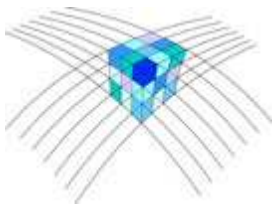


Atlis

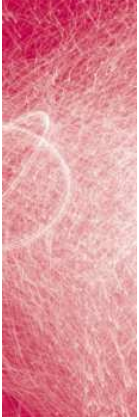
Virtualising large digital terrain model

George Spoelstra



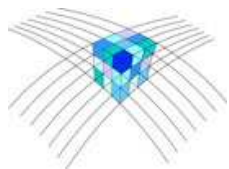
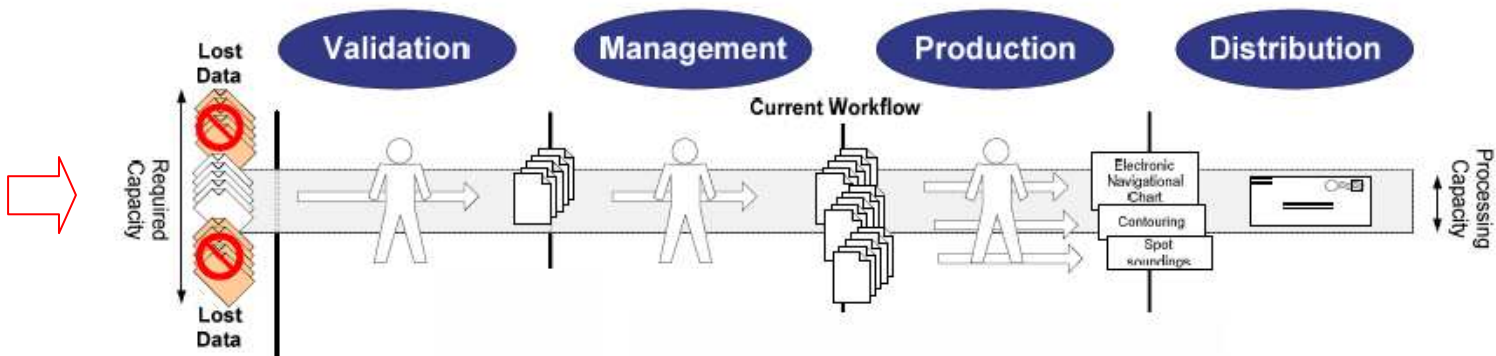
Presentation for the “Management of massive point cloud data:
wet and dry” seminar of the Netherlands Geodetic Commission,
November 2009

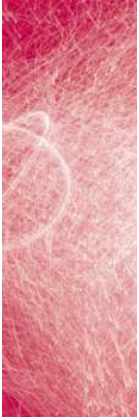




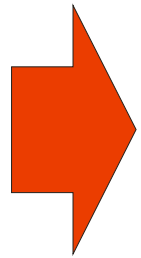
The Hydrographic data value chain

Data Acquisition

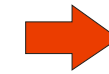




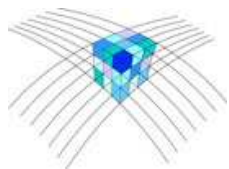
Data management bottleneck



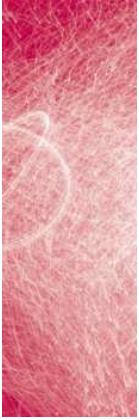
**Too much
input**



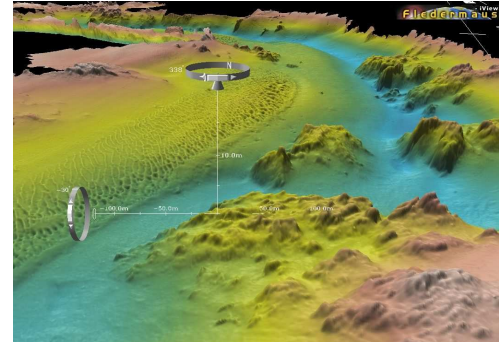
**Too little
output**



Atlis

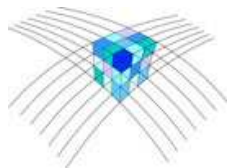


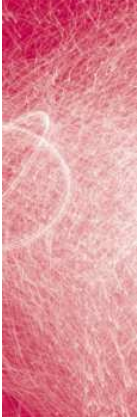
Data Acquisition Evolution of survey systems



