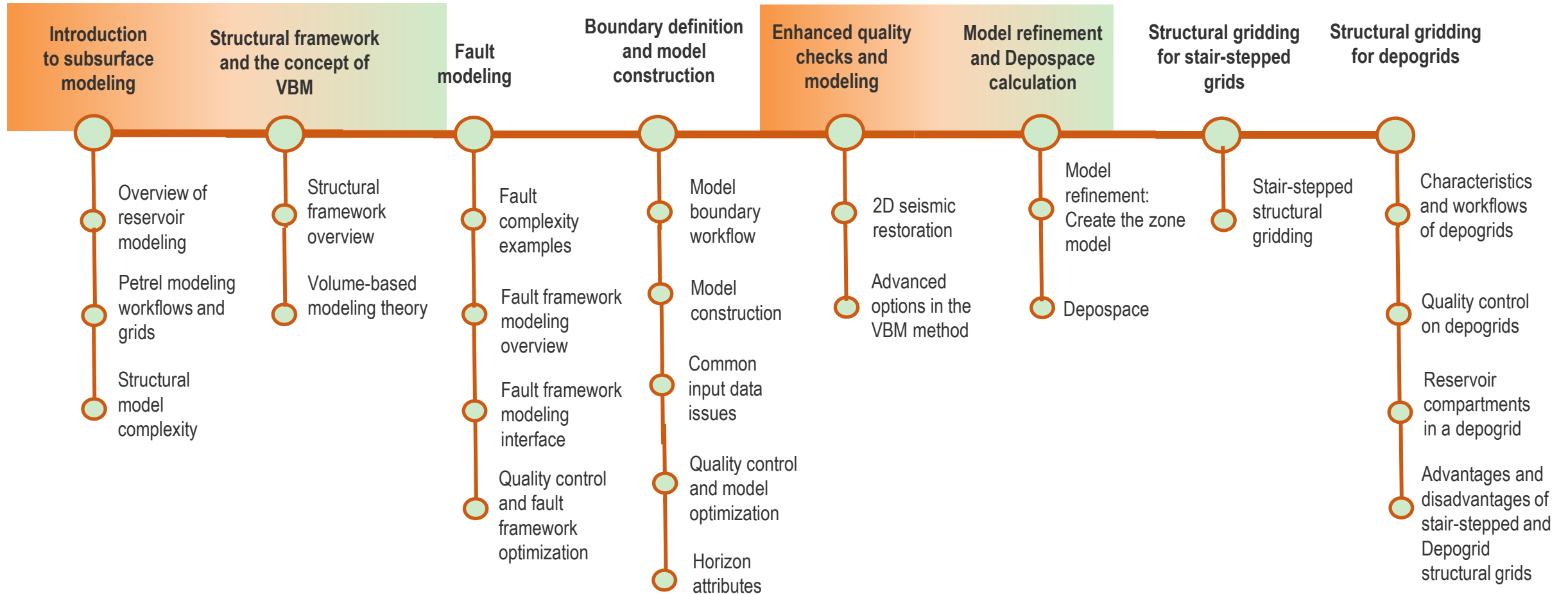# Structural Framework Workflows for Petrel 2018

