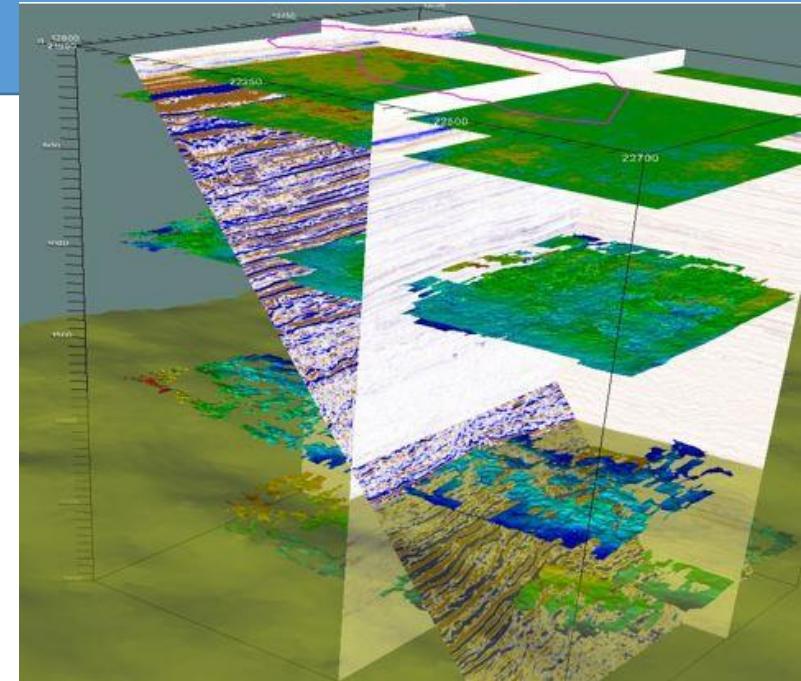
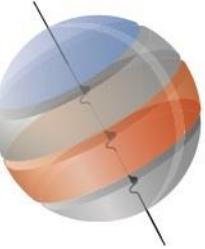


