity



Optimal z-tolerance

- A repeat test was performed to figure out optimal z-tolerance
  - Higher z-tolerance make lighter dataset, but danger of information loss is increased



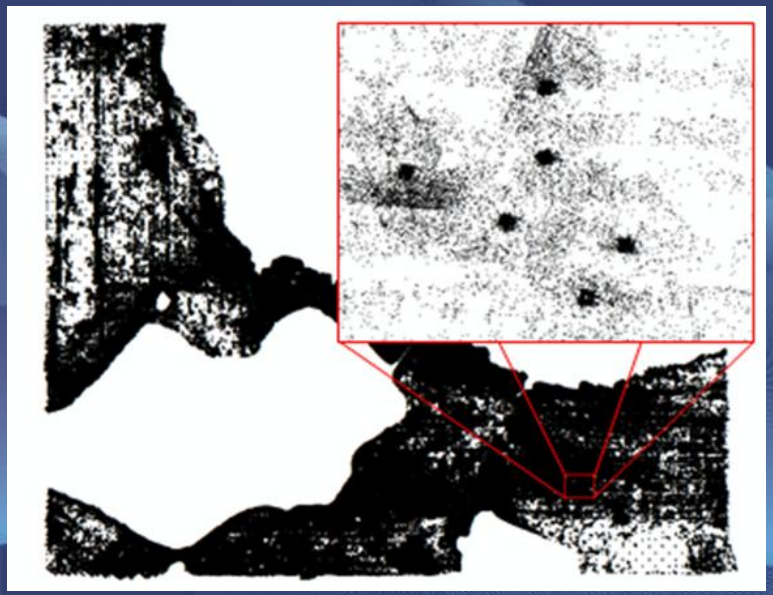
Test

- We generated new dataset for 4 sample site
  - Reduce data amount to 0.16 ~ 0.88% of original data count
  - Terrain accuracy is preserved

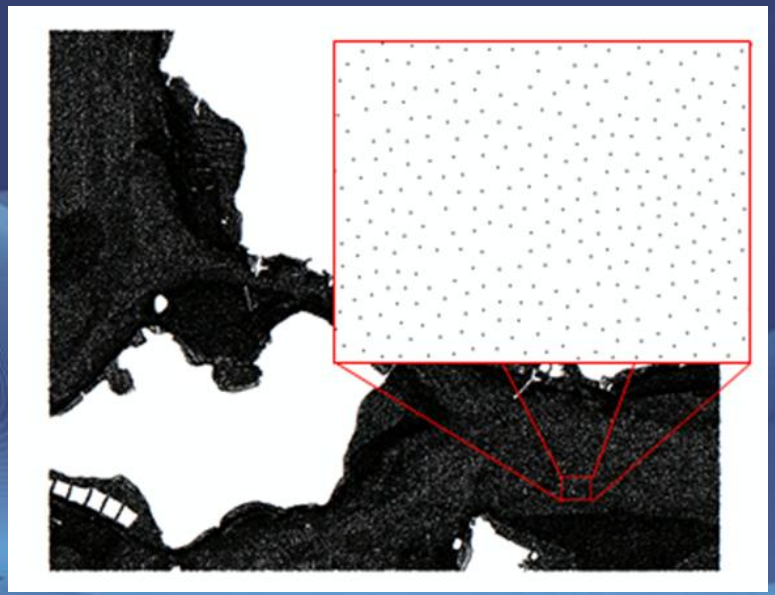
Test site	Input data properties				running options		results		
	average distance between points(m)	original point count	max depth(m)	min depth(m)	binning size(m)	z-tolerance (m)	running time	KBM point count	extract rate
Nokdong	0.37	236,463,404	36.2	-0.7	0.74	0.3	3h 51m	1,880,271	0.79%
Narodo	0.26	310,754,630	25.7	-0.9	0.52	0.2	4h 02m	499,053	0.16%
Hongdo	0.77	151,739,562	91.0	-0.7	1.54	0.5	2h 35m	1,336,246	0.88%
Jeju	0.60	366,742,743	91.4	0.3	1.2	0.2	3h 56m	1,736,139	0.47%

Test

- Preserved terrain accuracy
  - KHOA Bathymetry Dataset is very good at expressing details of terrain
  - Smooth sheet data could not express small objects on sea bed
  - Data count of both data are almost equal number

