thermoscientific

Porosity Block Modeling

1. Introduction

Building a rock model made of blocks (a so-called block model), each block being assigned the value of a property

(porosity, permeability, etc), is a way to have a description of the rock that can help sub-plugging, or directly be used as an input for third party solvers.

A dedicated module might be integrated in a future PerGeos release. In the meantime, we present here a workflow responsible of splitting the data into blocks and assigning the porosity of each block as the value for the whole block.

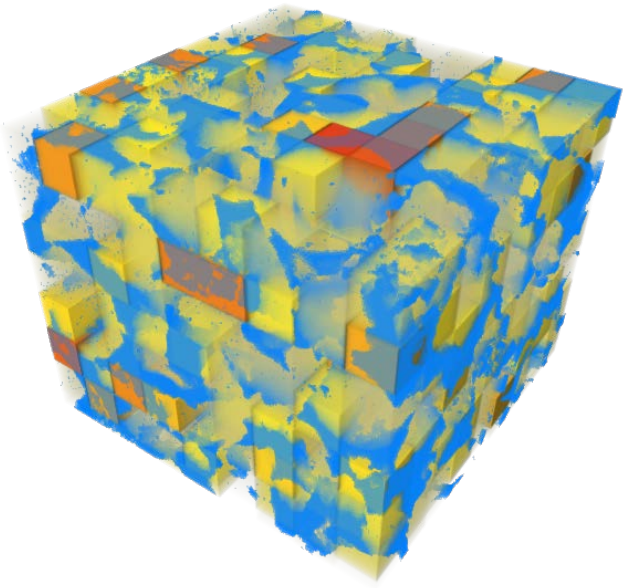


Figure 1 3D Block Model of the porosity

2. Building the recipe

The process is inspired by what is described in the technical highlight *Simple Rock Characterization* available here:

https://fei.netexplorer.pro/dl/KbrtT3r23vxV8hV1

1. Start with a binary volume of the pore space
   We will use the Berea sub-plug pore space from the tutorials directory.

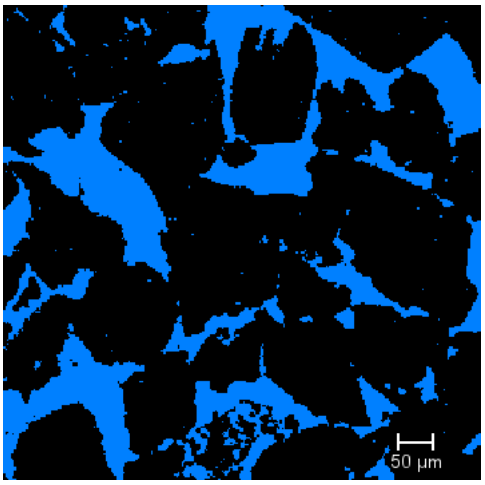
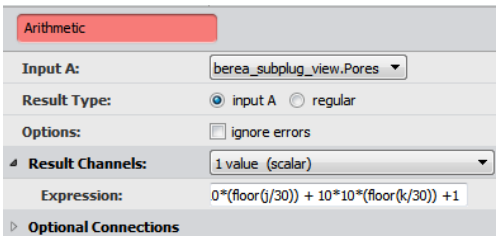
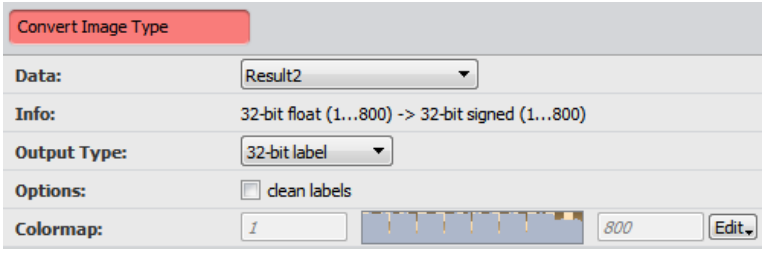


Figure 2 binary pore space

2. Split the volume into blocks with **Arithmetic**. We will use a block size of 30 voxels.
   The resolution of the Berea sub-plug is 273x271x222.
   There will be 273/30 = 10 blocks in X, 271/30 = 10 blocks in Y, and 222 / 30 = 8 blocks in Z.
   The regions are computed using the formula:
   (floor(i/30)) + 10*(floor(j/ 30)) + 10 * 10 *(floor(k/ 30)) +1