# Geo-4D

*Geoconsulting excellence*



## An overview of 3D Ground Modelling, Visualisation and Probabilistic Risk Analysis

Joe Durrant

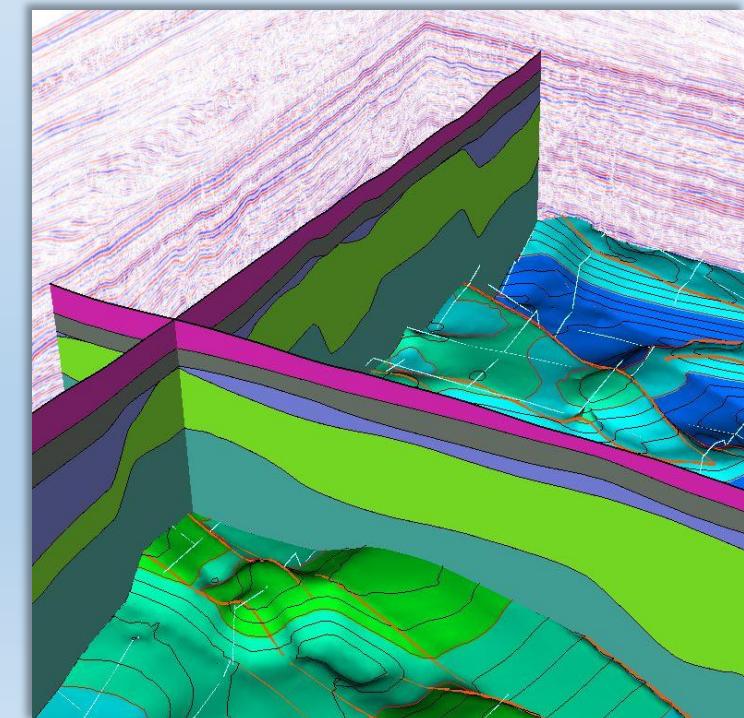