Module 6: Model refinement and Depospace calculation

Structural framework with Petrel 2018 – Modeling line
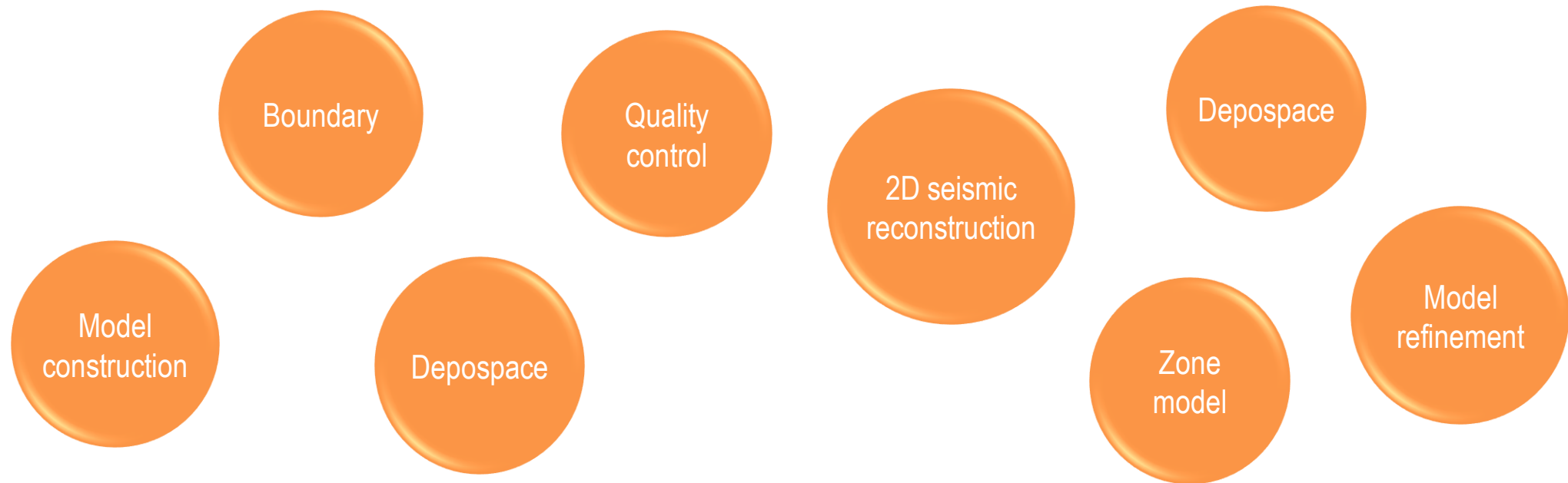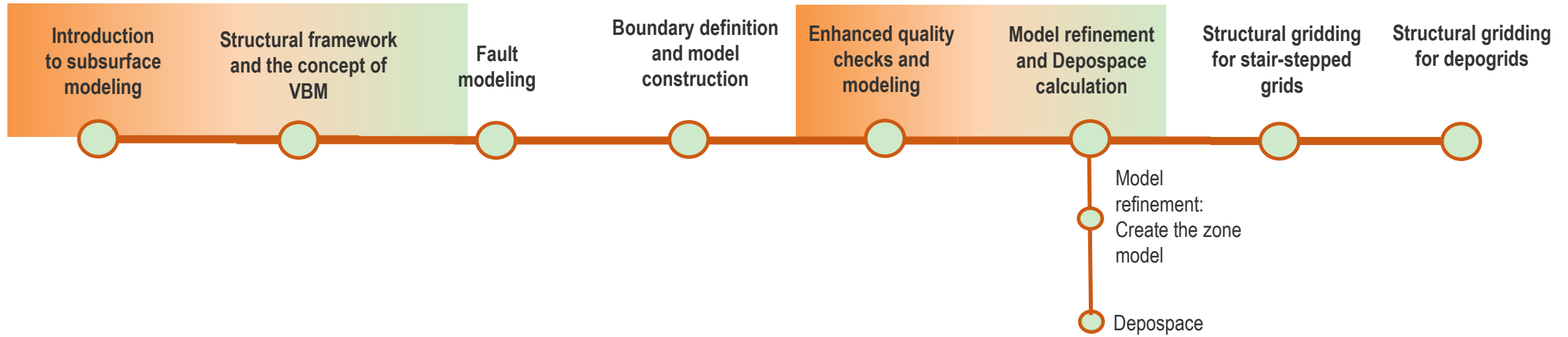

Introduction to subsurface modeling
- Overview of reservoir modeling
- Petrel modeling workflows and grids
- Structural model complexity

Structural framework and the concept of VBM
- Structural framework overview
- Volume-based modeling theory

Fault modeling
- Fault complexity examples
- Fault framework modeling overview
- Fault framework modeling interface
- Quality control and fault framework optimization

Boundary definition and model construction
- Model boundary workflow
- Model construction
- Common input data issues
- Quality control and model optimization
- Horizon attributes

Enhanced quality checks and modeling
- 2D seismic restoration
- Advanced options in the VBM method

Model refinement and Depospace calculation
- Model refinement: Create the zone model
- Depospace

Structural gridding for stair-stepped grids
- Stair-stepped structural gridding

Structural gridding for depogrids
- Characteristics and workflows of depogrids
- Quality control on depogrids
- Reservoir compartments in a depogrid
- Advantages and disadvantages of stair-stepped and Depogrid structural grids

Agenda
Structural framework– Day 2

9.00-12.00	12.00-12.30	12.30-14.30	14.30-16.45	16.45-17.00
Boundary definition and model construction	Lunch	Enhanced quality checks and modeling	Model refinement and Depospace calculation	Review

KEYWORDS

Boundary

Model construction

Depospace

Quality control

2D seismic reconstruction

Depospace

Zone model

Model refinement

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Module 6: Model refinement and Depospace calculation

Introduction to subsurface modeling

Structural framework and the concept of VBM

Fault modeling

Boundary definition and model construction

Enhanced quality checks and modeling

Model refinement and Depospace calculation

Structural gridding for stair-stepped grids

Structural gridding for depogrids

Model refinement: Create the zone model

Depospace

Learning objectives

When you complete this module, you will know how to:

- refine and construct zones for the structural framework model

- calculate isochores from zones in the model

- build a depositional space

Model refinement and Depospace calculation

Model refinement:
Create the zone model

Refinement options

Depospace
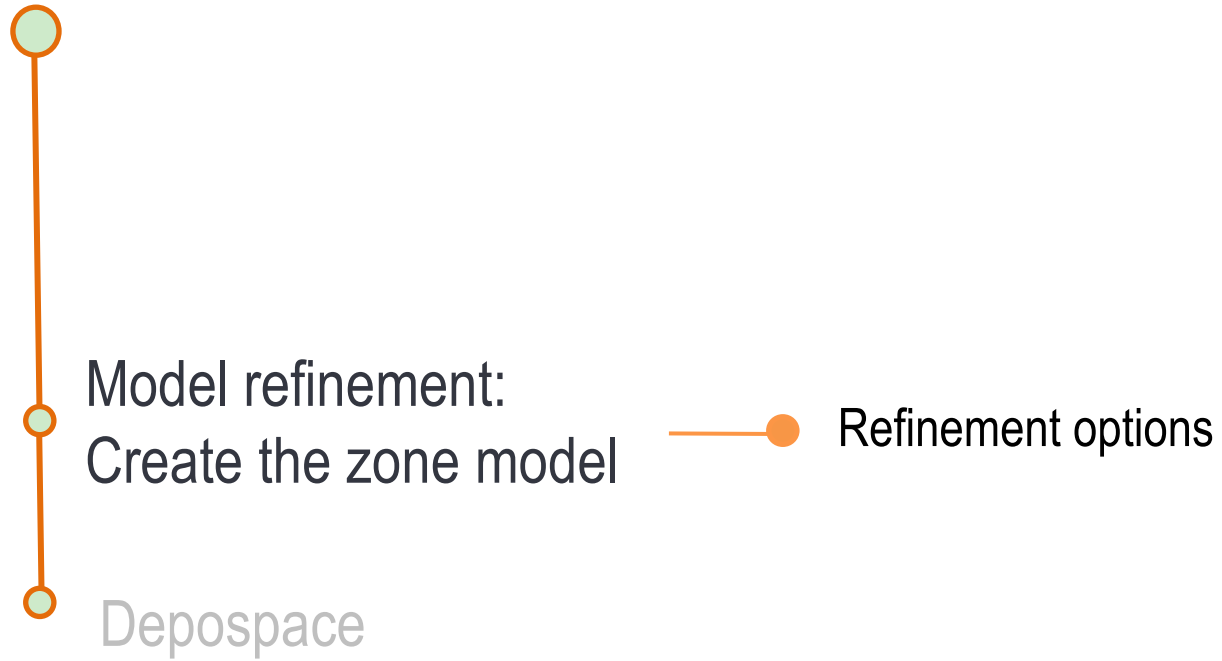
Model refinement (1)

- The algorithm generates a finer resolution of the model with geological zones.

- Horizons are generated at the resolution defined in the underlying tetrahedral mesh.

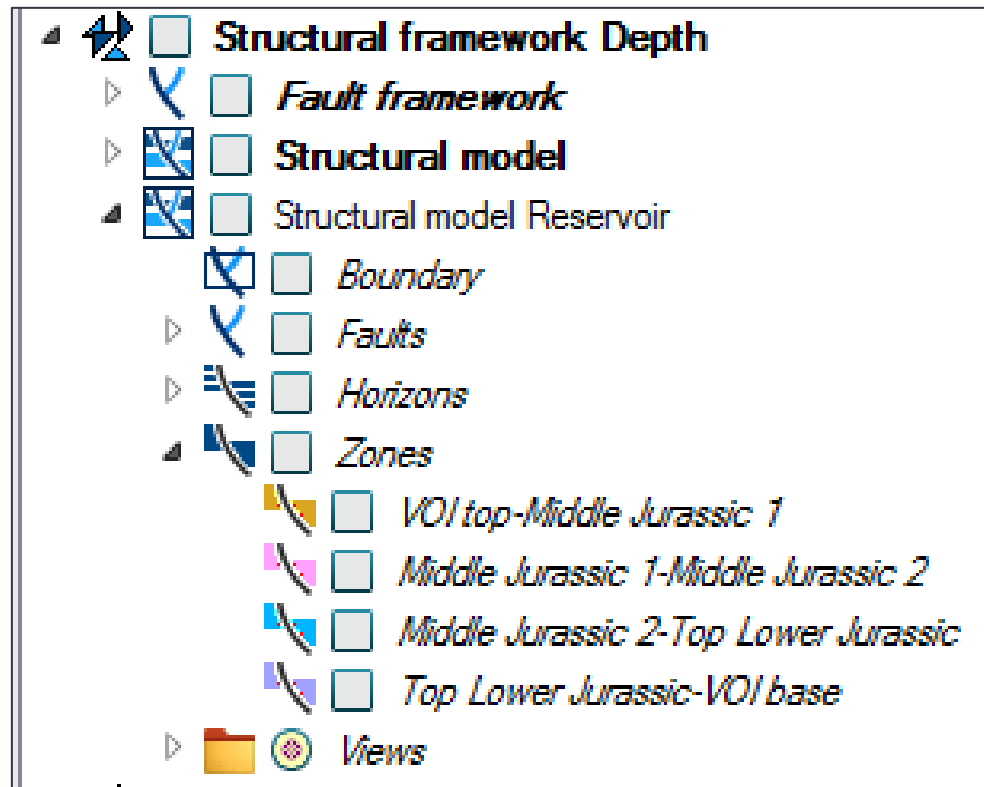- At this stage, horizons fit all input data points.
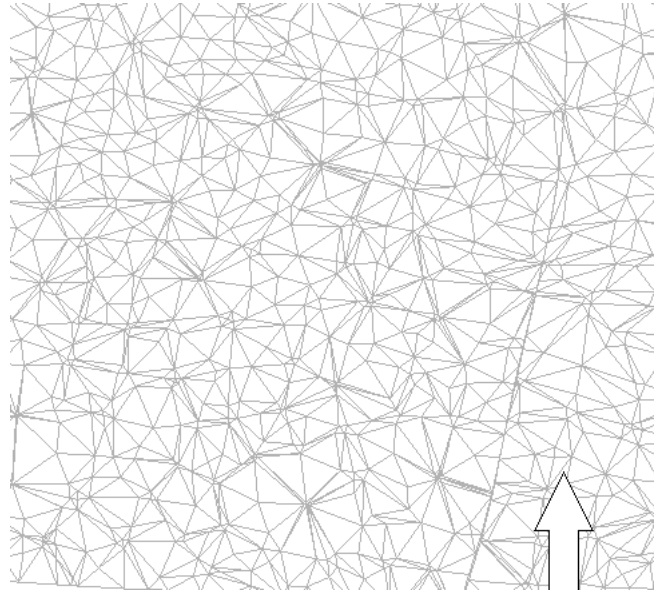
Tetrahedra in the un-refined model built with Complexity/Size parameter *Simple*.
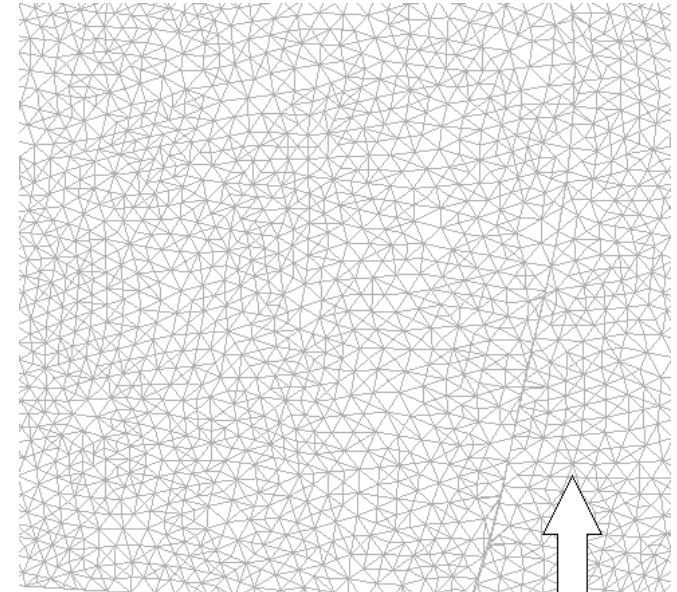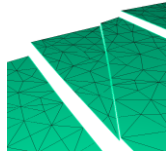