3. Convert it to a 32 bits label data with **Convert Image Type**



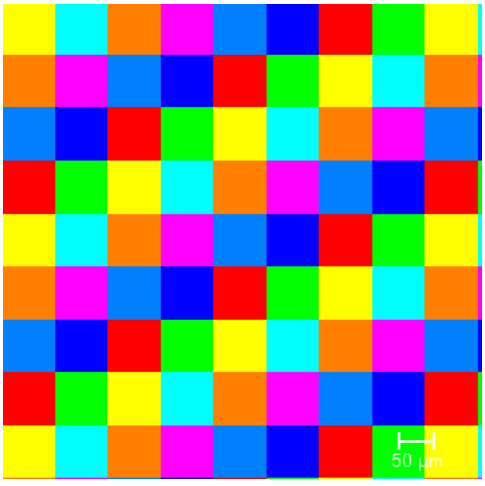
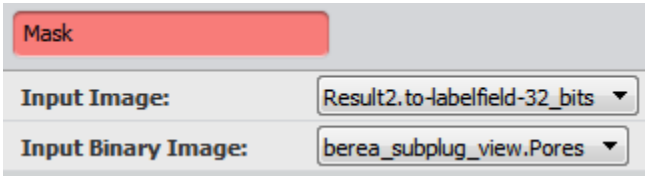


Figure 3 labelized blocks

4. Mask it with the pore space with **Mask**



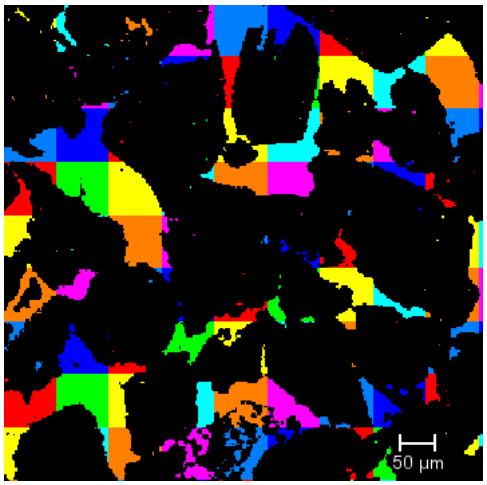
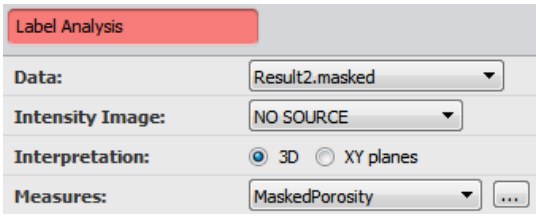
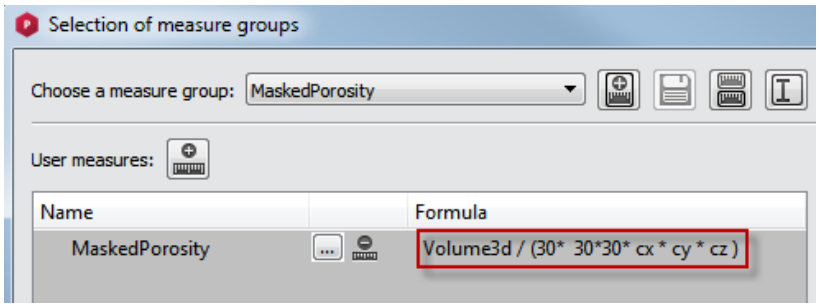


Figure 4 Masked Pore Space

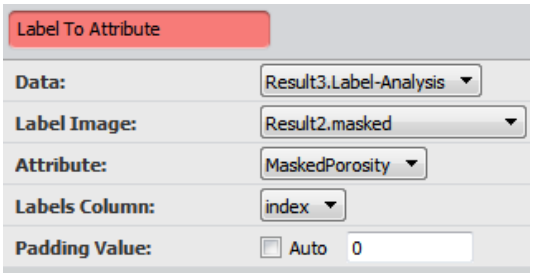
5. Compute the porosity per block with a custom formula.

   The *Volume3d* measure will return the volume of the pore space in the block.
   Dividing by the voxel size (cx*cy*cz) times the number of voxels of the block (30*30*30) will return the porosity.