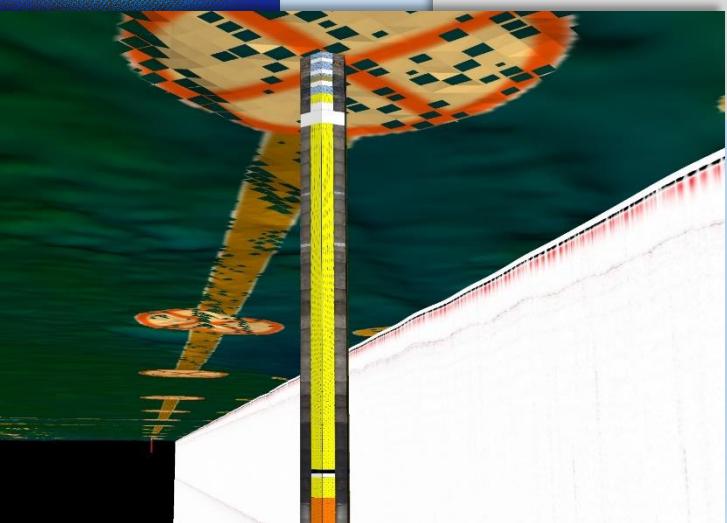
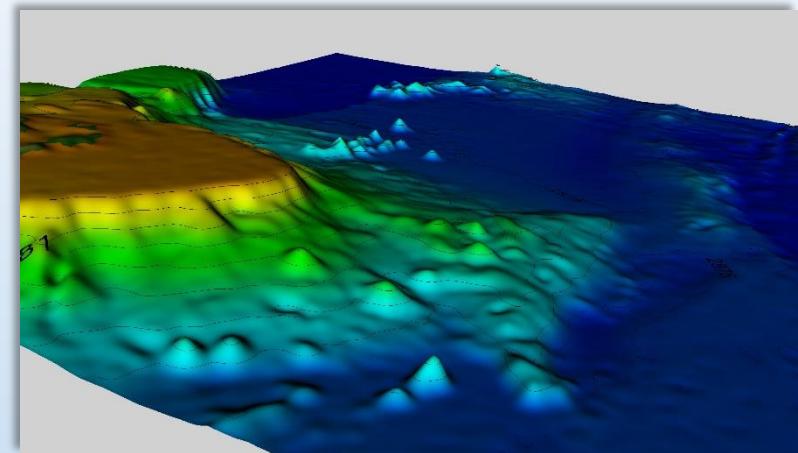
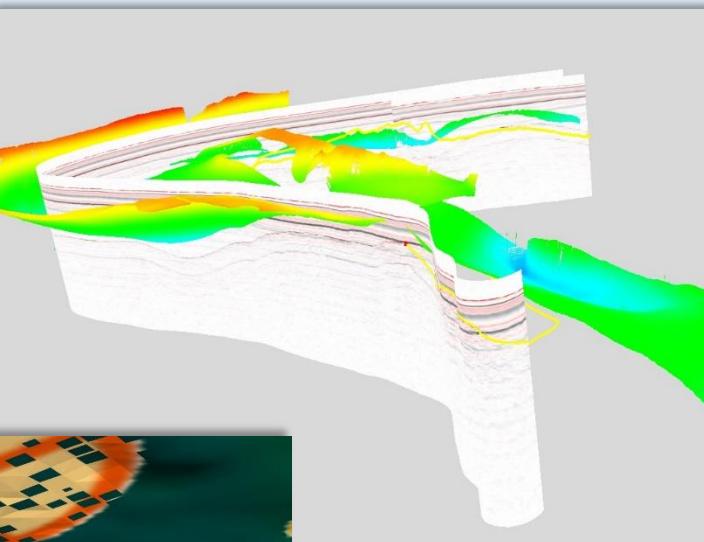
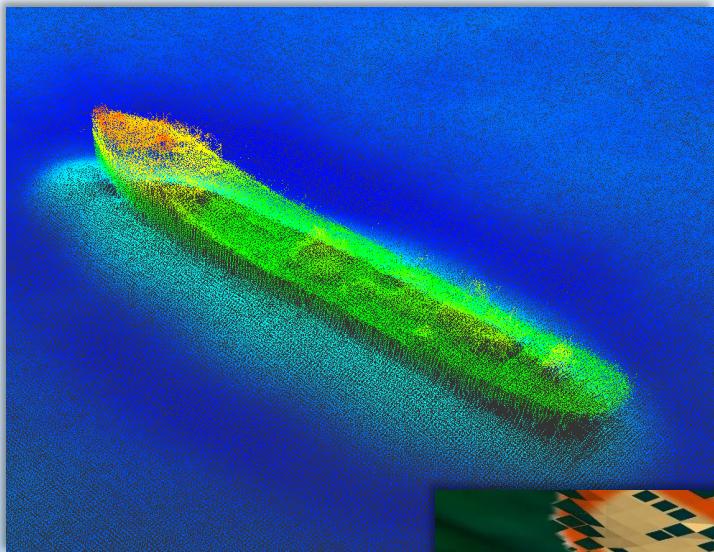


