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4D Multimodal Visualization and Analysis of Seafloor Vents and Plumes

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IVS 3D

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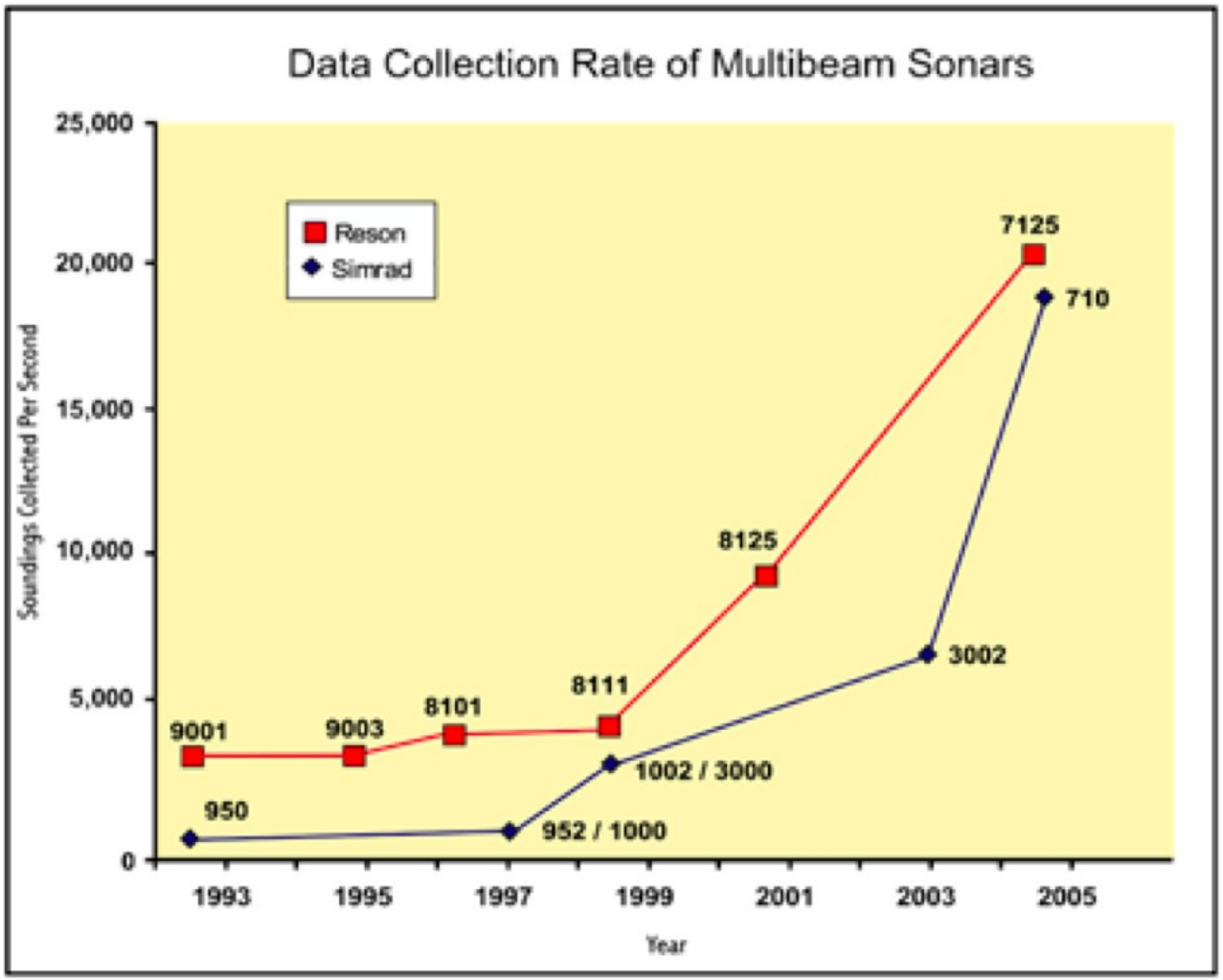
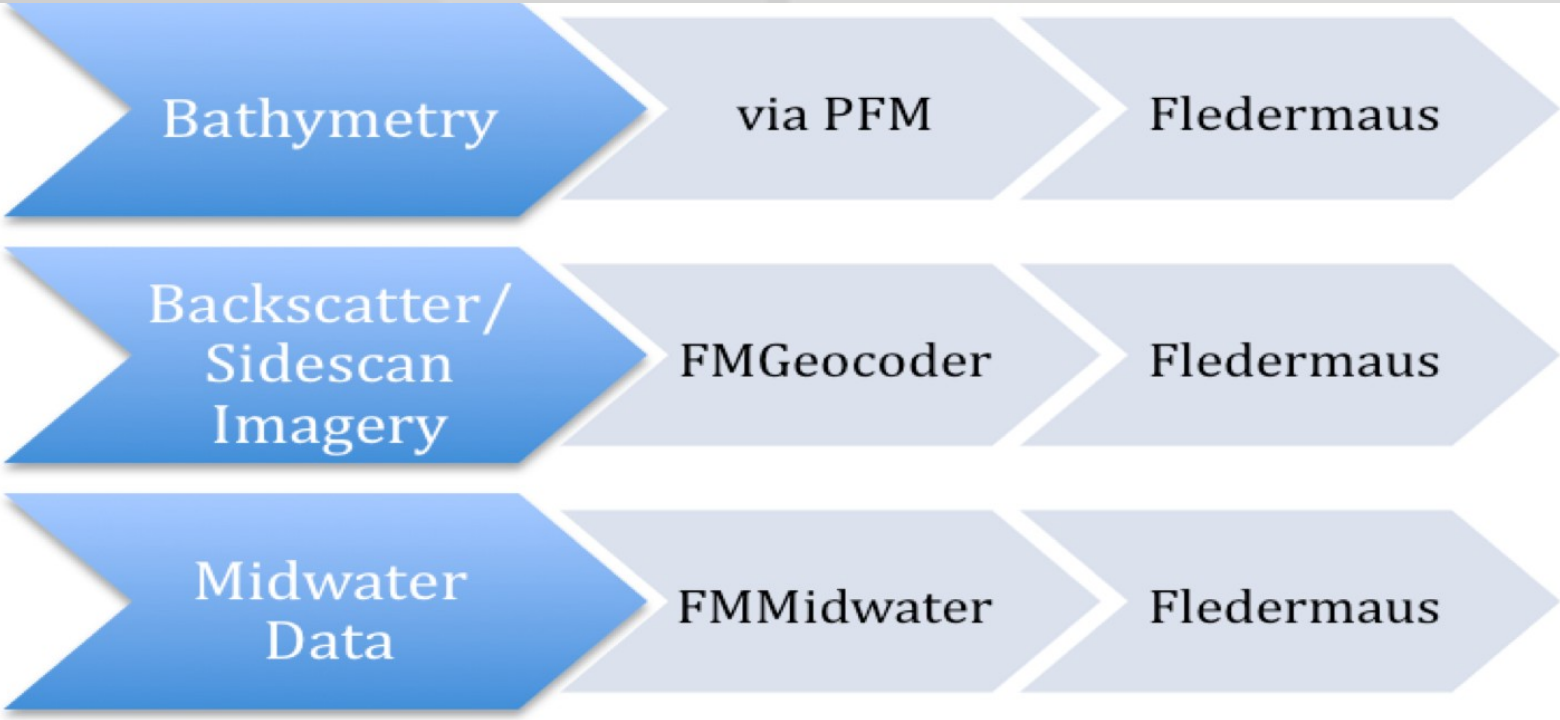
Challenges


Data Collection Rate of Multibeam Sonars
Soundings Collected Per Second
25,000
20,000
15,000
10,000
5,000
0
Reson
Simrad
9001
9003
8101
8111
8125
7125
950
952 / 1000
1002 / 3000
3002
710
1993
1995
1997
1999
2001
2003
2005
Year