Resulting tetrahedra at the refined stage.

Model refinement (2)
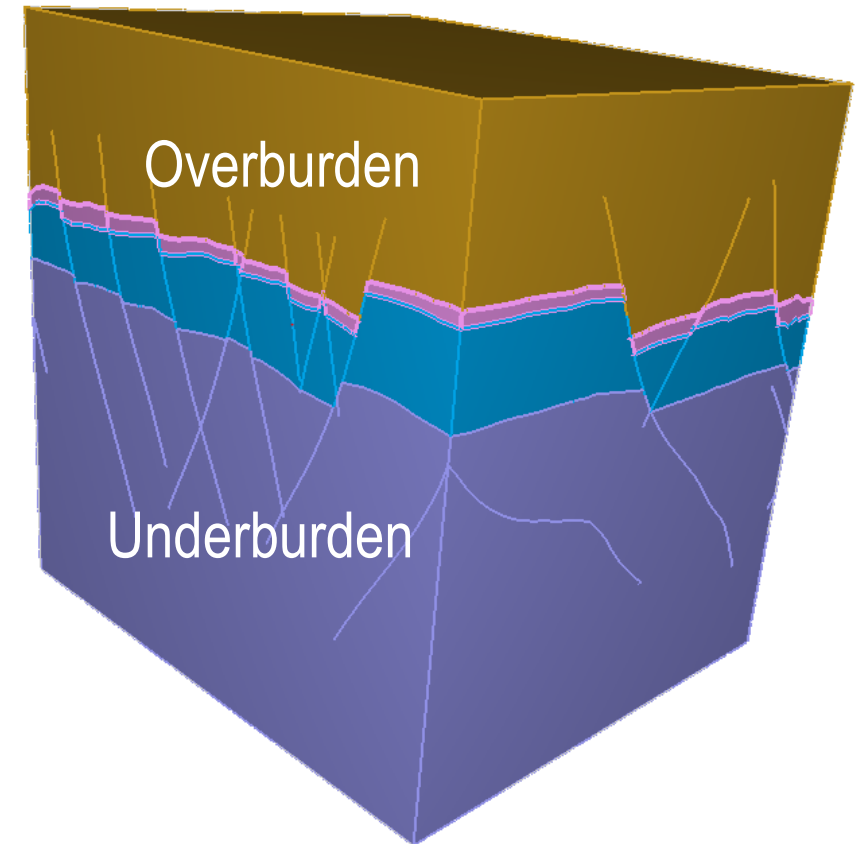
Refinement options

1. Model resolution

Average triangle edge length of refined horizons

2. Smoothing

The remeshed and fitted model horizon can be smoothed in a post-processing with a smoothing factor [1,100]. A high smoothing value tends to remove noise but decreases the fit to input data points.