Geo-4D



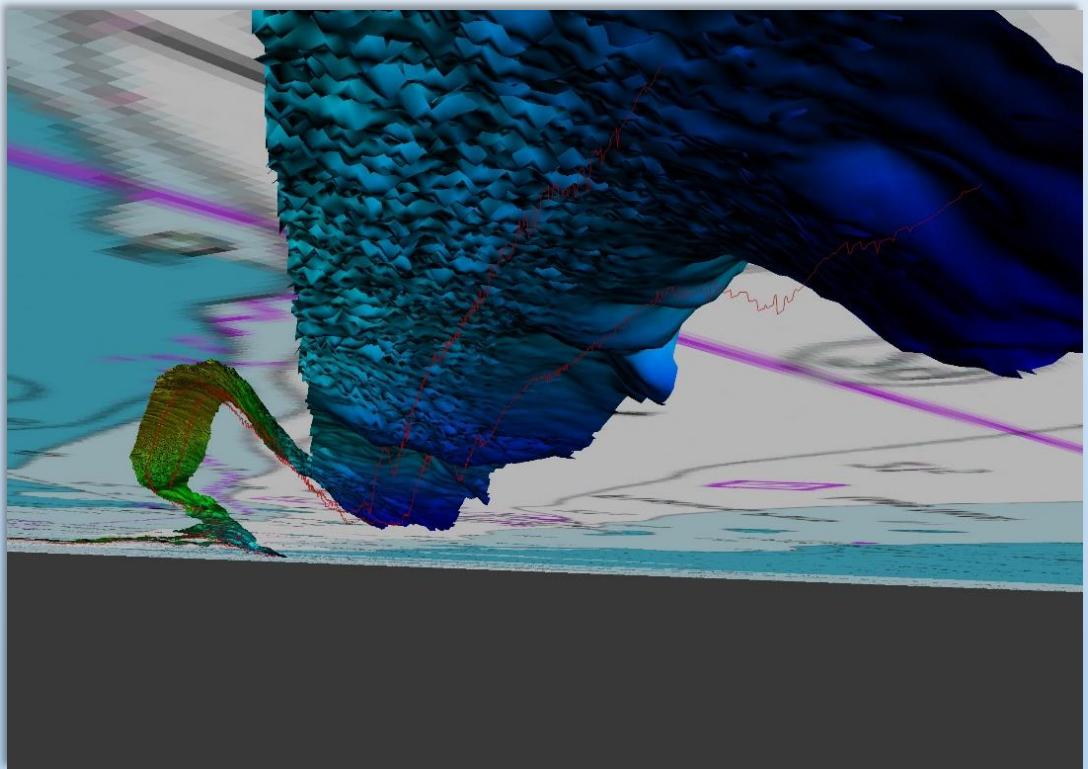


## Ground Modelling in Geocap



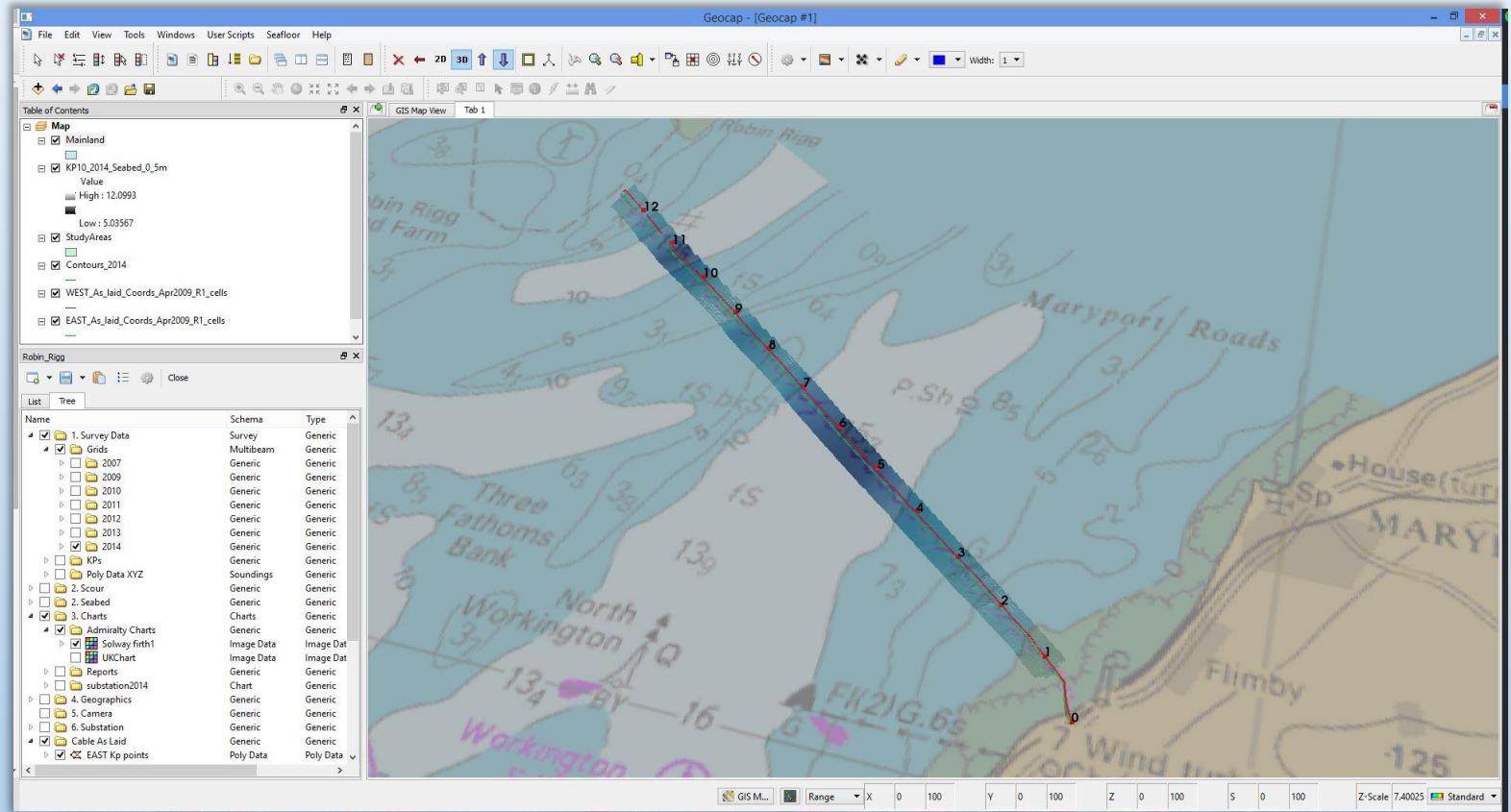
## Geo-4D Applications of Geocap

- Detailed seafloor analysis
- Cable burial assessments
- Modelling bed-form migration  
From comparison of time series data
- Direct export to ArcGIS
- Probabilistic risk analysis – heat map deliverables