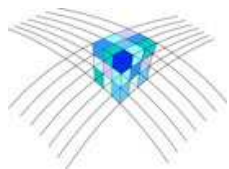
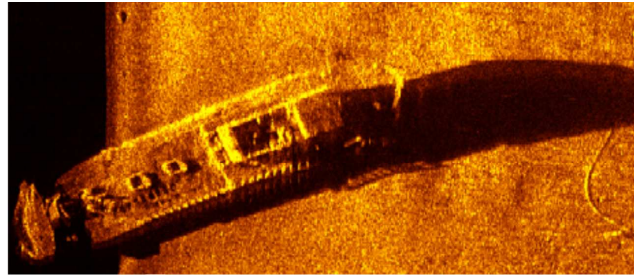
time

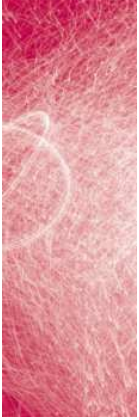
Data volumes





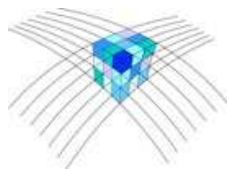
Wide range of users (customers)

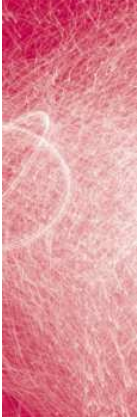




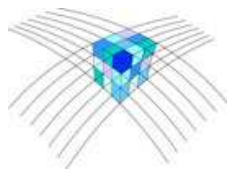
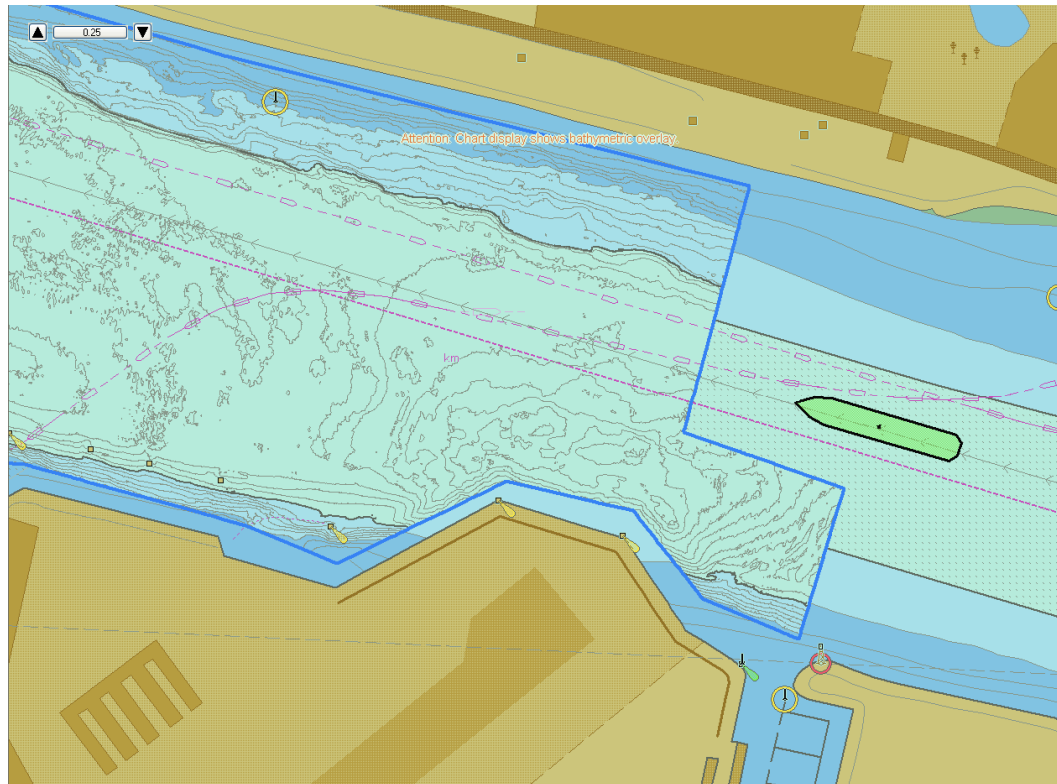
Customer demands are changing

- More data
- Better quality
- Faster delivery
- Open standards





High density bathymetric products



Technology is not so much a problem but timeliness is!

