# Modeling of Subduction Zone by a State of Plane Strain

# Tadafumi Ochi[1]; Teruyuki Kato[2]

[1] ERI, Univ. Tokyo; [2] Earthq. Res. Inst., Univ. Tokyo

In order to estimate the coupling between the subducting oceanic plate and overriding continental plate, the slip deficit model introduced by Savage [1983] has been widely accepted. This model simplifies the logic and enables us to estimate the coupling as “back slip”. Many researchers have used this model to estimate the coupling rate in many regions along the Japanese coast such as Tokai, Tonankai and Nankai as well as northern part of Japan.

The concept of this model, however, includes somewhat difficult ideas to understand. First of all, in this model, the coupling between two plates is represented by superimposing two states: (1) two plates sharing the common border sliding each other with no interaction and (2) the dislocation on the coupling area. The state (1) is not a dislocation. Thus this model superimposes two different concepts and the effect of (1) is neglected in this model. Therefore, this model is a kind of approximation. Although this approximation can be justified by consistency between the observed displacements and calculated displacements, the validity of the superposition of different conceptions is still remaining.

In addition, we can usually use the observation data on the surface of the overriding plate. Although the effects of the moving subducting plate could be obtained through the plate boundary, it is impossible to know such effects because the coupling of the plate boundary is the area of which the dislocations are to be estimated.

In the present study, we try to derive the formula to express the surface displacements of the overriding plate assuming plane strain. We employ an infinite wedge for representing an overriding plate as shown in the figure below. We use polar coordinated $r$ and $¥theta$ and the top boundary is taken as the line $¥theta = 0$ and the bottom boundary is taken as the line $¥theta=-¥alpha$, where $¥alpha$ is the inclination angle of the plate boundary. The boundary conditions are taken as in the figure in order to approximate the free surface and the shear stress. Using the Airy stress function, we try to derive the expressioin to estimate the stress field in the wedge due to the shear stress acting along $¥theta=-¥alpha$.

Although this new model cannot be expanded as easily as the dislocation model, the direct relationships between the displacements and shear stress acting on the overriding plate would be an advantage of this model compared with so-called “back-slip” model.