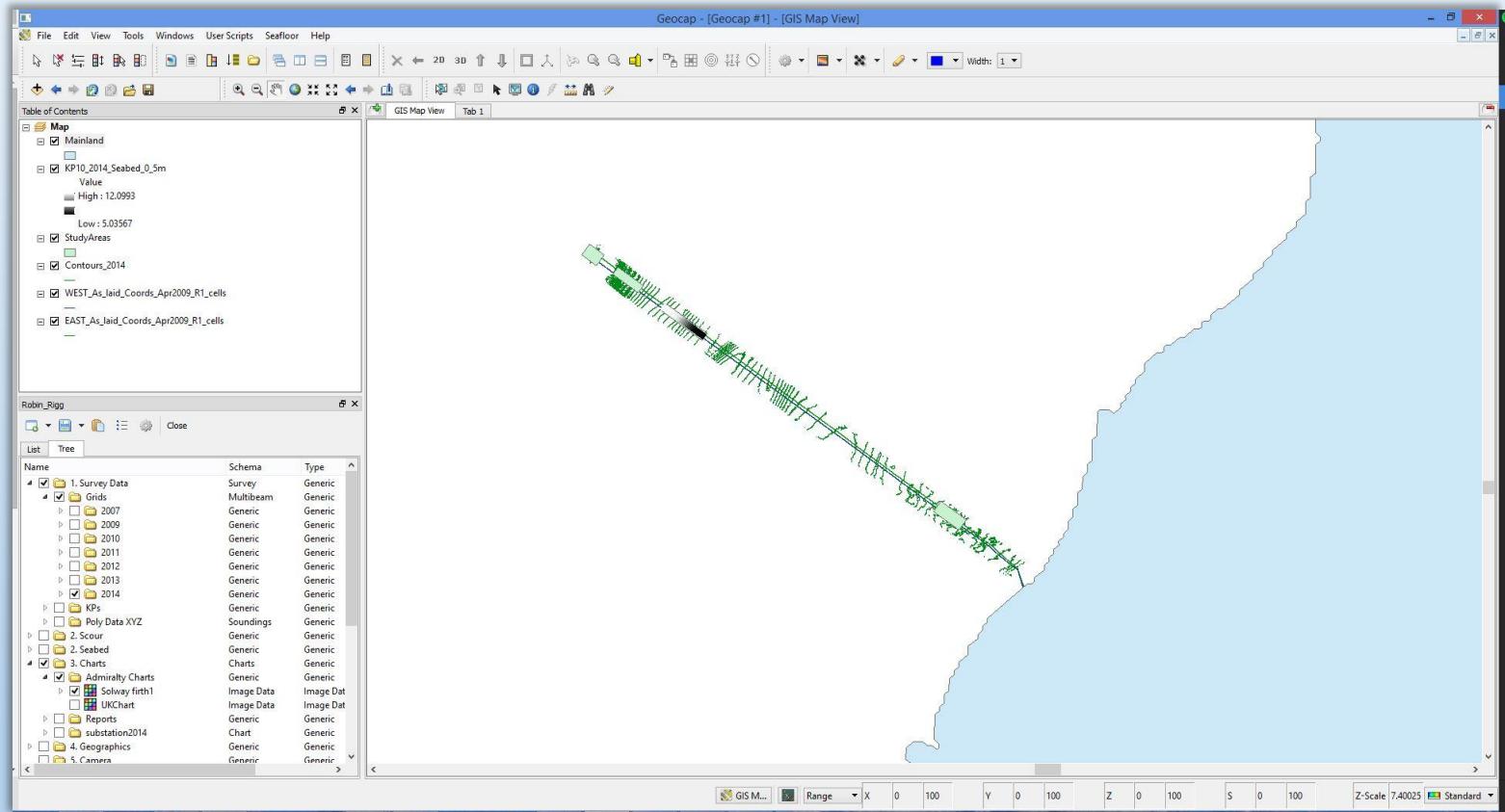
## Data Assimilation and 3D Visualisation