Processing Flows

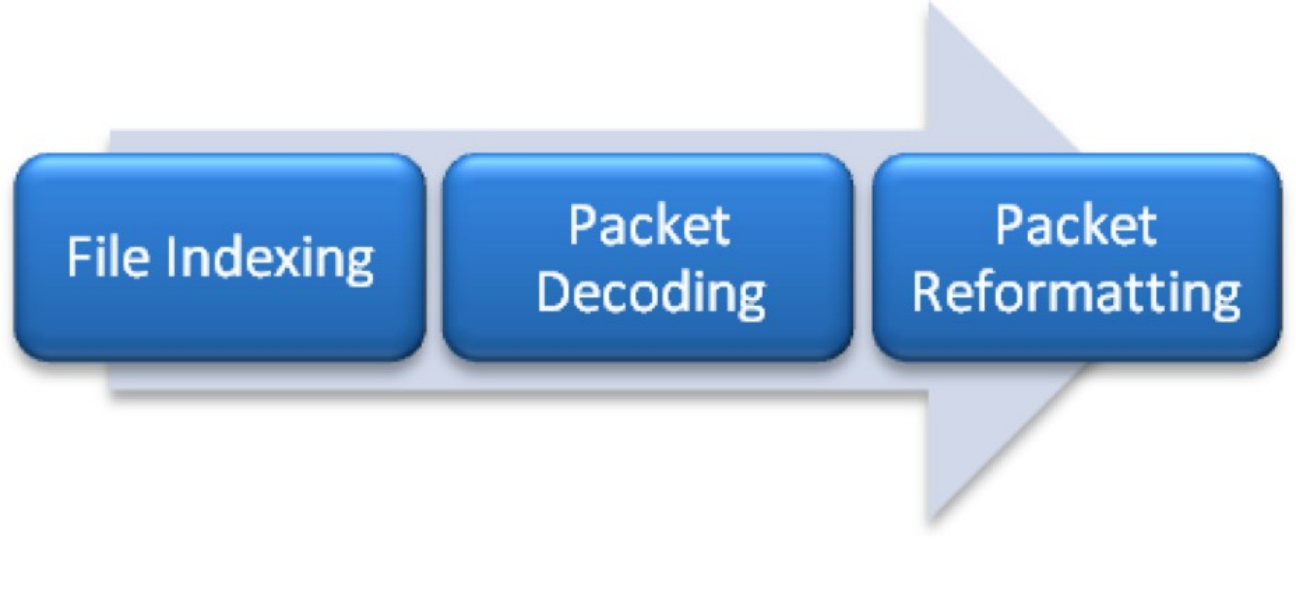


Midwater Challenge

- Data Density
- Most of the time there isn't much to see
- Different manufacturer have different storage schemes.

- Desire for a suitable and Open Format

The GWC Format

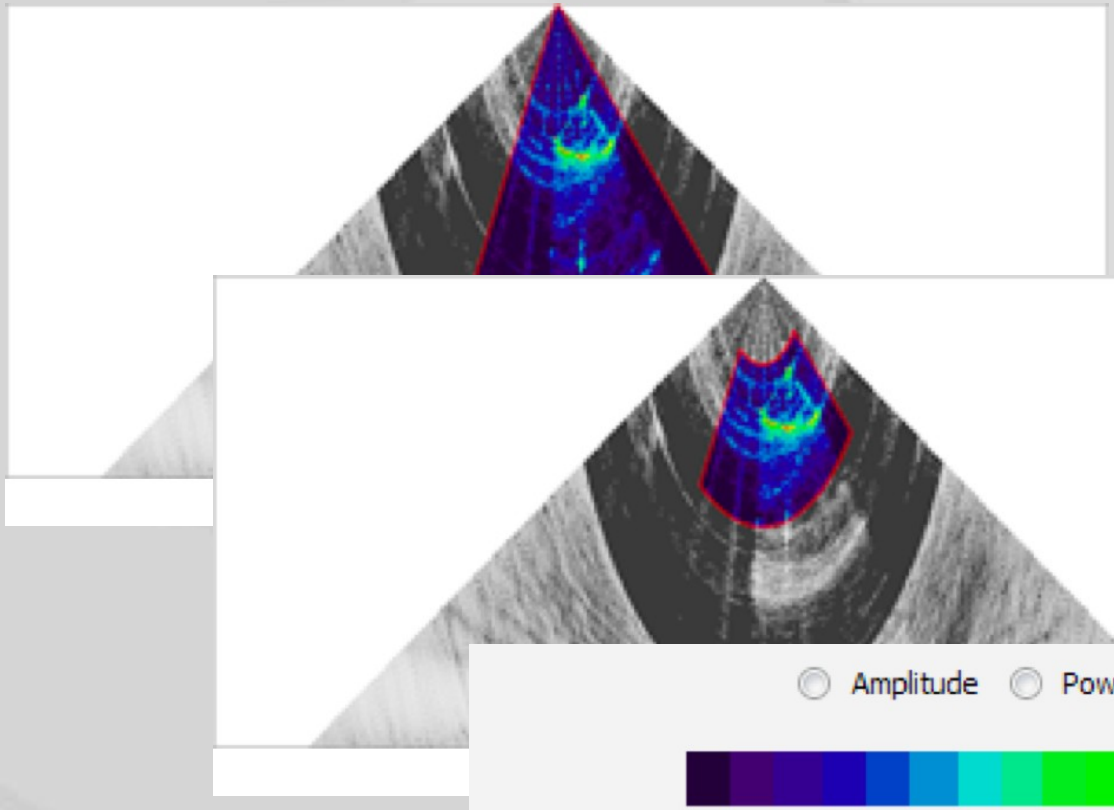


- Integrated ping based packets with TS & sync'd nav and attitude.
- Parsers for Kongsberg, Reson, Imagenex, XTF, etc.
- External navigation can come from POSPac and GSF.

Feature Extraction

- Method of feature extraction
  - No automatic feature detection
  - Provide tools for feature examination and visualization.
    - Fan View/Stack View
    - Ability to control the time range and beam range of interest
    - Ability to zoom in on the histogram of resulting intensities.
  - Data sent to Fledermaus for 4D visualization and analysis.