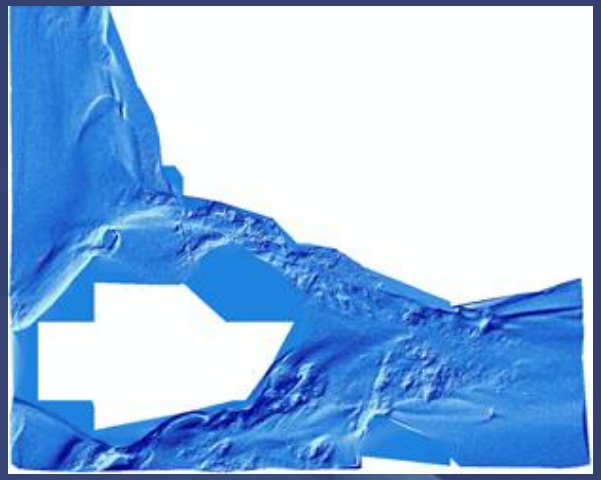


KHOA Bathymetry dataset positions

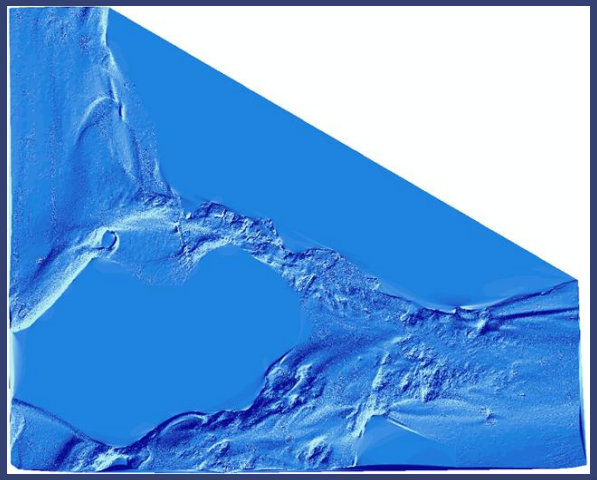


Smooth sheet data positions

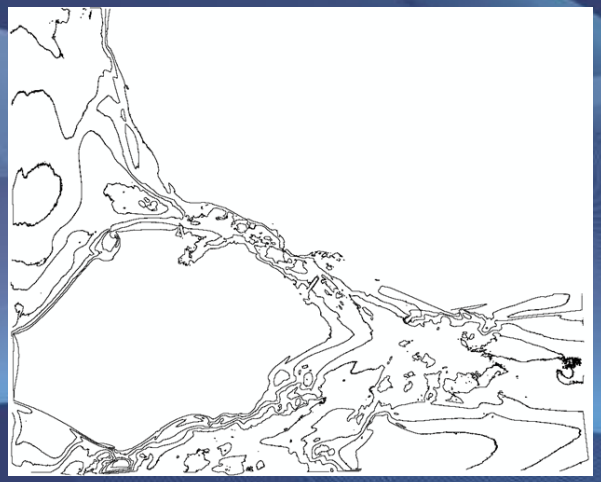
Test



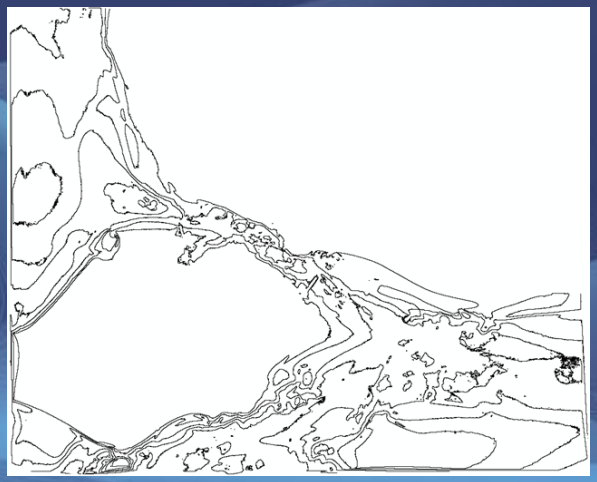
Shaded image of original data



Shaded image of KHOA Bathymetry dataset

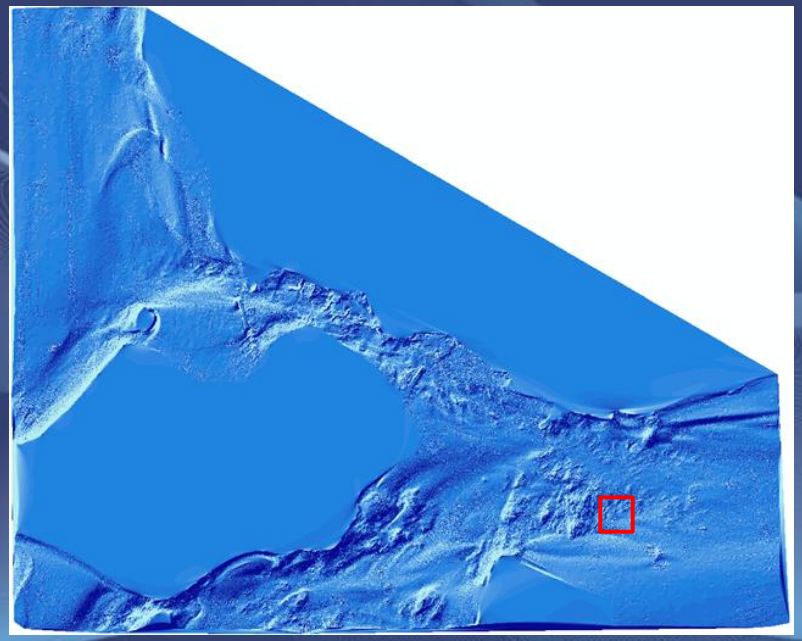


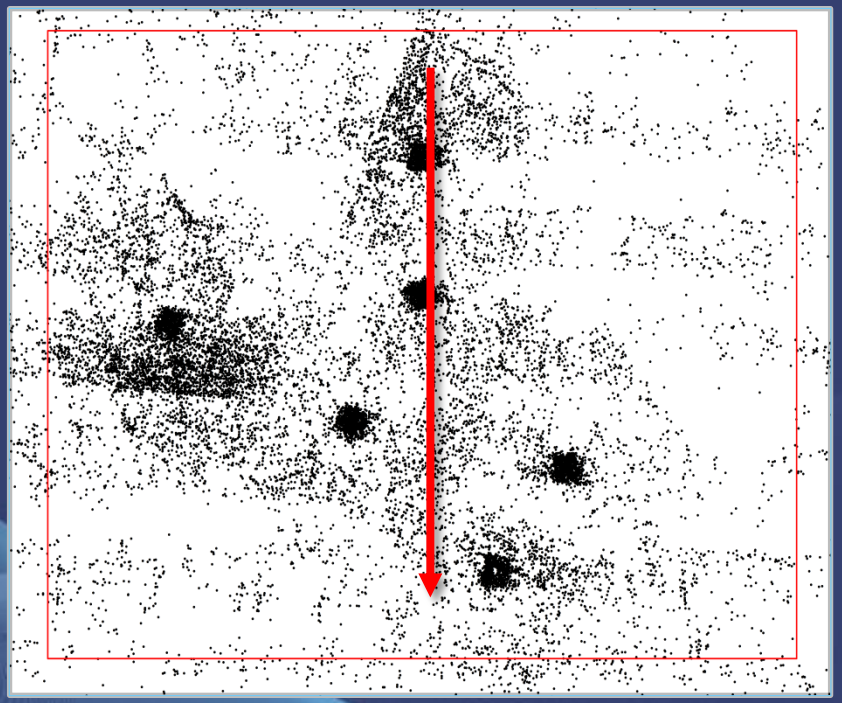
Contour of original data



Contour of KHOA Bathymetry dataset

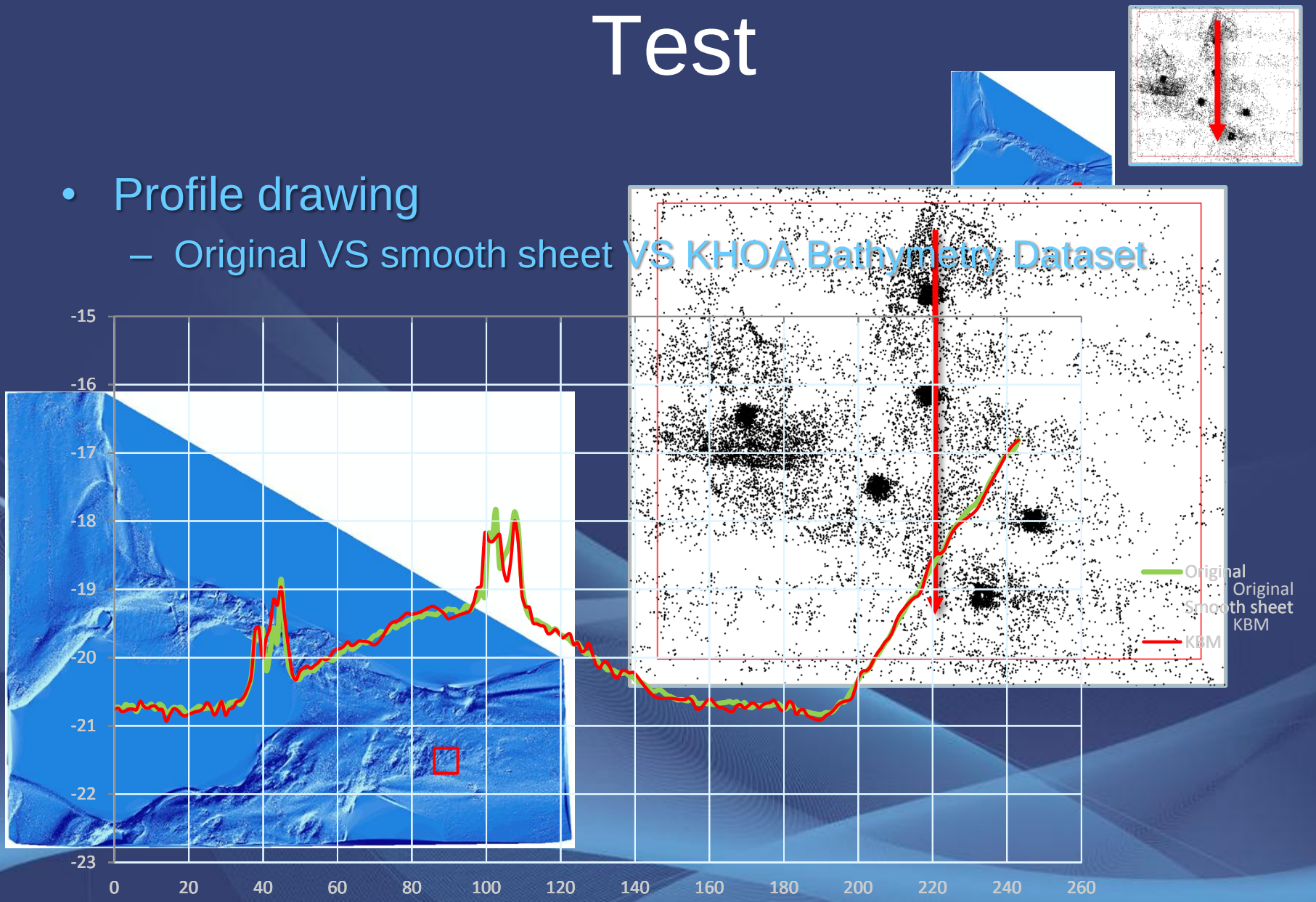
Test





Test

- Profile drawing
  - Original VS smooth sheet VS KHOA Bathymetry Dataset



Expected applications

- Depth data for ocean numerical modeling
  - Calculate correct volume of water mass
- Coastal engineering
  - Assessment of aggregate resource
  - Estimate dredging volume
  - Provide basic information for making decision on coastal management
- Marine GIS
  - Data fusion of land and ocean DEM
  - Simplification of bathymetric data sets and integration with other data sources

Conclusions

- Most hydrographical survey deliverables are designed for navigational safety, but many other fields need real sea floor topology rather than safety depth
- Real bathymetry data is too huge to handle
- KHOA has developed new bathymetry dataset and test it for 4 site
  - Reduce data amount to 0.16 ~ 0.88% of original data count
  - Terrain accuracy is preserved
- KHOA Bathymetry Dataset will provide accurate and light-weighted bathymetry information to non-navigational purpose users

Questions?