- **Multiple features/data**
  - Bathymetry
  - Cable burial depth
  - KP markers
  - Admiralty Charts
  - Aerial photography
  - Sub bottom profiles
- **Time series analysis**
  - Scour/bedform migration plots
- **Slope Analysis**
  - UNCLOS



## Native ArcGIS window in Geocap – Seamless data integration

- **ArcGIS Functionality**
  - Geodatabase creation
  - Feature class creation
  - Raster conversion
  - Simplified map layer organisation + visualisation
  - Dedicated Arc Toolbars
  - Export Shapefiles, tables etc..



## Probabilistic Risk Assessment of Anchor drag and anchor drop.

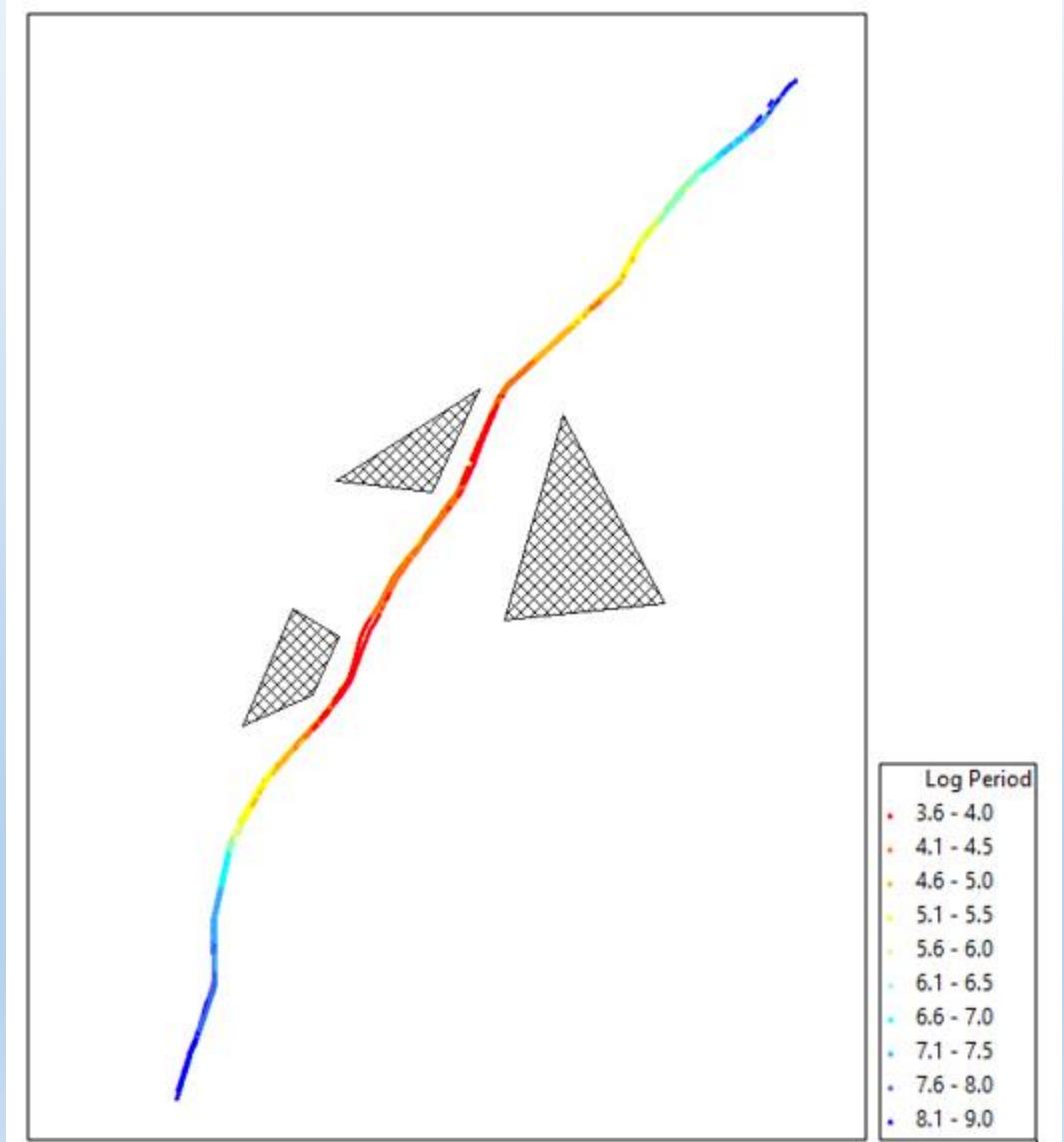
Anchor drag captures the chance that a vessel will drag it's anchor from an anchorage, across the cable. The risk is primarily dependent on the vessel traffic density combined with wind strength and direction, the burial depth, and the anchor penetration.