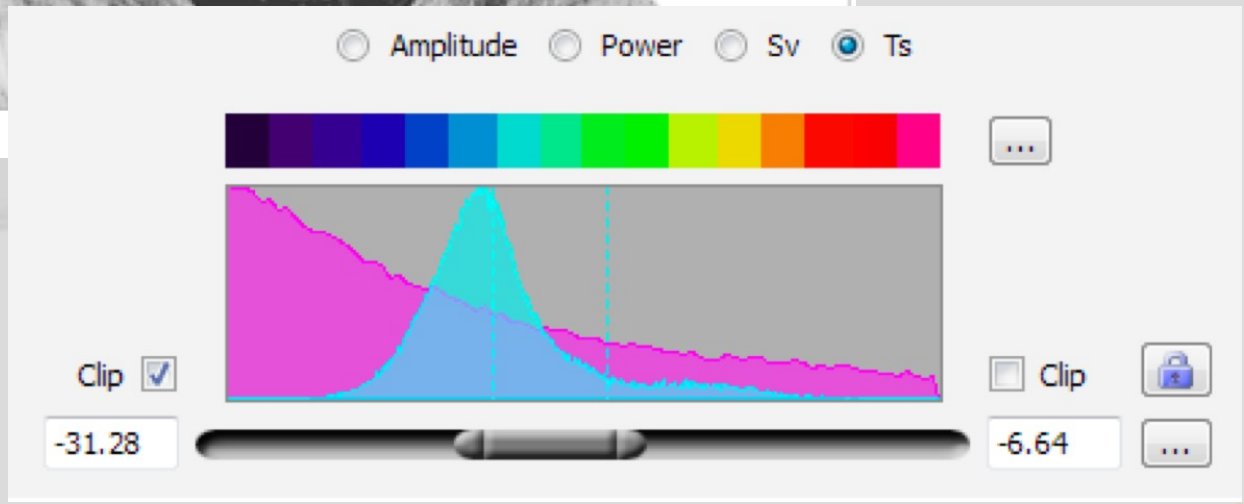
Midwater Processing

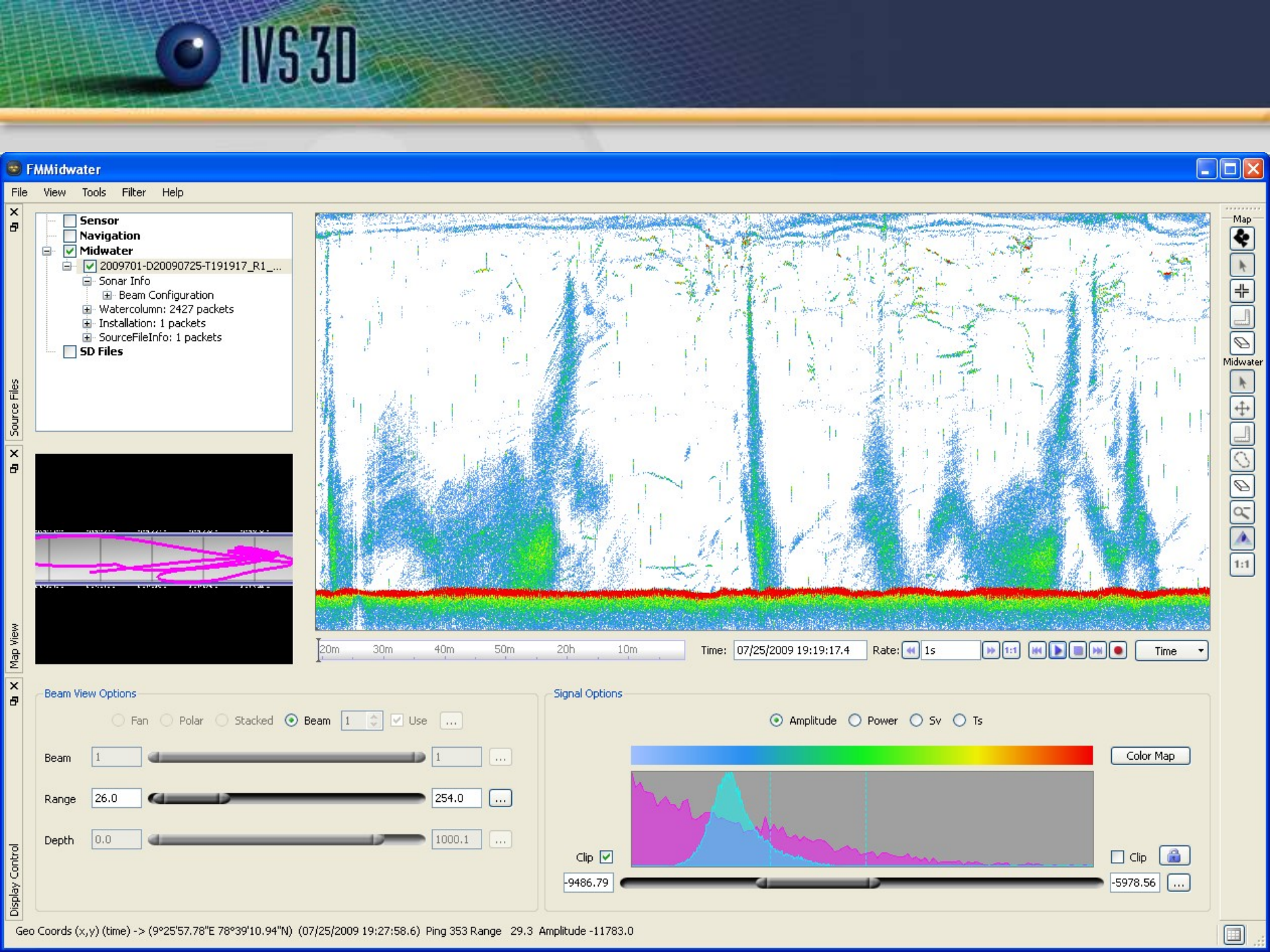


Beam Limiting

Range Limiting

Histogram Limiting

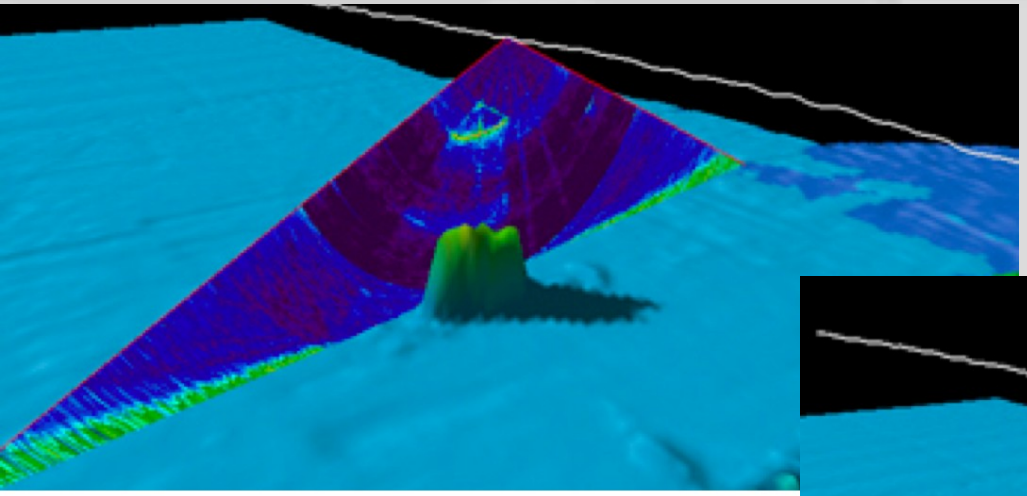


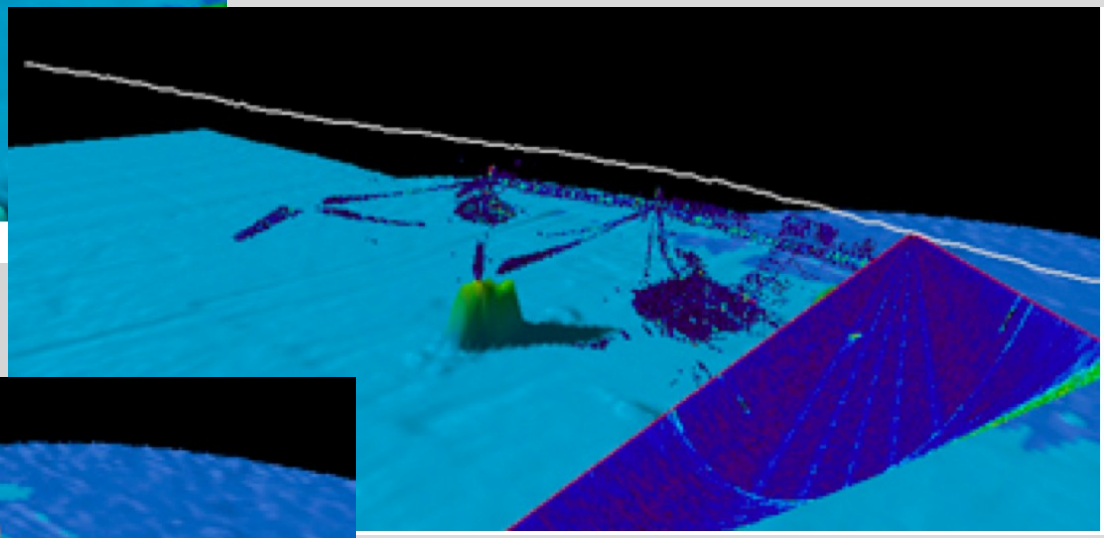

IVS 3D
FMMidwater
File
View
Tools
Filter
Help
Sensor
Navigation
Midwater
2009701-D20090725-T191917_R1_...
Sonar Info
Beam Configuration
Watercolumn: 2427 packets
Installation: 1 packets
SourceFileInfo: 1 packets
SD Files
Source Files
Map View
Display Control
Map
Midwater
1:1
20m
30m
40m
50m
20h
10m
Time:
07/25/2009 19:19:17.4
Rate:
1s
Time
Beam View Options
Fan
Polar
Stacked
Beam
Use
Beam
Range
26.0
254.0
Depth
0.0
1000.1
Signal Options
Amplitude
Power
Sv
Ts
Color Map
Clip
-9486.79
Clip
-5978.56
Geo Coords (x,y) (time) -> (9°25'57.78"E 78°39'10.94"N) (07/25/2009 19:27:58.6) Ping 353 Range 29.3 Amplitude -11783.0

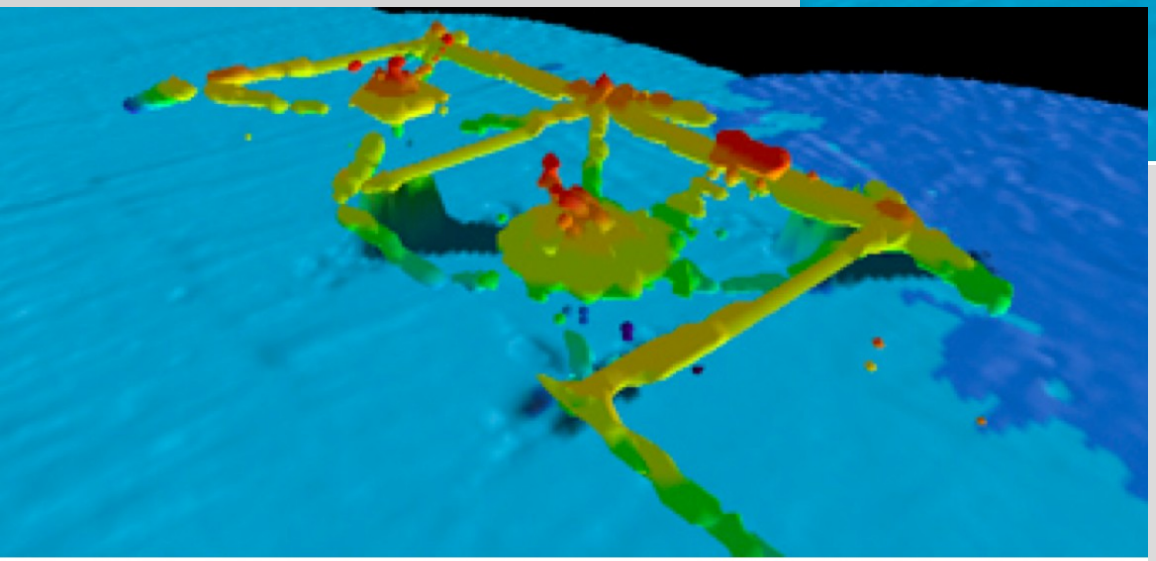
GWC Visual Modalities

- Beam Time Series Curtain
- Ping Fan over time
- 3D Points from resulting features (time tagged)
- 3D Volume with ISO surface visualization