3. Ignore outlier further than

Input data points located outside of this 3D distance to the corresponding non-refined horizon are disregarded in the model refinement to avoid spikes.
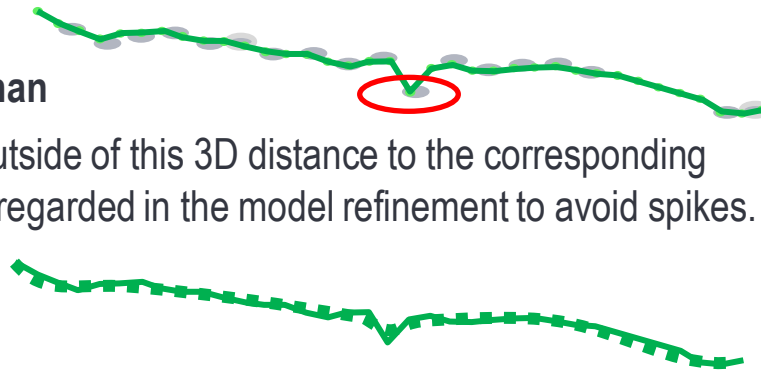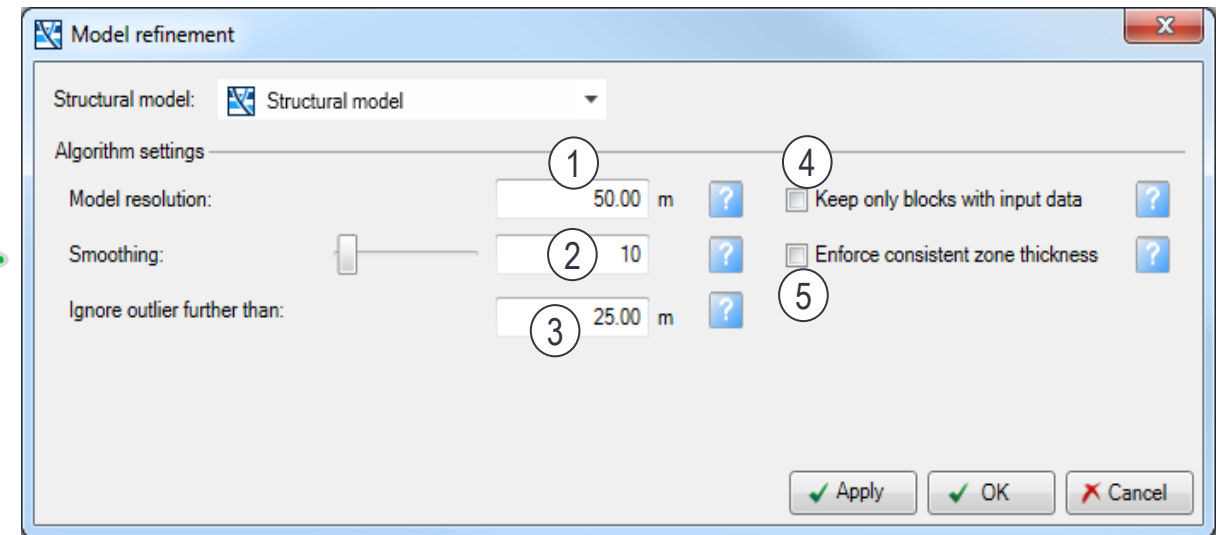
4. Keep only blocks with input data

Removes zone patches without corresponding horizon interpretation

5. Enforce constant zone thickness

Minimizes the crossing between refined horizons

Model refinement

Structural model: Structural model

Algorithm settings

Model resolution:	(1) 50.00 m	(4) ☐ Keep only blocks with input data
Smoothing:	(2) 10	(5) ☐ Enforce consistent zone thickness
Ignore outlier further than:	(3) 25.00 m	

✓ Apply   ✓ OK   ✗ Cancel

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Model refinement and Depospace calculation

Model refinement:
Create the zone model

Depospace

Depospace general settings (Demo)