Anchor drop captures the chance that a passing vessel will drop it's anchor onto the cable. This is a much smaller risk than anchor drag.

Sediment mobility is also taken into account which modifies the burial depth in that area, which changes the risk profile.

It is possible to extend the model to take into account activities such as dredging and fishing.

Here is an example of a risk map from three anchorages. The period corresponds to the expected period, in years, between cable damage events. It uses burial depth information corrected for sediment mobility.





## Probabilistic Analysis – Sneak peek

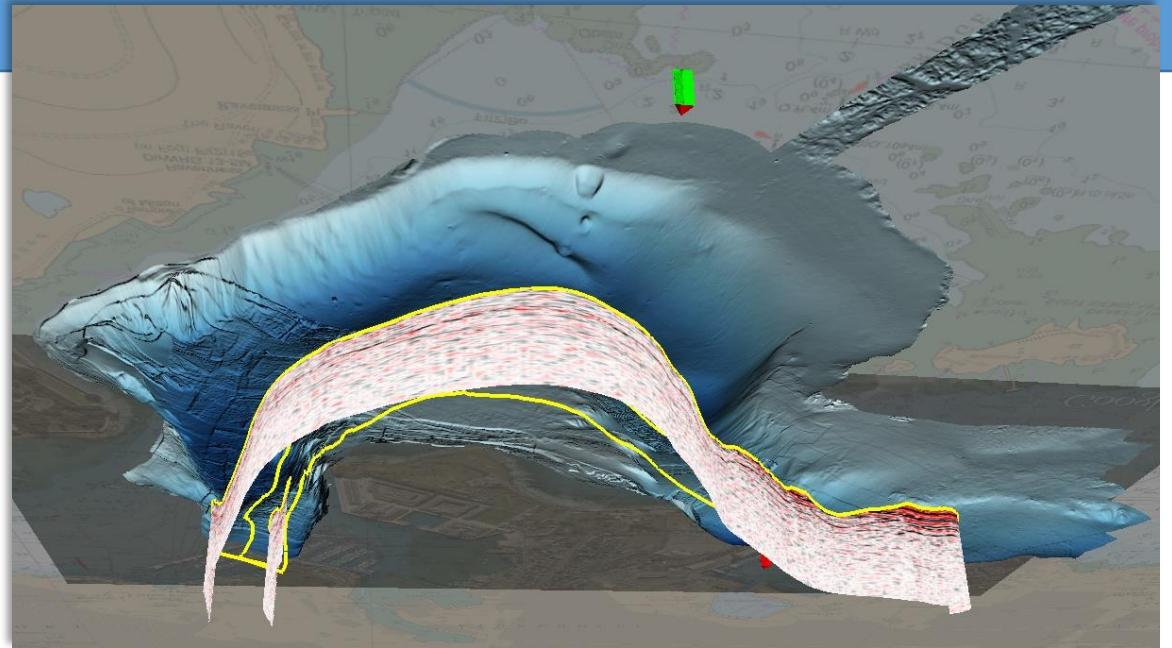
The screenshot shows the Geo-4D software interface. It includes two windows for "West cable" and "East cable", both displaying logs of data parsing and simulation parameters. Below these are two Notepad windows: "sum - Notepad" which contains a summary of completed simulations, and "cab - Notepad" which contains a detailed log of individual simulation runs with columns for X, Y, KP, Damage Period, and Log Damage Period.