GWC Visual Modalities



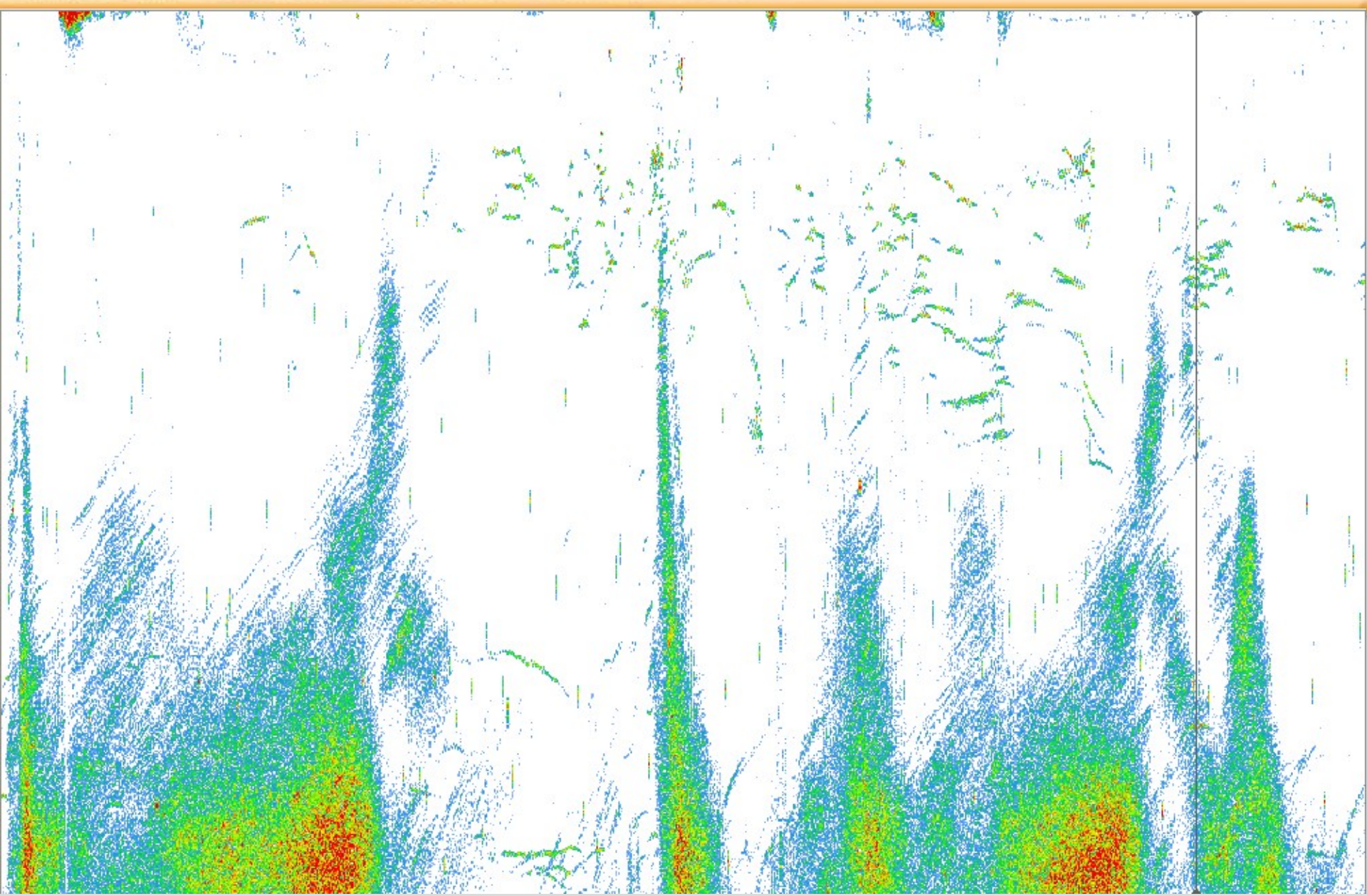




Svalbard Single Beam Survey

- Kongsberg ES60 Survey
  - Jens Greinert
  - Data collected offshore of Svalbard on the RV Jan Mayen (University of Tromsoe)
  - Data collected in 3 frequencies
    - 18 KHz, 38 KHz, 120 KHz

Svalbard ES60 Singlebeam - 18 KHz



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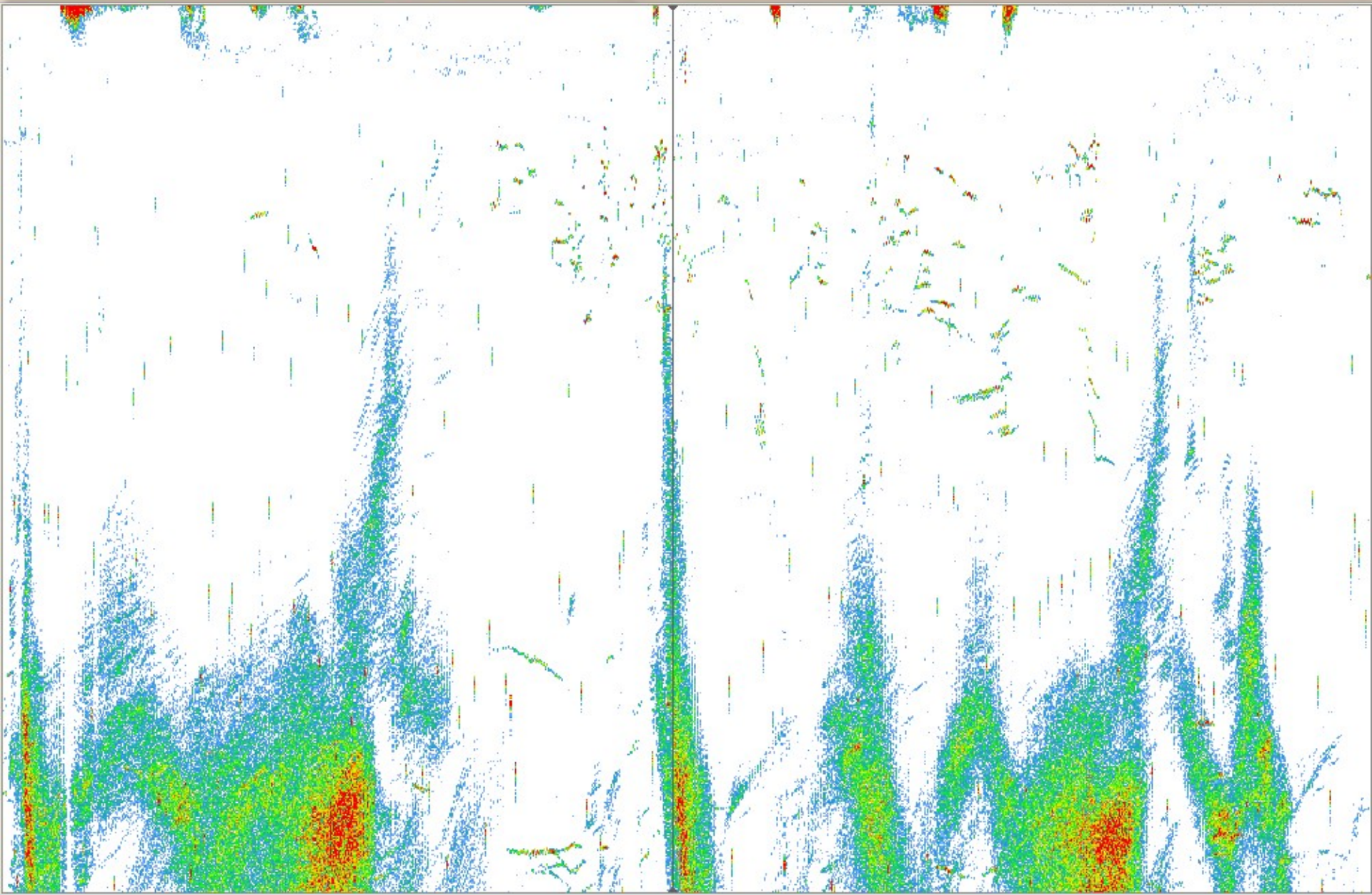
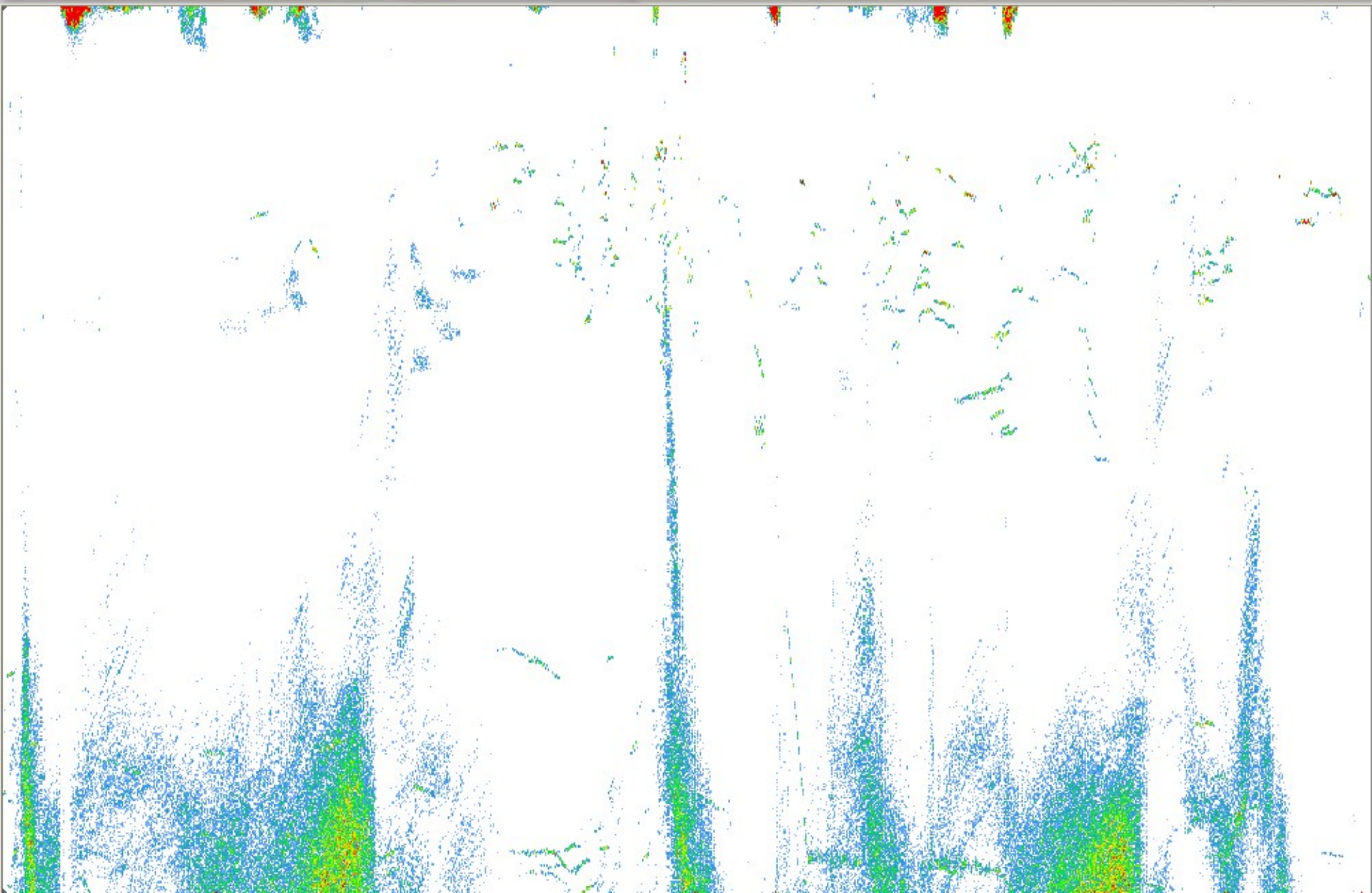
Svalbard ES60 Singlebeam - 38Khz



