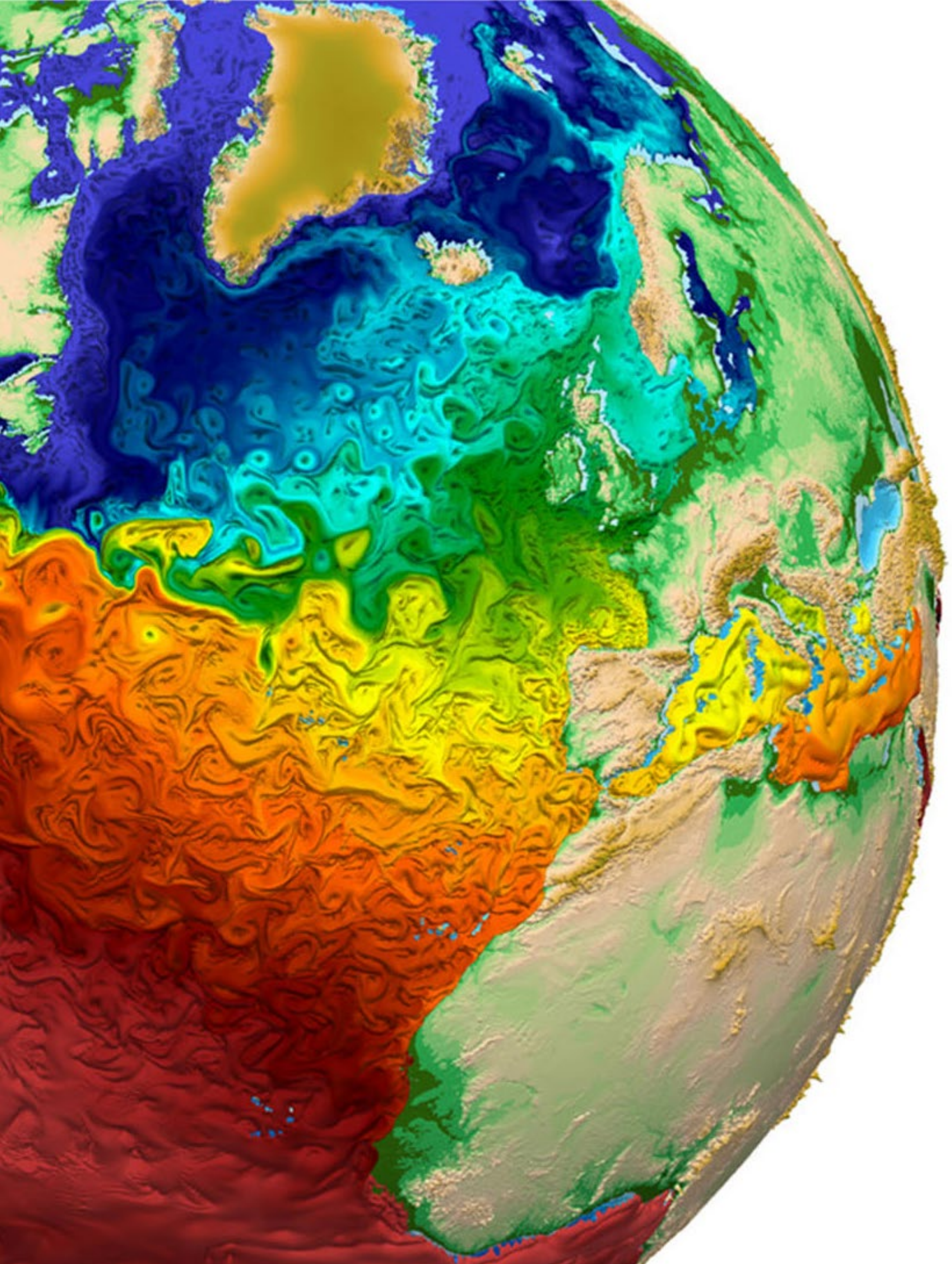

Vector Visualization

Displacement Plots

Scientific Visualization

Professor Eric Shaffer

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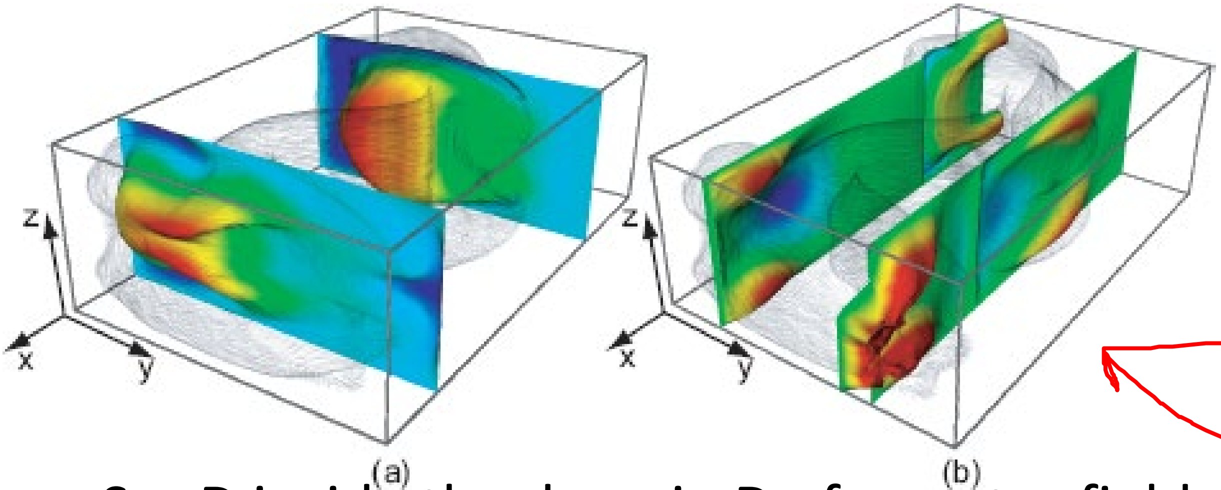
Displacement Plots



We create a surface S ∈ D inside the domain D of a vector field

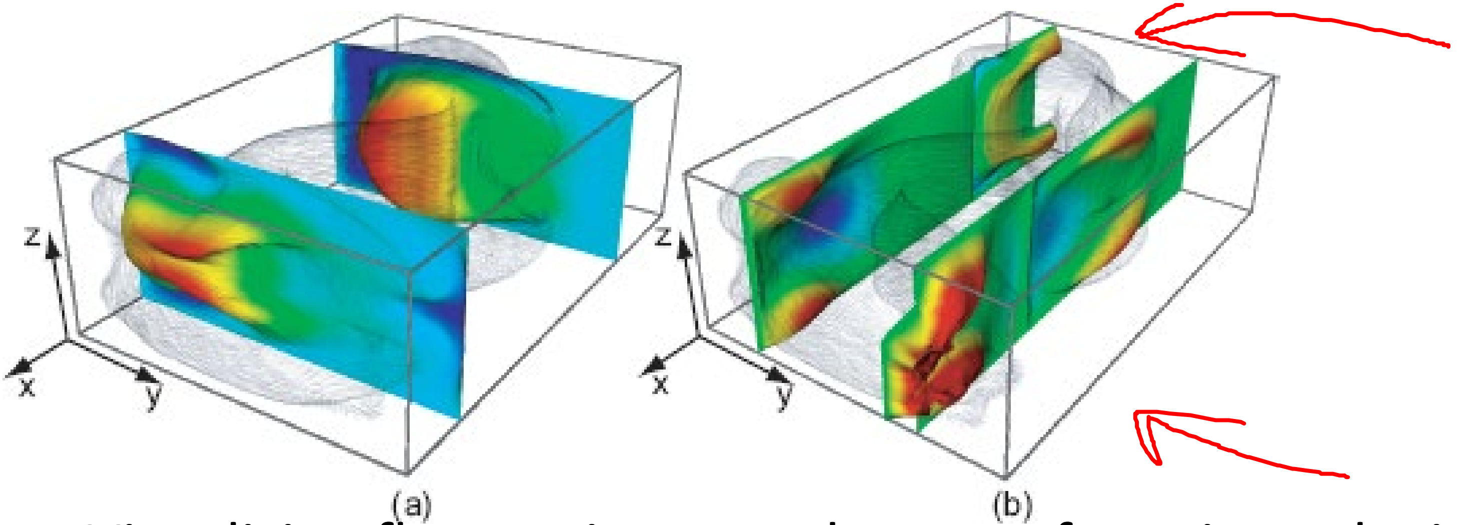
S is discretized as a set of sample points p_i

A displacement plot of S is a new surface S” given by the set of sample points

$$p'_i = p_i + k\mathbf{v}'(p_i)$$

- *k* controls the scale of the displacement
- v′ is a vector field that controls the displacement of the surface S
  - in the simplest case we can use v′ = v