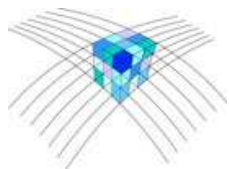


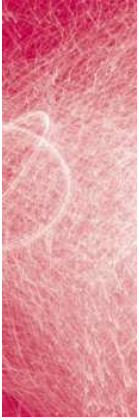


Spatial data infrastructures

- Data producers must comply to SDI frameworks
- Use of open standards
- Internet technology
- Unknown customer

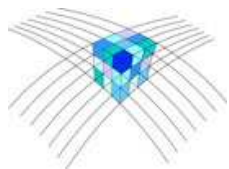
Flexibility

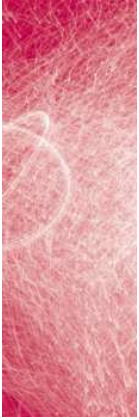




EMODNET project

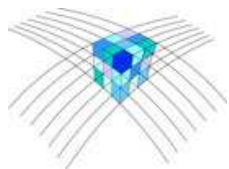
- European Commission demand
- Building of an European Bathymetric Database
- Fully compliant with Inspire Directive
- Data access through the Internet
- Operational in 2012

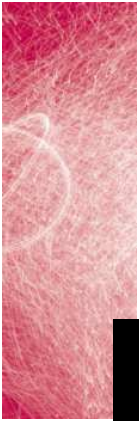




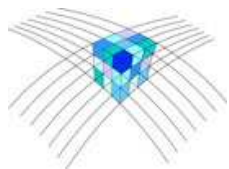
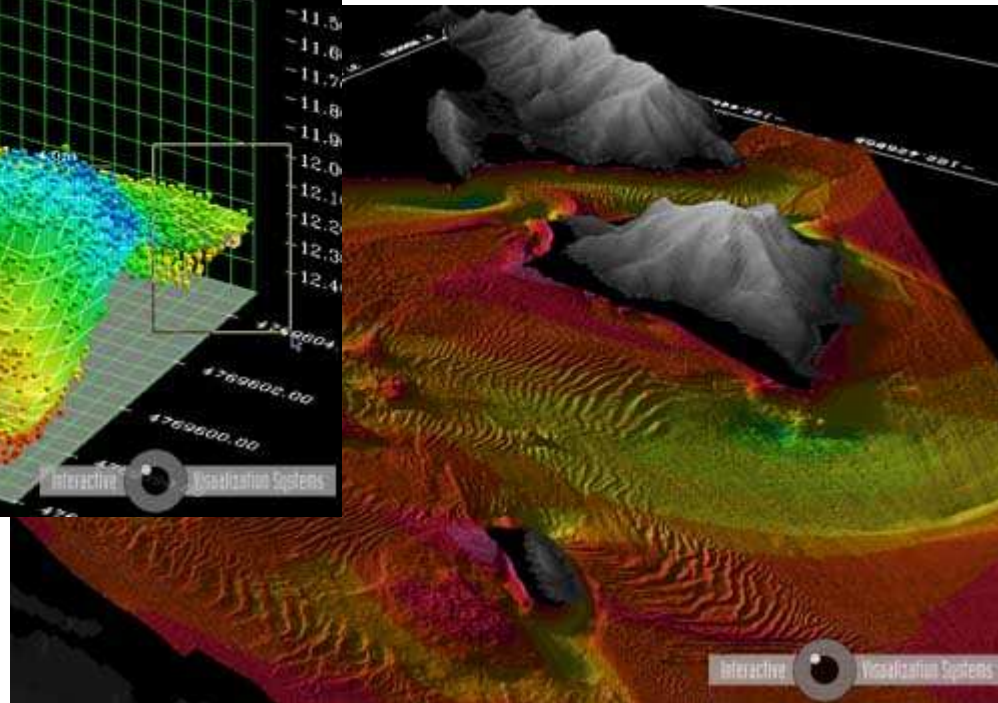
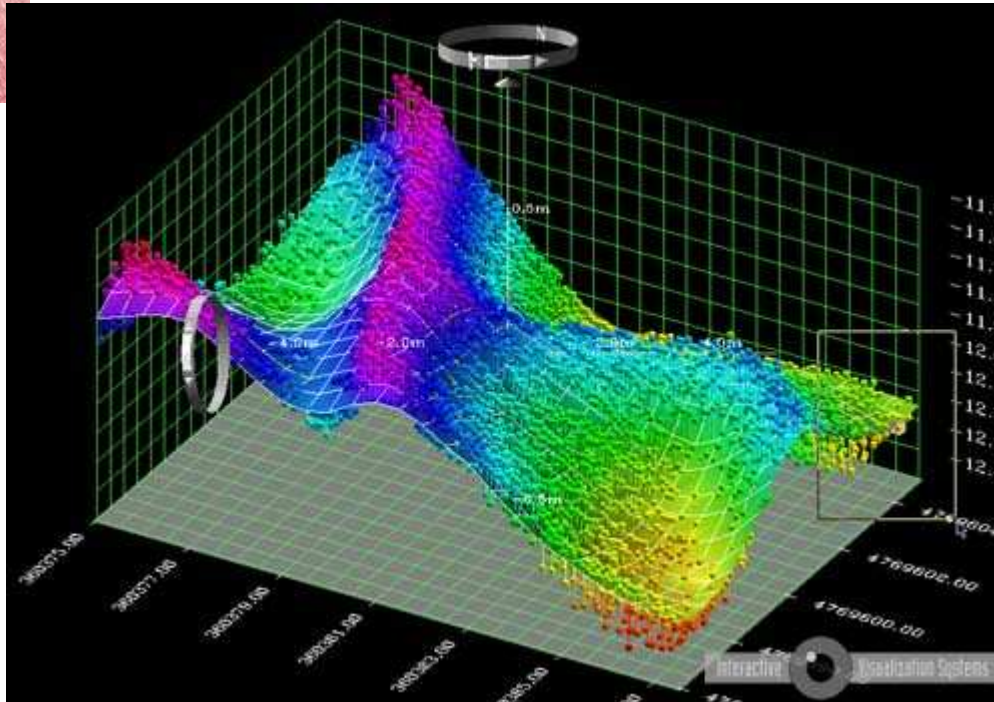
Today's solutions