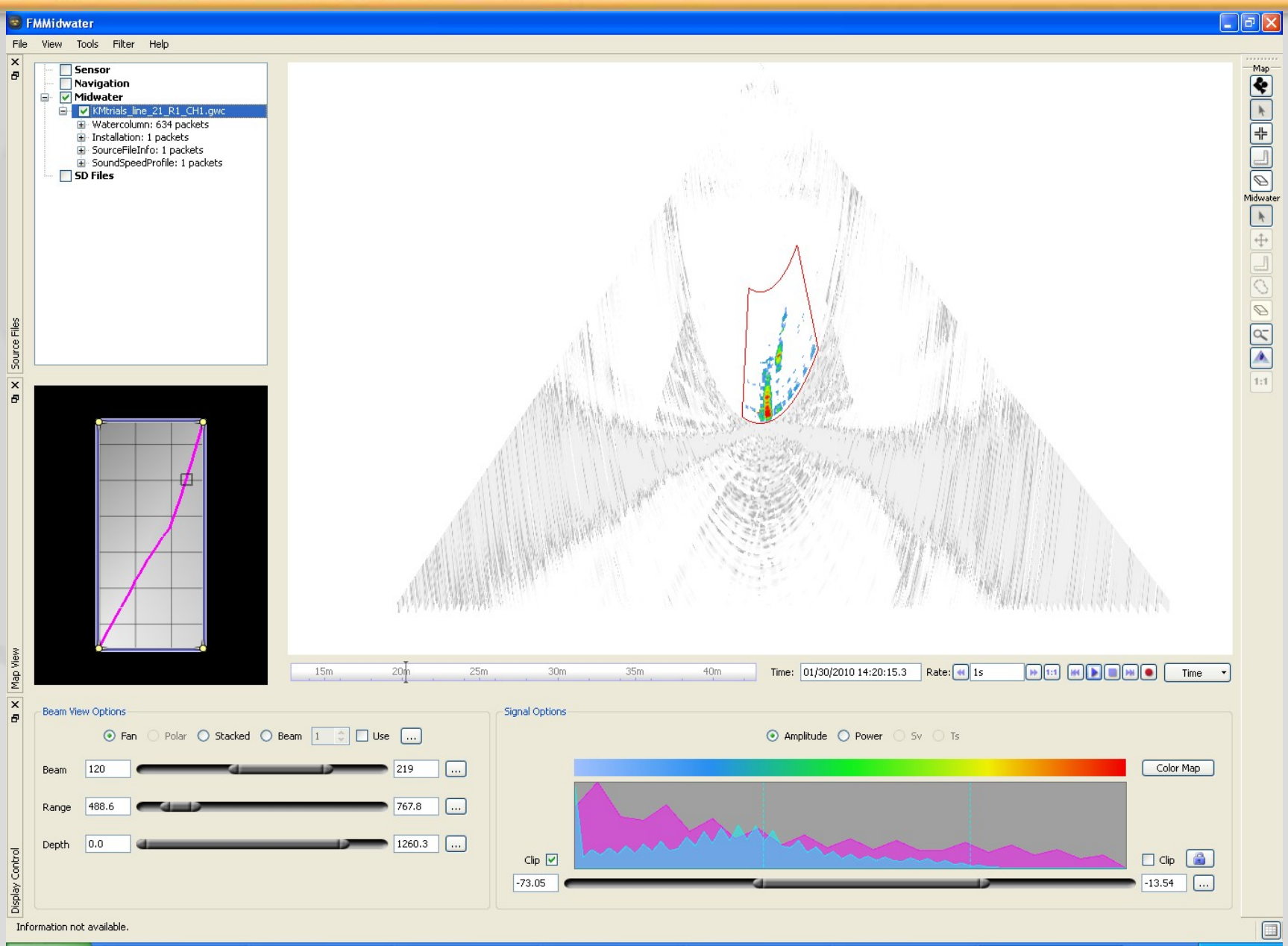
Svalbard ES60 Singlebeam – 120 Khz



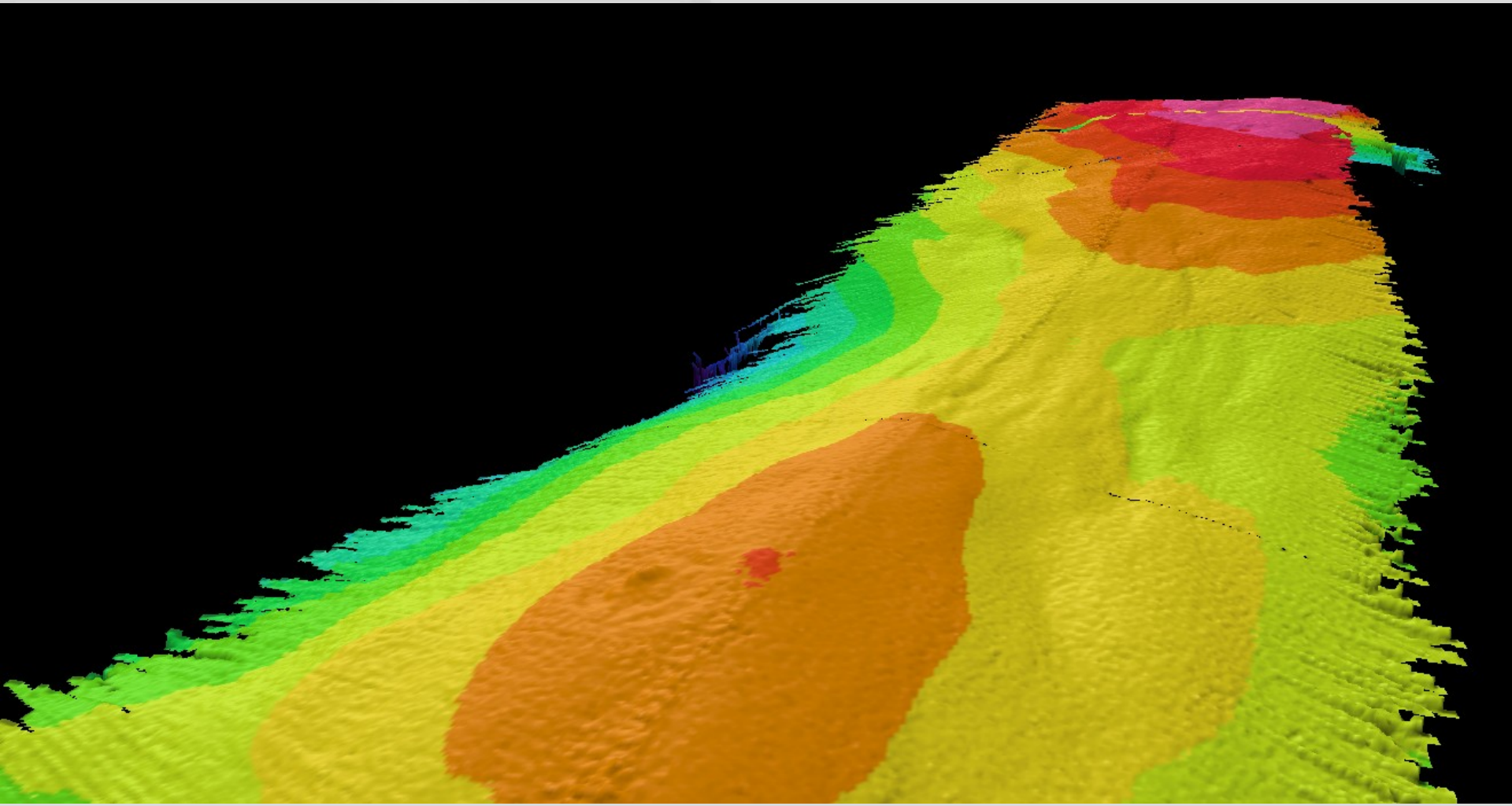
Hydrate Ridge

- EM122 Sea Acceptance Trials
- Known area of hydrate plumes
- Interested to see whether the sonar would pick up the plume at 12Khz