**sum - Notepad**

```
Completed 100 simulations.  
Anchor drag:  
Towards cable 42.0 times (42.0%). Period = 6.19 years.  
Reached cable 3.7 times (3.70%). Period = 70.247 years.  
Damaged cable 0.27 times (0.275%). Period = 946.71 years.  
Anchor drop:  
Dropped near cable 11315.37 times. Period = 3054.25 years.  
Damaged cable 2774.24 times. Period = 12457.48 years.
```

**cab - Notepad**

```
X, Y, KP, Damage Period, Log Damage Period  
315929.610, 5865228.070, 10.477, 456154.80166, 5.65911  
315948.540, 5865248.820, 10.505, 306983.80515, 5.48712  
315966.520, 5865268.160, 10.531, 441741.98199, 5.64517  
315985.660, 5865287.340, 10.558, 880968.65324, 5.94496  
316124.700, 5865428.470, 10.756, 5721934.14942, 6.75754  
316146.040, 5865450.110, 10.787, 4838900.10712, 6.68475  
316166.620, 5865471.410, 10.816, 3761470.47698, 6.57536  
316542.260, 5865882.390, 11.372, 9018.77454, 3.95515  
316560.430, 5865902.130, 11.399, 4207.57319, 3.62483  
316576.660, 5865923.610, 11.426, 3216.3482, 3.50736  
316593.370, 5865947.160, 11.455, 1663.10268, 3.22092  
316610.010, 5865970.150, 11.483, 2430.60915, 3.38572  
316625.900, 5865993.080, 11.512, 2430.83517, 3.38576  
316642.310, 5866016.390, 11.541, 9683.94666, 3.98605  
316690.890, 5866084.870, 11.625, 114976.20961, 5.06061  
316707.120, 5866107.740, 11.653, 123644.07335, 5.09217  
316722.920, 5866129.880, 11.680, 129302.14378, 5.11161  
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316770.500, 5866195.990, 11.761, 8749.87201, 3.942  
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316804.140, 5866237.770, 11.815, 7496.32476, 3.87485  
316820.360, 5866258.420, 11.841, 15112.92563, 4.17935  
316836.990, 5866279.070, 11.868, 2540450.33158, 6.40491  
316854.390, 5866300.470, 11.895, 2176836.34709, 6.33783  
316871.690, 5866321.620, 11.923, 2389231.93333, 6.37826  
316888.920, 5866342.100, 11.949, 2479141.3846, 6.3943  
316905.900, 5866362.580, 11.976, 2136784.59596, 6.32976  
316922.300, 5866383.770, 12.003, 2707843.41728, 6.43262  
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316971.970, 5866452.240, 12.088, 7297.21143, 3.86316  
316989.600, 5866476.130, 12.117, 5367.53192, 3.72977  
317006.390, 5866499.210, 12.146, 5296.51146, 3.72399  
317024.700, 5866524.470, 12.177, 119148.86548, 5.07689  
317043.060, 5866549.890, 12.209, 123278.9037, 5.09089  
317061.180, 5866574.880, 12.239, 107838.54692, 5.03277
```



Thank you