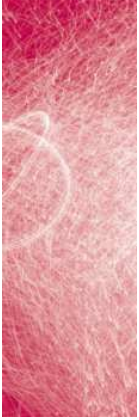
- Focus on processing and analysis of MultiBeam (backscatter) information
- Tools like Fledermaus from IVS-3D provide a wealth of functionality
- The ALL operate on files
- Sufficient for project based work
- Not optimal as data management solution





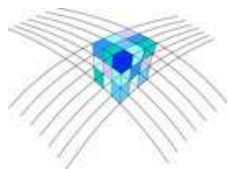
3D analysis

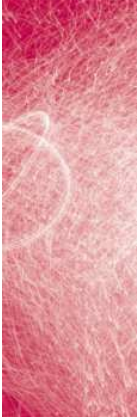




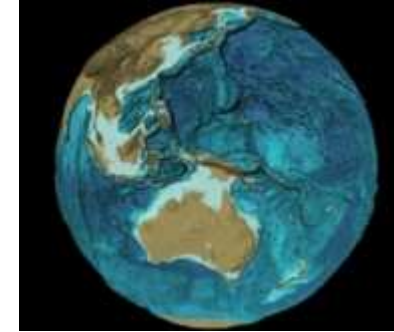
What is required?

- Spatial indexing
- Partitioning
- Pyramiding
- Lossless compression

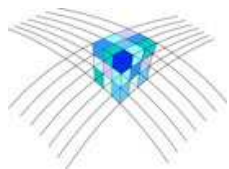


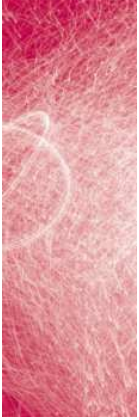


Large digital terrain models



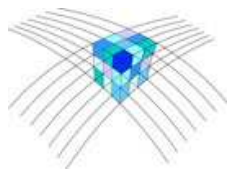
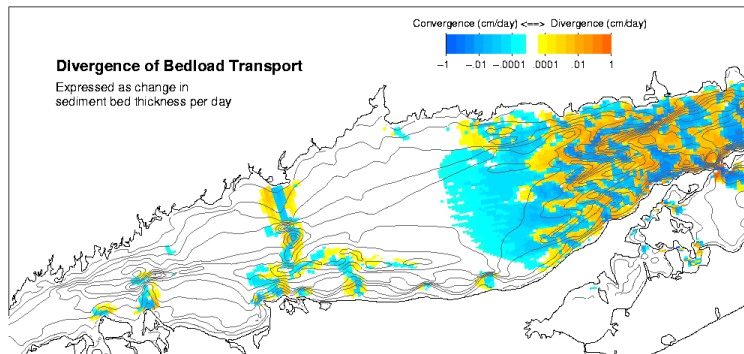
- Not just 1 source file but many combined
- High resolution data
- The ETOPO1/GEBCO datasets are not very big (approximately 1 GB at 30 arc second spacing)
- SDIs will require more and better data
- Not as a 1 time project but maintained continuously
- Versatile data that can be used by different communities

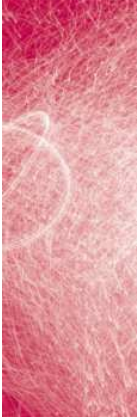




Obligation to manage multiple models

- Different user needs (e.g. Morphology vs. safe navigation)
- Liability (history and process information)





Virtual Continuous Models (VCM)

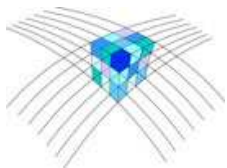
The solution is not to:

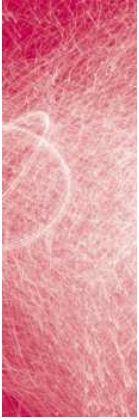
- Simplify the models (TINs or grids)
- Build alternative RDMS systems

But to:

- Keep the data in its original form as much as possible
- Use open standards and available technology

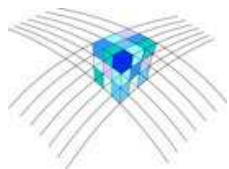
ATLIS has implemented this as the VCM concept

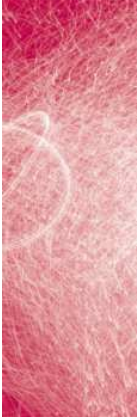




The VCM concept

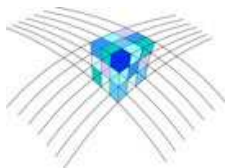
- Store survey data in an archive
- Store it only once
- Pay attention to metadata
- For each VCM that is required, store only:
 - Rules how to combine and de-conflict the source data
 - The required modeling
 - Set of convex hulls that spatially describe the components of the model
- Number of VCM is unlimited

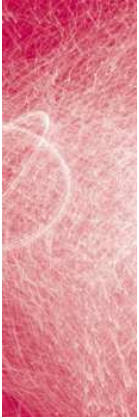




Rules

- The rule sets are defined as queries
- The sorted result of the query determines the stacking order of the source data
- Rules range from very simple (e.g. most recent on top)....
to very complex (e.g. give me complete coverage of multi beam surveys that are collected around a certain time period)