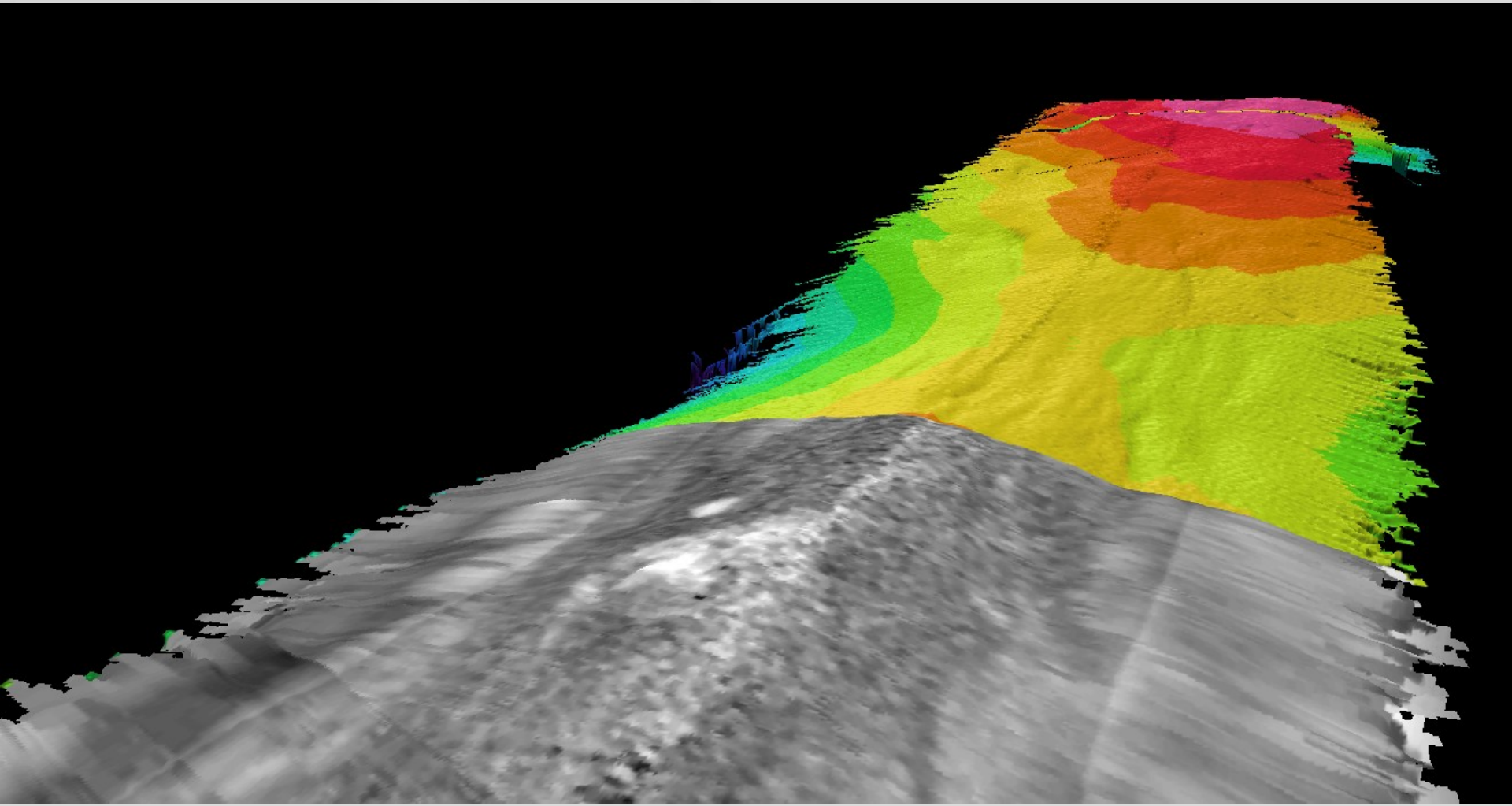
FM Midwater – Fan View



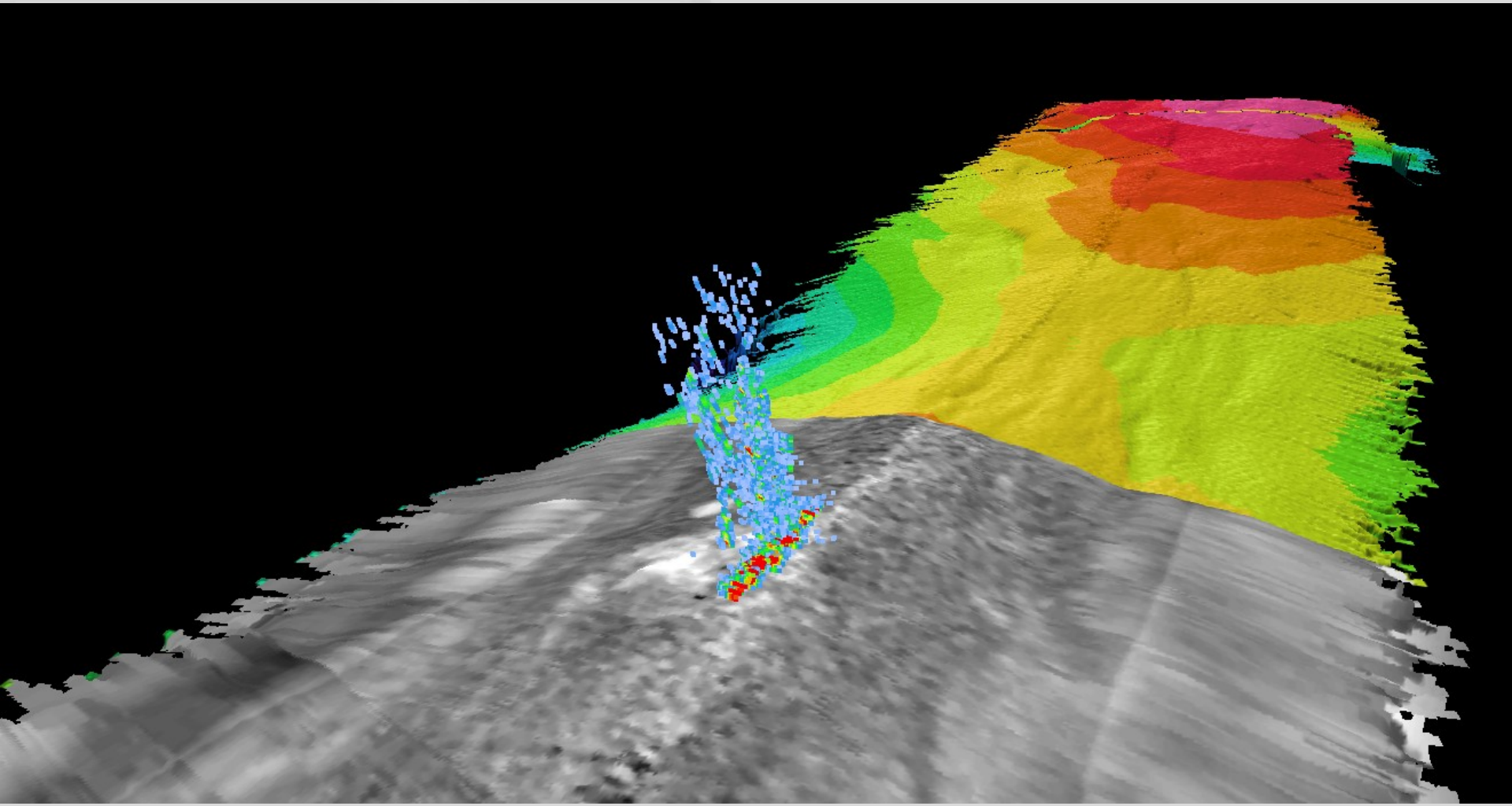
Hydrate Ridge - Bathy



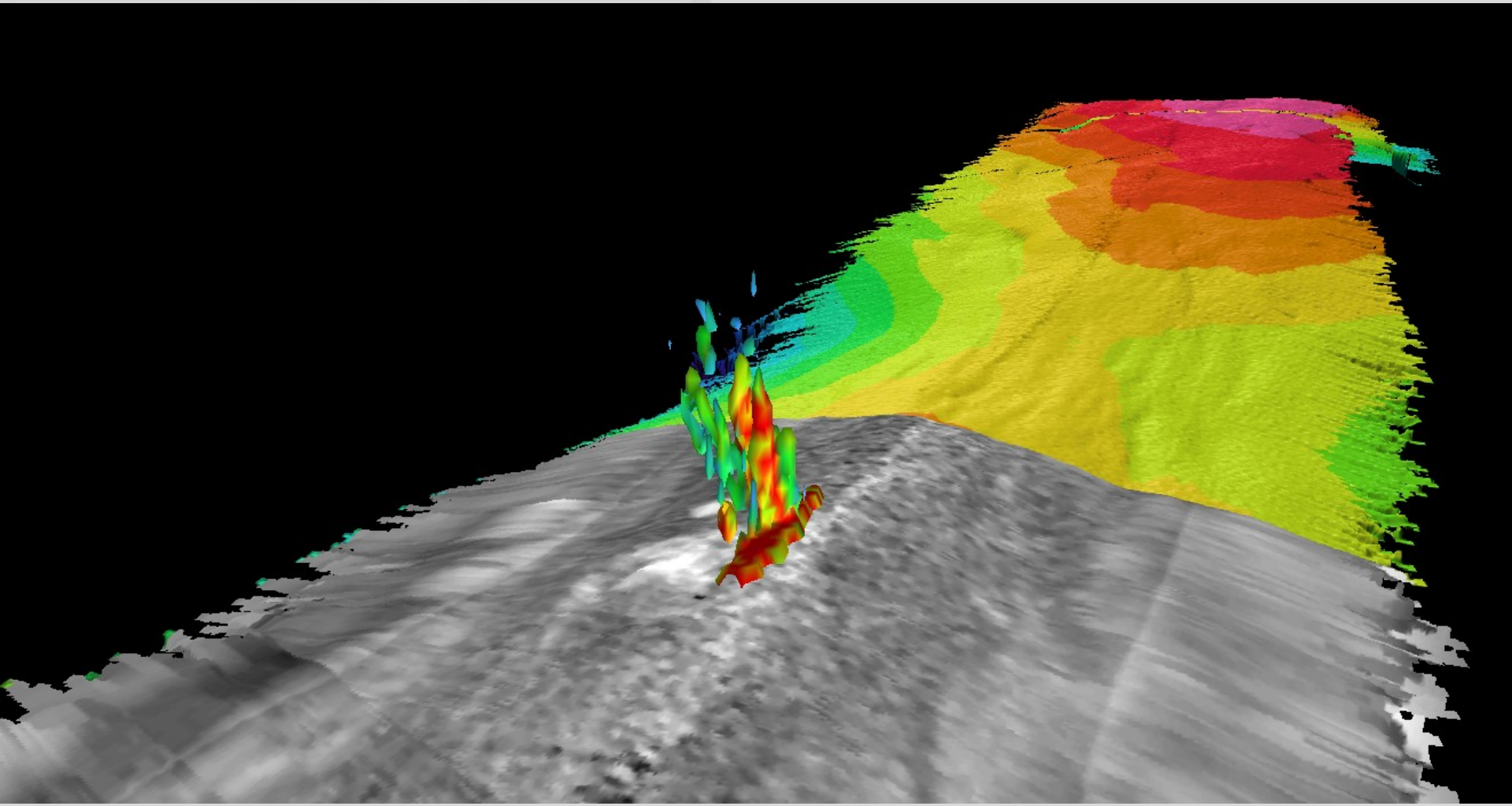
Hydrate Ridge

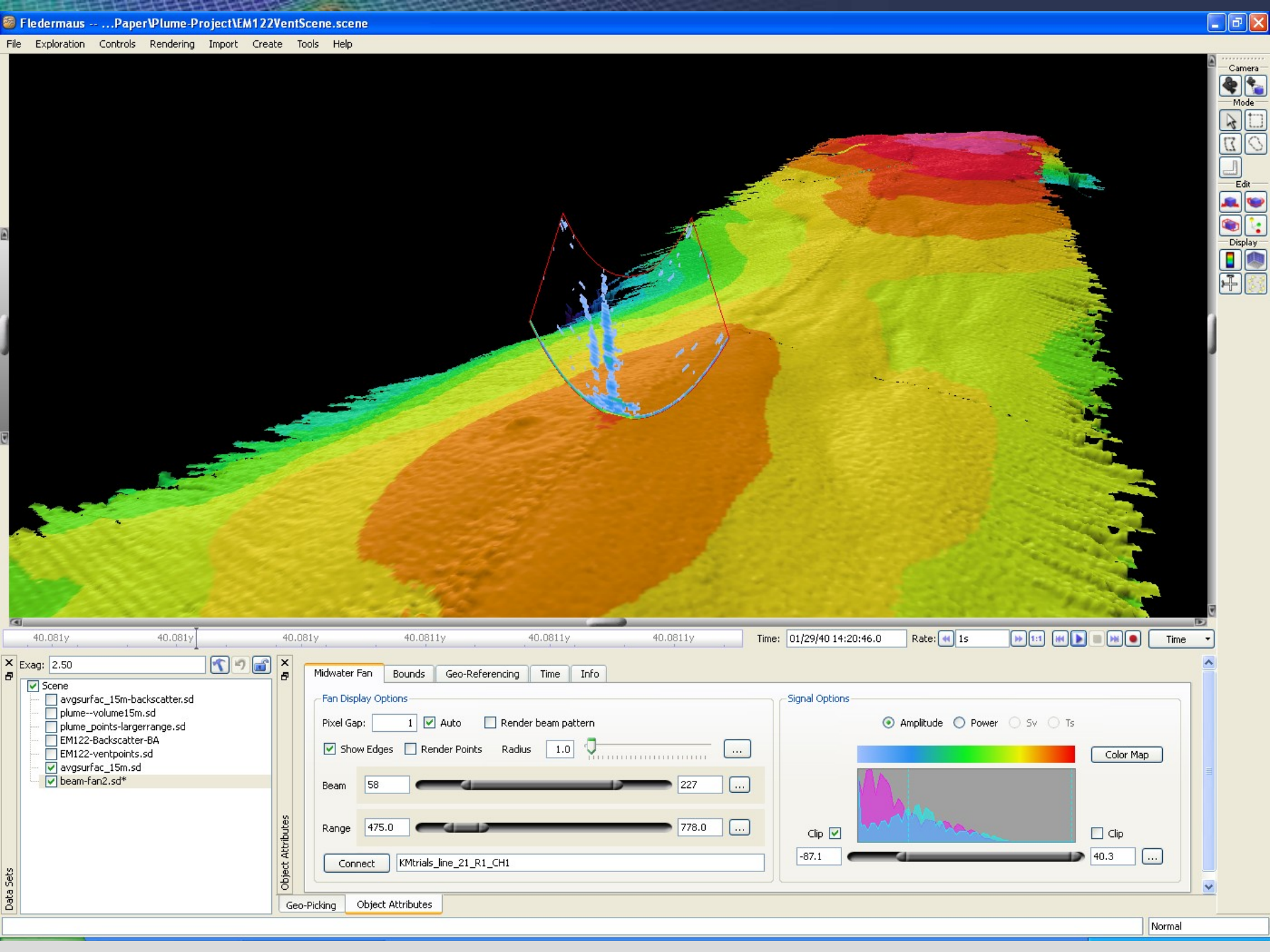


Hydrate Ridge

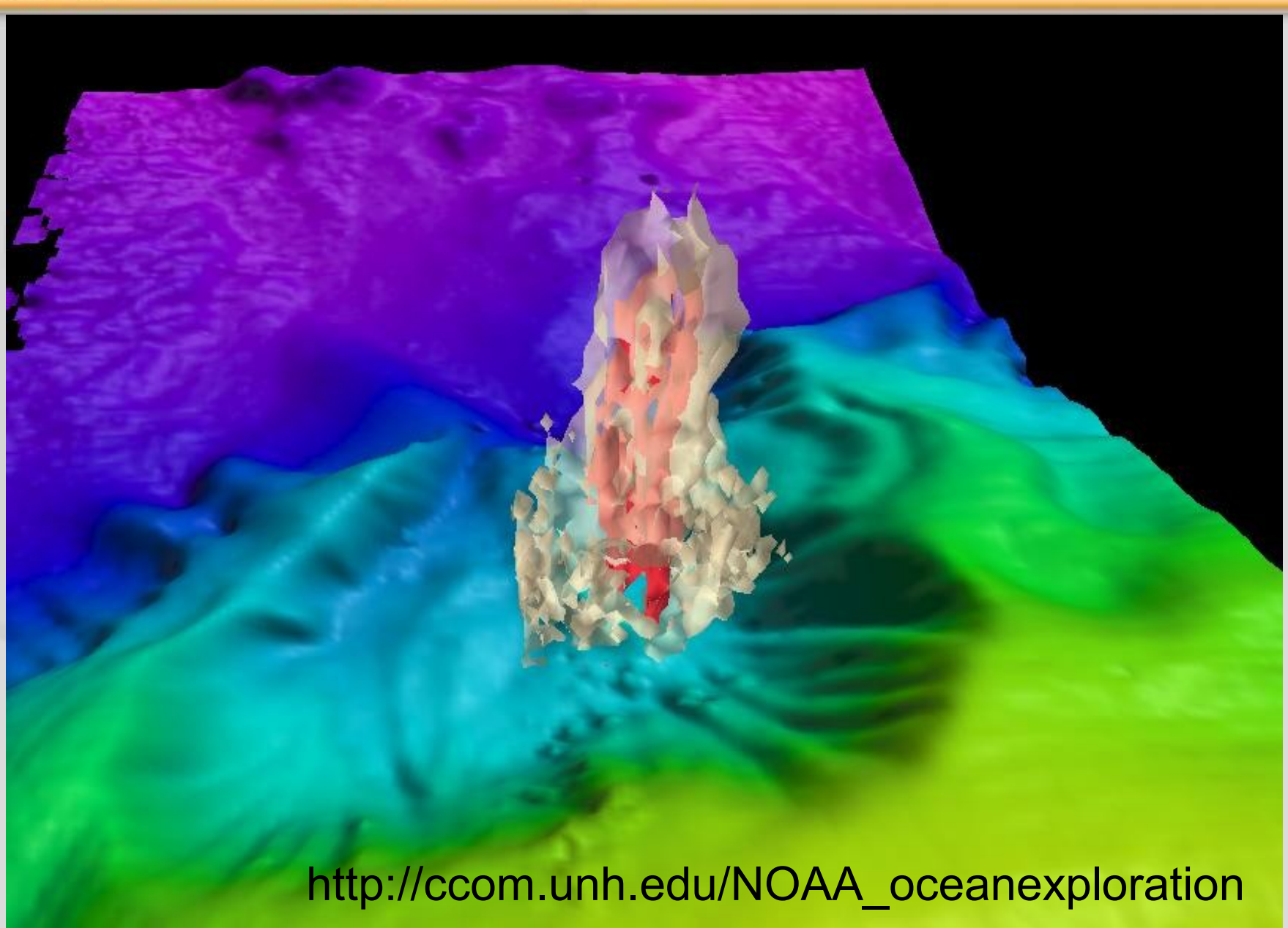


Hydrate Ridge




Fledermaus -- ...Paper\Plume-Project\EM122VentScene.scene
File Exploration Controls Rendering Import Create Tools Help
Camera
Mode
Edit
Display
40.081y 40.081y 40.081y 40.0811y 40.0811y 40.0811y
Time: 01/29/40 14:20:46.0 Rate: 1s 1:1 Time
Exag: 2.50
Scene
avgsurfac_15m-backscatter.sd
plume--volume15m.sd