Depospace versus Structural reconstruction
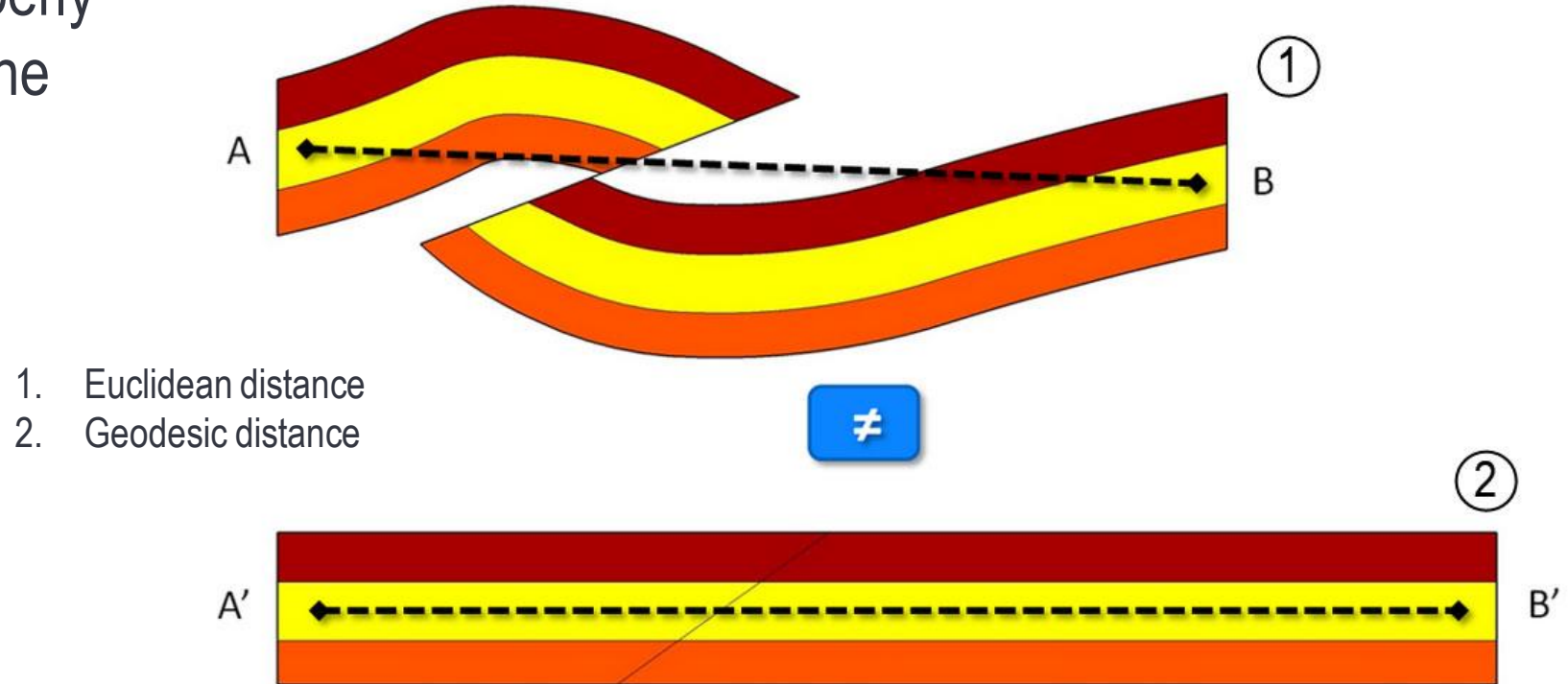
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Concept of Depospace

Construction of a virtual and physically consistent depositional space controlled by the chronostratigraphic environment at the time of deposition.
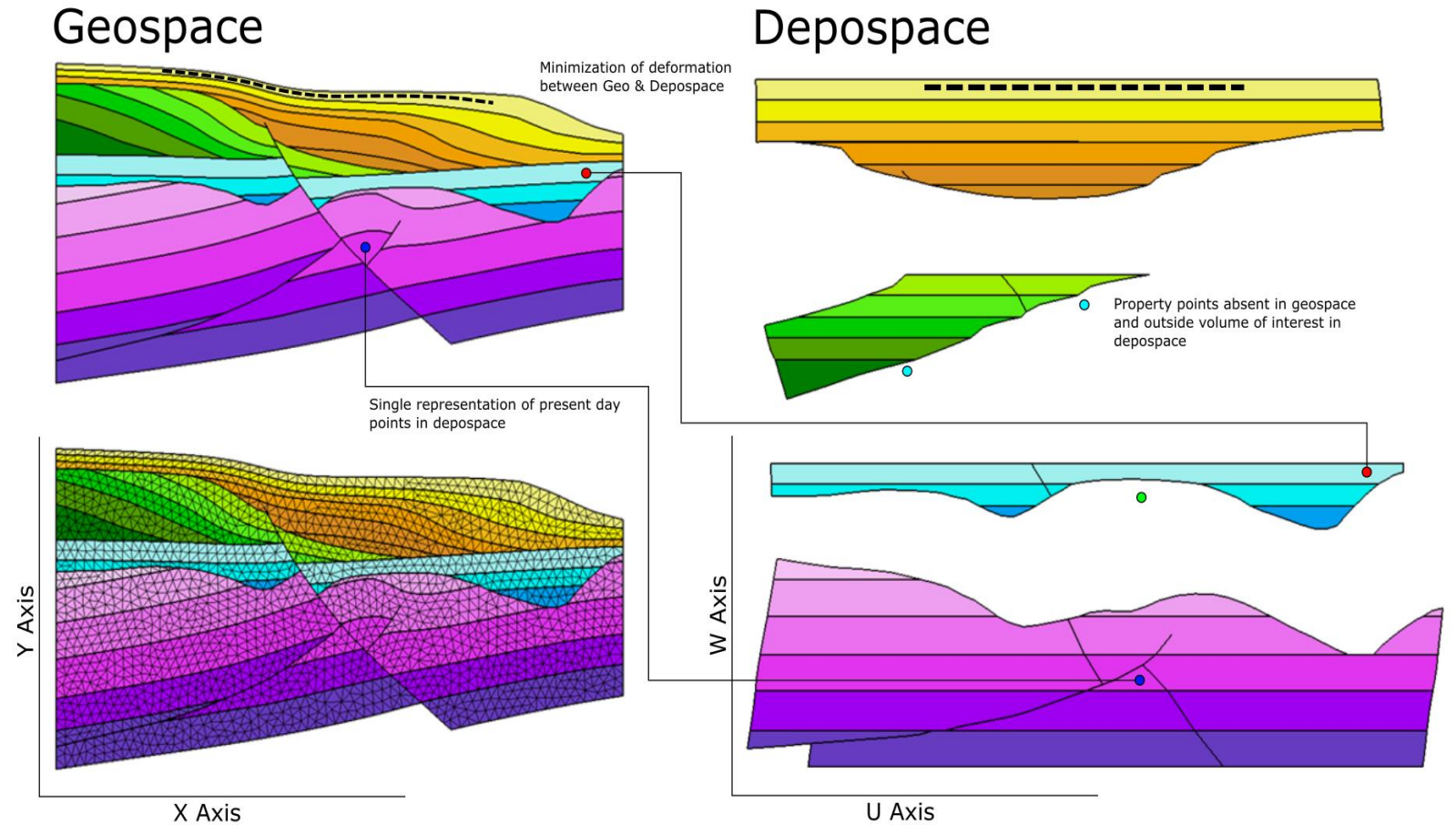