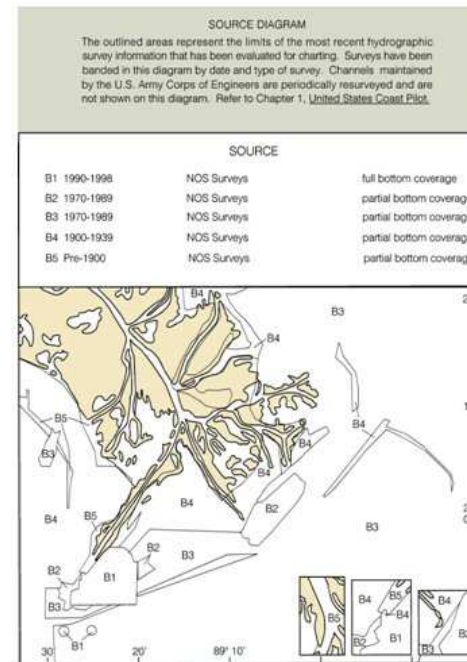
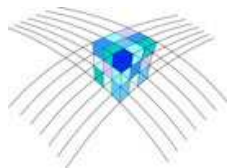
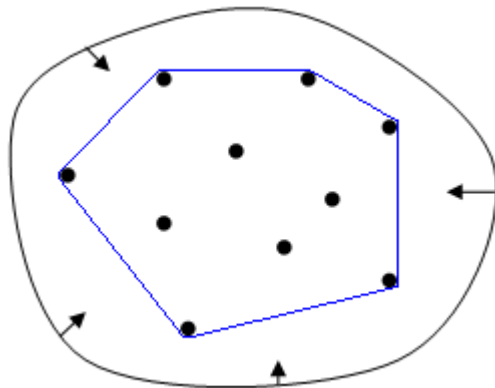




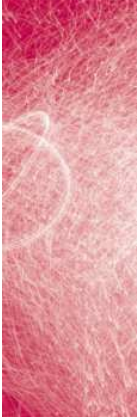
Convex hull set

- Set of intersected and de-conflicted survey hulls (based on the specified rule)
- Can best be imagined as a source diagram as shown on nautical charts

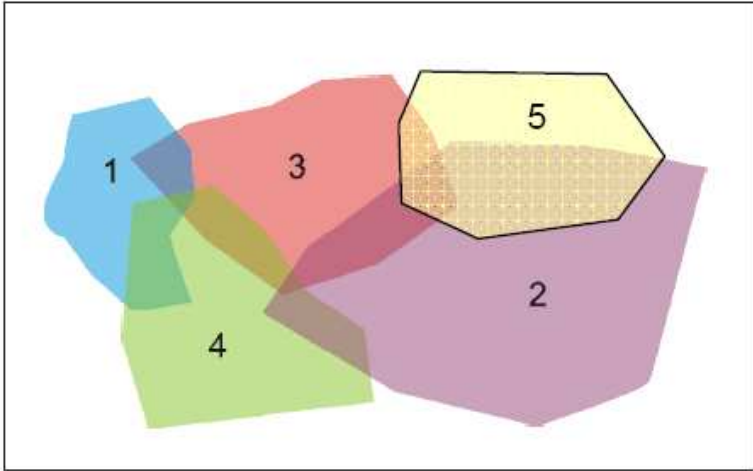
Convex hull acts as a rubber band around a point cloud



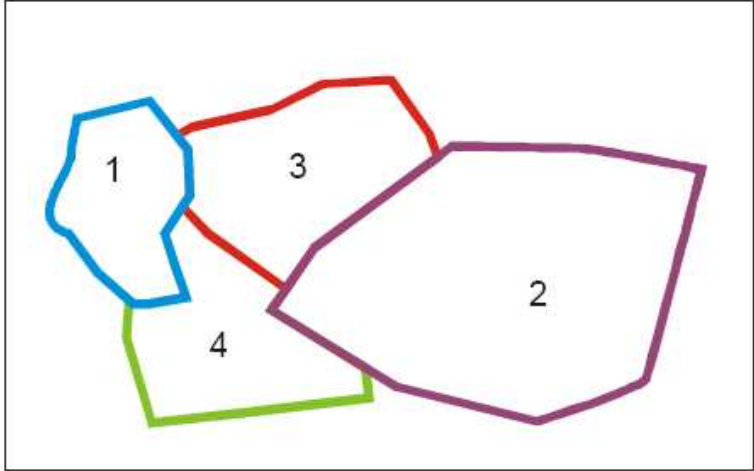
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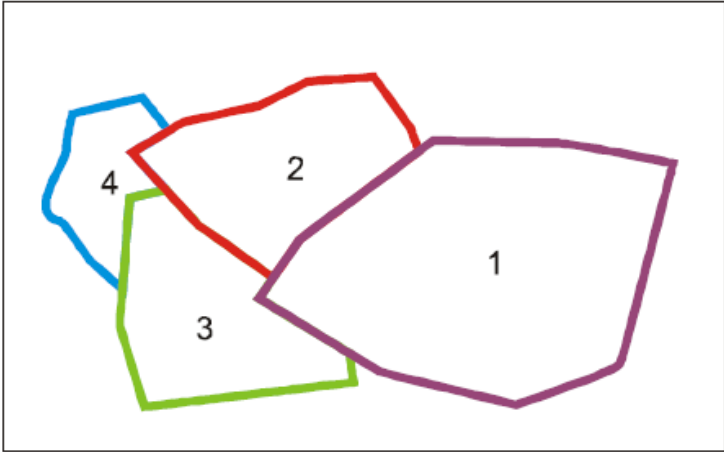
Different rules, different model