6. Extract the porosity values with **Label to Attribute**



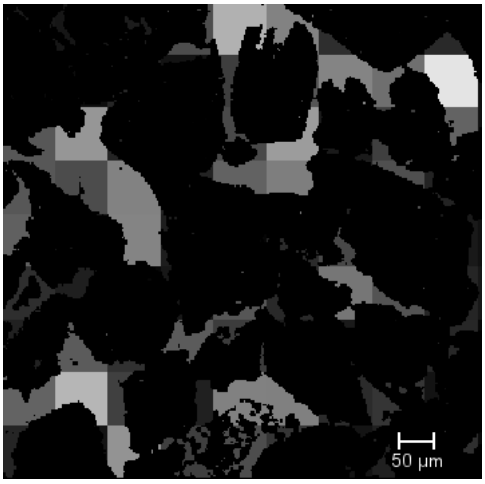
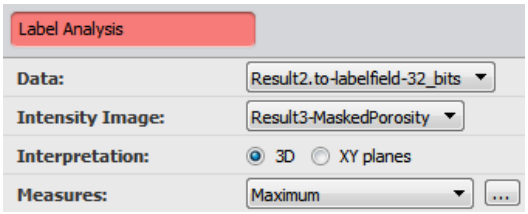
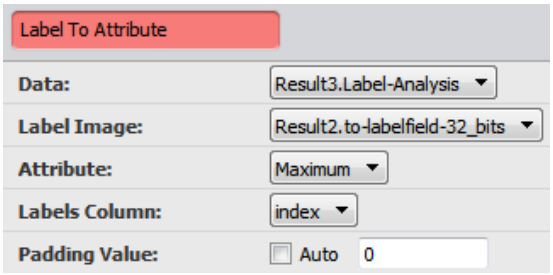


Figure 5 Masked pore space embedding porosity values

7. Apply a new **Label analysis** on the blocks label field, retaining the Maximum value per block, thus assigning the porosity values to every whole block in a measure table



8. Copy the values from the table to the block volume with **Label to Attribute**



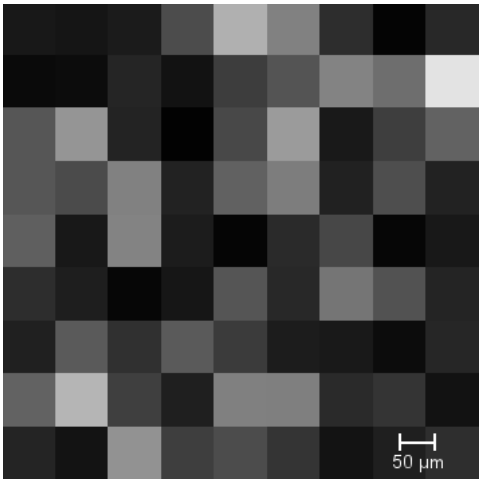
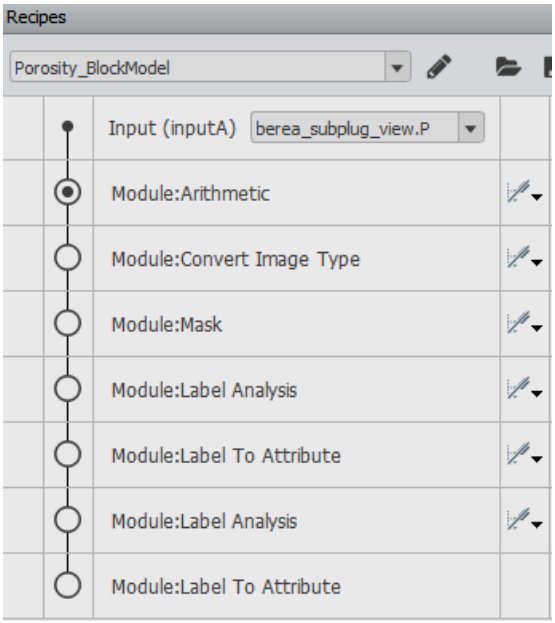


Figure 6 Block Model embedding porosity values

3. Using the recipe

The Porosity block modeling recipe can be found here:

https://fei.netexplorer.pro/dl/NG118XkvJk



Note that the Arithmetic step and the custom measure needs to be adjusted depending on the resolution of the input data.