$c_{i0} + c_{i1}$ and c_{i0} are the sills reached in the direction of the major and minor axes respectively. c_{i1} can of course be negative. If we have nested spheres in some direction, only the sphere with the longest range should be modeled in this fashion.

Modeling sill anisotropy in the above fashion causes the semivariogram models to have "peanut-shaped" contours. Another way of performing this modeling is to apply additive models where range and sill anisotropies are modeled in separate additive terms. This type of modeling allows the sill anisotropy direction to be independent of the range anisotropy direction.

Figure 1.3 shows examples of the models suggested in the equations in this section, elliptic cone (top-left with paper in landscape mode), single elliptic spherical (top-right), single elliptic spherical with sill anisotropy (bottom-left), and un-nested double elliptic spherical with sill anisotropy for both spheres (bottom-right). For practical estimation purposes some of these models may contain too many parameters. The parameter estimation software for these 2-D models presently needs some further attention.

1.4 Regularization

Another important concept in geostatistics is **regularization**, i.e. the averaging of a random function over a domain $\mathcal{D}$. Let $\boldsymbol{x} \in \mathcal{D}$. The regularized value $\bar{Z}_{\mathcal{D}}$ of Z is

$$\bar{Z}_{\mathcal{D}} = \frac{1}{|\mathcal{D}|} \int_{\mathcal{D}} Z(\boldsymbol{x})\, d\boldsymbol{x}, \tag{1.27}$$

where $|\mathcal{D}|$ is the area (or volume) of $\mathcal{D}$. Similarly for the moment functions, e.g.

$$\bar{\gamma}(\mathcal{A}, \mathcal{B}) = \frac{1}{|\mathcal{A}||\mathcal{B}|} \int_{\mathcal{A}} \int_{\mathcal{B}} \gamma(\boldsymbol{x} - \boldsymbol{y})\, d\boldsymbol{y}\, d\boldsymbol{x}. \tag{1.28}$$

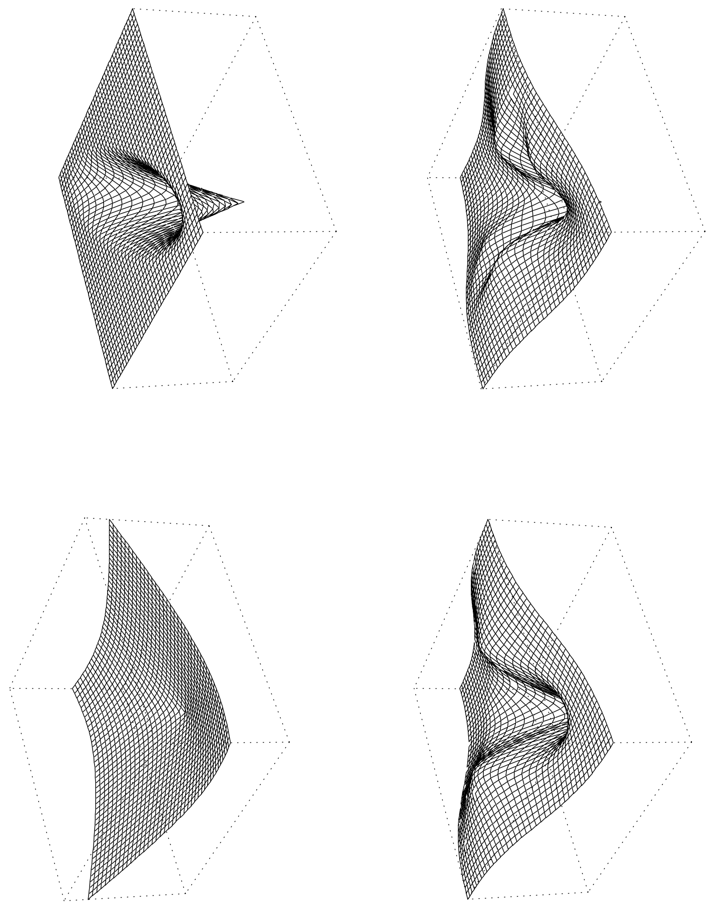

Figure 1.3: Examples of 2-D elliptic cone/spherical semivariogram models