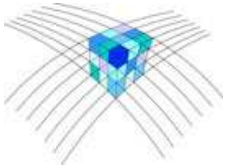
Archive

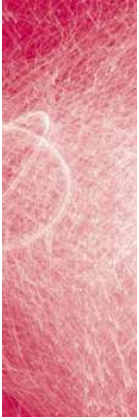


Model A



Model B





Modeling process

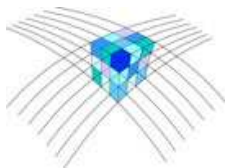
Optional steps may include:

- Adjustment of vertical datum (based on separation models or fixed offsets)
- Data validation (e.g. using CUBE)
- Data thinning
- Gap management

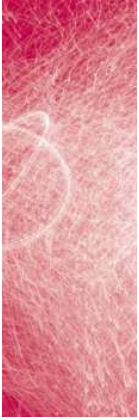
Modeling takes place on the source data and the result is stored in the archive



20

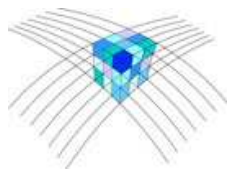
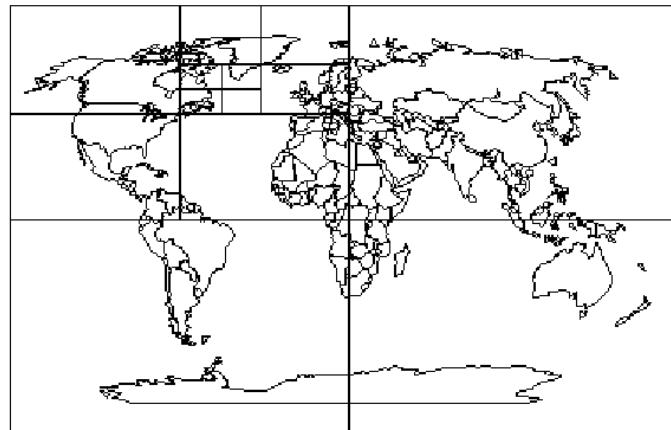


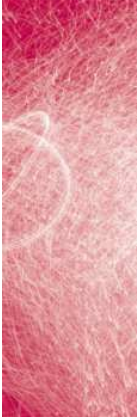
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Performance

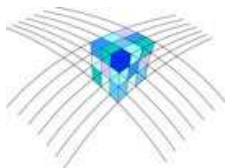
- Use of latest Oracle 11g technology
- Optimised spatial indexing and partitioning
- Use of HHCcode technology on top of Oracle further enhances the performance





Challenges

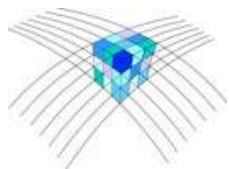
- Source files will continue to grow
- More research is required to improve indexed access to large point clouds
- Oracle 11g is a vast improvement over earlier versions but geospatial industry must put as much pressure on Oracle to stay ahead of the sensor builders.

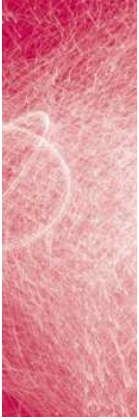




Conclusions

- File based management of large point cloud data sets is reaching its limitations
- Solution is provided by (open) DBMS systems
- ATLIS has developed the Virtual Continuous Model (VCM) concept to allow management of many different and large digital terrain models
- With the VCM concept organisations only have to store the point cloud data once. There is NO redundancy for each DTM
- More research is required to further improve indexing in open DBMS systems





Questions



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