plume_points-largerrange.sd
EM122-Backscatter-BA
EM122-ventpoints.sd
avgsurfac_15m.sd
beam-fan2.sd*
Data Sets
Object Attributes
Midwater Fan Bounds Geo-Referencing Time Info
Fan Display Options
Pixel Gap: 1 Auto Render beam pattern
Show Edges Render Points Radius 1.0
Beam 58 227
Range 475.0 778.0
Connect KMtrials_line_21_R1_CH1
Signal Options
Amplitude Power Sv Ts
Color Map
Clip
-87.1
Clip
40.3
Geo-Picking Object Attributes
Normal

Mendincino - NOAA Ship Okeanos



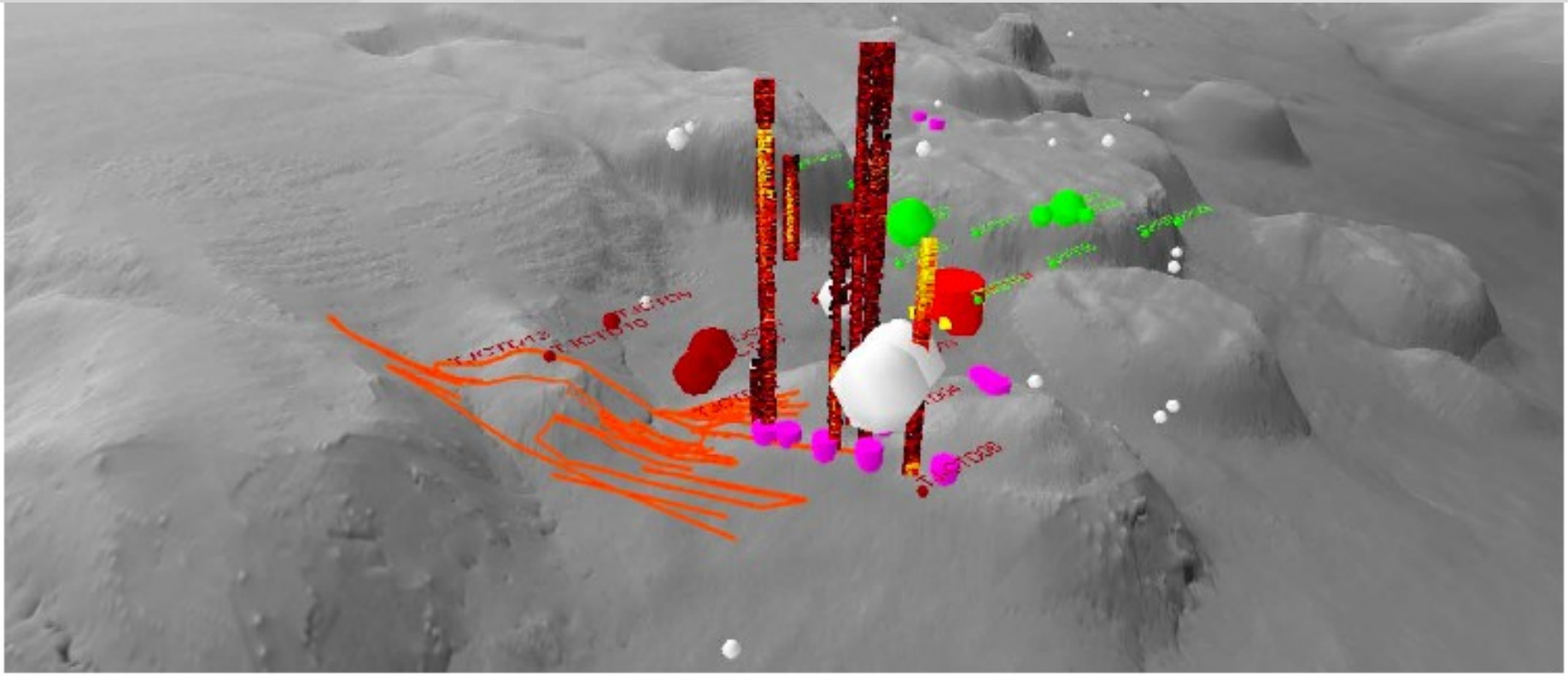


Figure 20. Natural seeps (red and yellow columns) mapped by *Thomas Jefferson*, and by *Gordon Gunter* (purple cylinders) along with CTD stations showing high fluorescence (brown, green and white spheres). Deepwater Horizon well site is in background (red cylinder) and distribution of Bottom Following Reflectors is represented by orange lines.

Conclusion

As the latest sonar system hardware leads the way providing new capabilities it is our goal as a software vendor to provide the tools to maximize the investment you've made in that hardware.

GWC Format Information

Request the GWC format via email:

support@ivs3d.com

We will post the format on the web:

http://www.ivs3d.com/support/gwc