Numerical experiments of convection in the partially ice-covered ocean

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   In the ocean partially covered by sea ice, the horizontal scale of non-uniform negative buoyancy forcing made by brine rejection may be comparable with a convective cell. We carry out idealized numerical experiments for this situation using a three-dimensional non-hydrostatic ocean model. In these experiments, in spite of the total density flux over the domain is unchanged, the density of the water made by convection depends on the size and distribution of an area of buoyancy forcing. This result suggests that in order to parameterize convection in the ice-covered ocean in a hydrostatic model, we should include a size distribution of open water in addition to grid-averaged ice concentration.
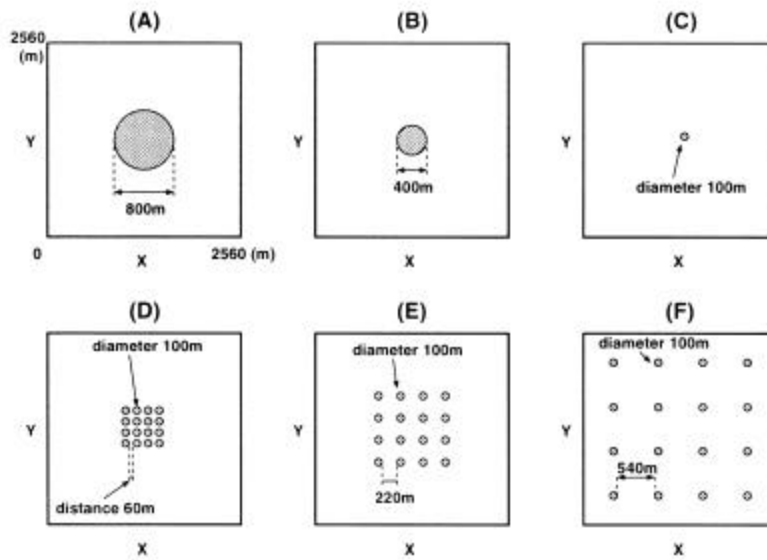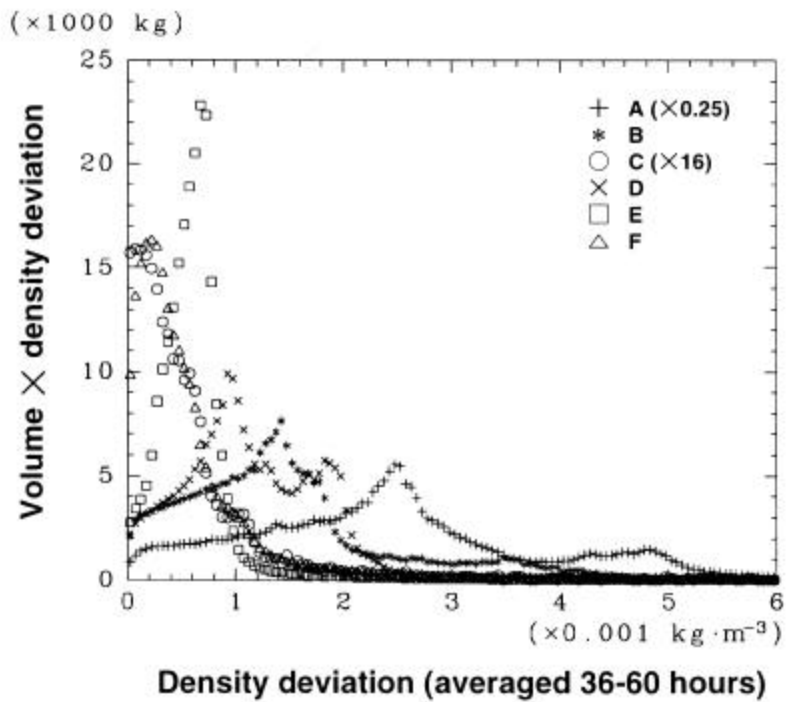
図 1: それぞれのケースで浮力フラックスを与えた領域

図 2: モデル領域全体の初期状態からの密度偏差のヒストグラム。実験開始後 36 時間〜60 時間の平均。縦軸は体積と密度偏差の積 (フォーシング面積で正規化済)