Displacement Plots



Visualizing flows using two planar surfaces in each visualization

- (a) orthogonal to the *x*-axis
- (b) othogonal to the *y*-axis

Colored by the vector field component on which the input surface is perpendicular

- (a) $|\mathbf{v}_x|$
- (b) $|\mathbf{v}_y|$

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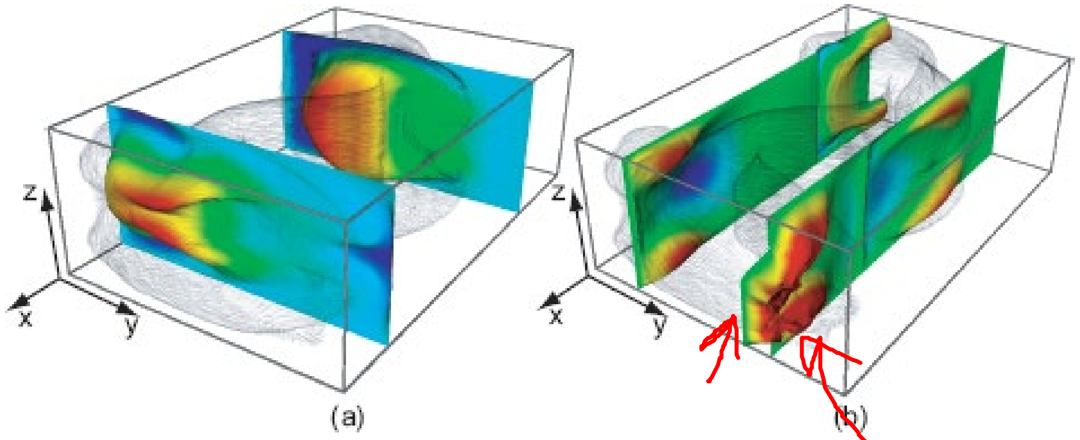
Parameter Settings



(a) (b)

$$p'_i = p_i + k\mathbf{v}'(p_i)$$

Setting the scaling factor k
- too large can easily lead to self-intersecting surfaces.
- too large warp factors shift the displaced surface far away from its actual location
- too small a factor will not show the warping effect enough so that it is recognizable

Setting the shape and position of the surface to be warped
- planar surfaces are often a popular choice for displacement plots
- since they are flat, displacement values are easy to distinguish on them
- problematic when surface is (almost) tangent to the vector field to be visualized
- warped surface stays in the same plane as the original surface

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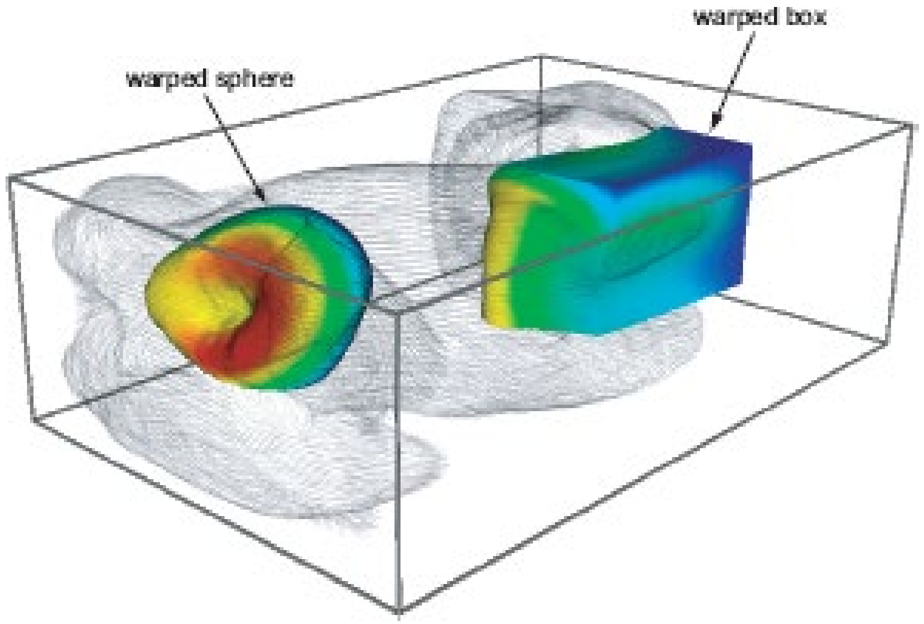
Alternatives



Non-planar geometric objects can be used to create displacement plots

In addition to surfaces, curves can be used too

Choice of the object to deform should be correlated with the vector field behavior and meaning

- example: material deformation a mechanical assembly can be shown using the assembly's own surface.

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