Geospace
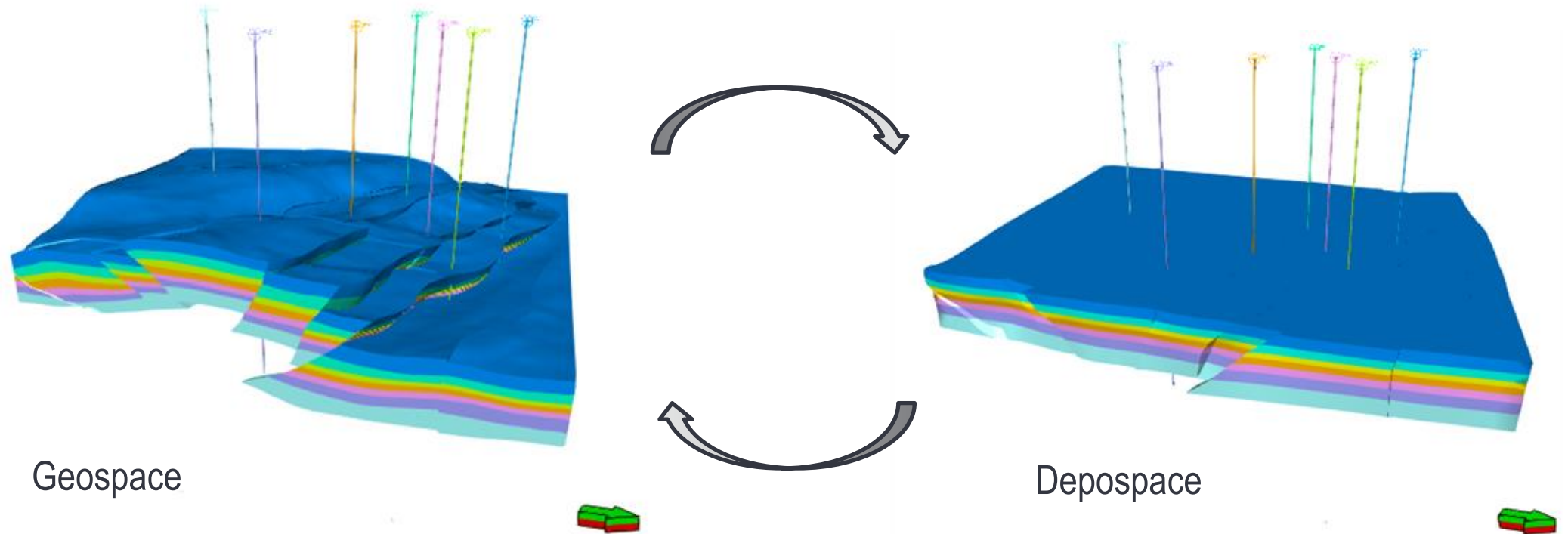
Depospace

Geospace versus Depospace distances

The calculation ensures that the distances are considered properly when you unfold and unfault the conformable horizons.
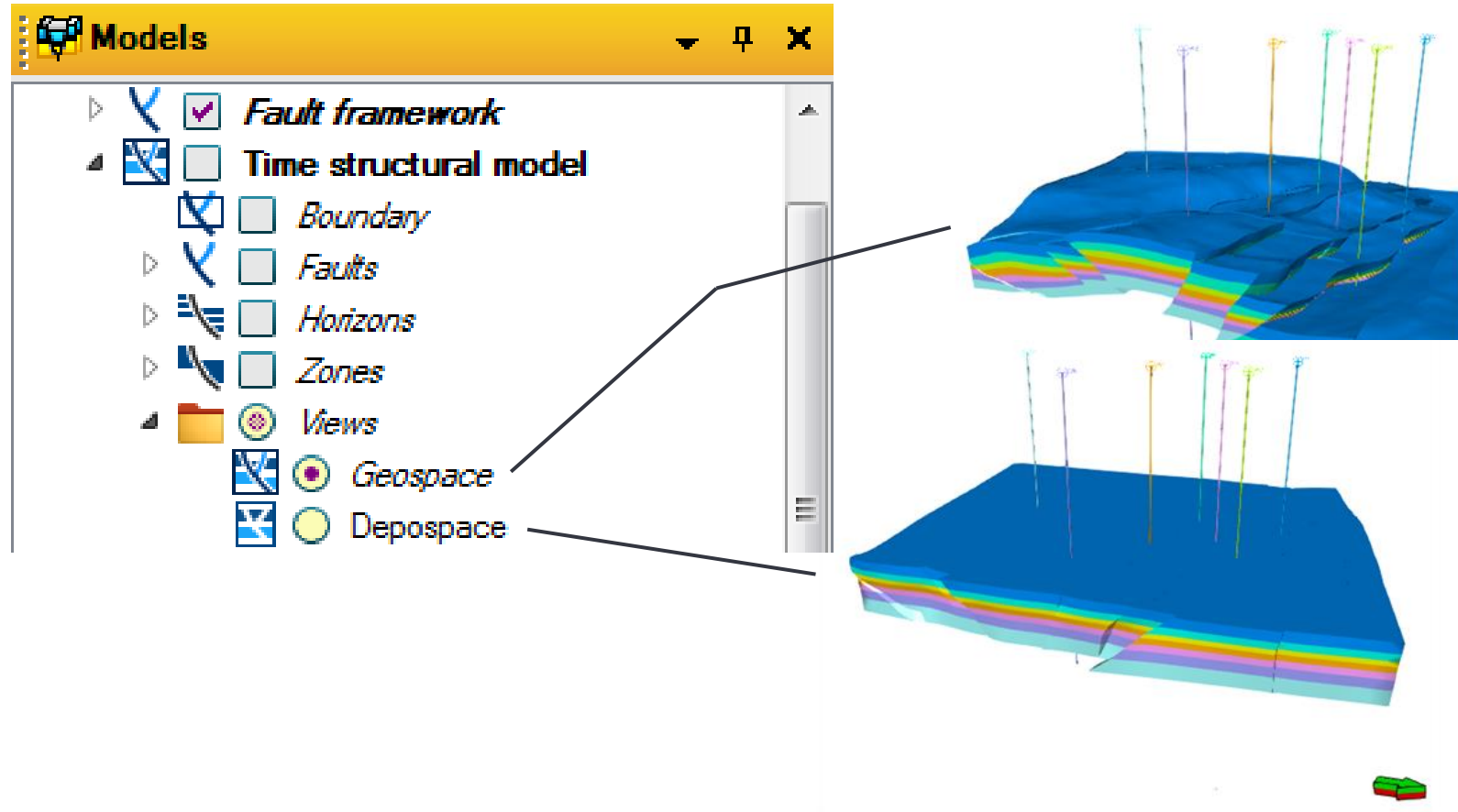
1. Euclidean distance
2. Geodesic distance

Depospace calculation

Each sequence has its own Depospace

Geospace

Depospace

Minimization of deformation between Geo & Depospace

Single representation of present day points in depospace

Property points absent in geospace and outside volume of interest in depospace

Y Axis

X Axis

W Axis

U Axis

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Visualize the result

Depospace versus Structural reconstruction

There are significant differences between the Depospace and the reconstruction workflows

- In Depospace, all the horizons of the structural model are deformed in a single step. As a result, it is not possible to differentiate between several tectonic events. Usually, the Reconstruction workflow identifies the difference.

- In Depospace, all conformable horizons are flattened. Paleo-topography is not included.

- Unlike Structural reconstruction, Depospace does not preserve the zone thicknesses or volumes and it does not use decompaction.

Exercises and workflow example videos:

- Exercise: Run Model refinement and QC result

- Workflow example video: Create horizon model and add well tops to build zones

- Exercise: Calculate isochores and use result to build surfaces

- Exercise: Calculate Depospace and apply boundary conditions.

- Workflow example video: Build Depospace and QC results

Summary

In this module, you learned how to:

- refine the structural model

- calculate isochores from zones in the model

- build a depositional space

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Learning game: Model refinement and Depospace calculation (1)

Instructions:
There are several questions. Select the correct answers.

Learning game: Model refinement and Depospace calculation (2)

What is Depospace?

a. A structural restoration of the VBM model to the time of deposition

b. A virtual space in which the stratigraphic function is unfolded and unfaulted

c. A property population calculation space

d. Both b. and c. are correct

e. All the answers above are correct

Learning game: Model refinement and Depospace calculation (3)

What are the alternative depospace transform creation algorithms and when do you use them?

a. Mechanical and Geometrical: try Mechanical first unless highly compressive model regime

b. Mechanical and Geometrical: try Geometrical first

c. Geomechanical and Elastic deformation: try Geomechanical first unless highly compressive regime

d. Elastic and Mechanical: try Mechanical first

e. Geometrical and Elastic deformation: try Geometrical first

Learning game: Model refinement and Depospace calculation (4)

How do you display a structural framework model in Deopospace?

a. Select the dedicated simbox in the mini toolbar

b. Select the *Depospace* button for the model in the **Models** pane

c. Both a. and b. are correct

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