



**FIGURE 4.5:** The ocean bottom as seen by the model : (a)  $z$ -coordinate with full step, (b)  $z$ -coordinate with partial step, (c)  $s$ -coordinate : terrain following representation, (d) hybrid  $s - z$  coordinate, (e) hybrid  $s - z$  coordinate with partial step, and (f) same as (e) but with variable volume associated with the non-linear free surface. Note that the variable volume option (**key\_vvl**) can be used with any of the 5 coordinates (a) to (e).

The choice of a vertical coordinate, even if it is made through a namelist parameter, must be done once of all at the beginning of an experiment. It is not intended as an option which can be enabled or disabled in the middle of an experiment. Three main choices are offered (Fig. 4.5a to c) :  $z$ -coordinate with full step bathymetry ( $ln\_zco = true$ ),  $z$ -coordinate with partial step bathymetry ( $ln\_zps = true$ ), or generalized,  $s$ -coordinate ( $ln\_sco = true$ ). Hybridation of the three main coordinates are available :  $s - z$  or  $s - zps$  coordinate (Fig. 4.5d and 4.5e). When using the variable volume option **key\_vvl** (*i.e.* non-linear free surface), the coordinate follow the time-variation of the free surface so that the transformation is time dependent :  $z(i, j, k, t)$  (Fig. 4.5f). This option can be used with full step bathymetry or  $s$ -coordinate (hybrid and partial step coordinates have not yet been tested in NEMO v2.3). If using  $z$ -coordinate with partial step bathymetry ( $ln\_zps = true$ ), ocean cavity beneath ice shelves can be open ( $ln\_isfcav = true$ ).

Contrary to the horizontal grid, the vertical grid is computed in the code and no provision is made for reading it from a file. The only input file is the bathymetry (in meters) (*bathy\_meter.nc*)<sup>1</sup>. After reading the bathymetry, the algorithm for vertical

1. N.B. in full step  $z$ -coordinate, a *bathy\_level.nc* file can replace the *bathy\_meter.nc* file, so that the computation of the number of wet ocean point in each water column is by-passed