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Batdorf parameter for the spherical shells tectonics

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The buckling phenomena of the subducting lithosphere due to the sphericity of the earth has been studied as spherical shell tectonics which happen the megaquake along the boundary of subducting lithosphere. The earthquake scale is decided by slab length or arc length. However, a relationship between slab length and the normalized hydrostatic pressure along the bottom circumferential edge of a hemispherical shell has not been clear yet. So, by using the data set of the geometrical parameters for subducting lithosphere andBuckingham's Pi-theorem, we found out a new linear relationship between Batdorf parameter $Z = L^2(1 - v^2)^{0.5}/(Rh)$ for the measurement of the slab length L and the normalized hydrostatic pressure along the bottom circumferential edge of a hemispherical shell $Q = qRL^2/(\pi^2 D)$, where $D = Eh^3/[12(1 - v^2)]$ with E = modulus of elasticity of lithosphere, R is Earth radius, q is the hydrostatic pressure along the bottom circumferential edge of a hemispherical shell, and h is the thickness of subducting lithosphere. In the engineering sciences, a similar relationship between Batdorf parameter for the panel length and normalized hydrostatic pressure was proposed for the buckling of partially liquid-filled circular cylindrical shells under hydrostatic pressure. Moreover, by previous researches, the slab length is approximately proportional to the arc length or the lithosphere thickness related to lithosphere age. Therefore, the Batdorf parameter for subducting lithosphere is an important parameter for the spherical shells tectonics.