and hence

$$\frac{\partial F^*}{\partial t} = \frac{\partial F}{\partial t} + \frac{\partial F}{\partial \theta}\frac{\partial \theta}{\partial t} \quad , \tag{4–174}$$

$$\left.\frac{\partial F}{\partial t}\right)_{\Theta=\text{const.}} = \left.\frac{\partial F}{\partial t}\right)_{\theta=\text{const.}} + F_\theta \frac{\partial \theta}{\partial t} \quad , \tag{4–175}$$

in an obvious notation. Thus, in order to get $\partial F/\partial t$ in Wavre's sense, we have to add to $\partial F/\partial t$ in our present sense a "θ-correction".

The factor $\partial\theta/\partial t$ is the change of θ along the normal to the equisurface passing through the point (t, θ) under consideration. It is easily found as follows (Fig. 4.9). The infinitesimal distance PF can be expressed in two ways:

$$-r d\theta = \delta dr \tag{4–176}$$

(we have put the minus sign since in Fig. 4.8 we had taken $r = OP_1$, whereas now

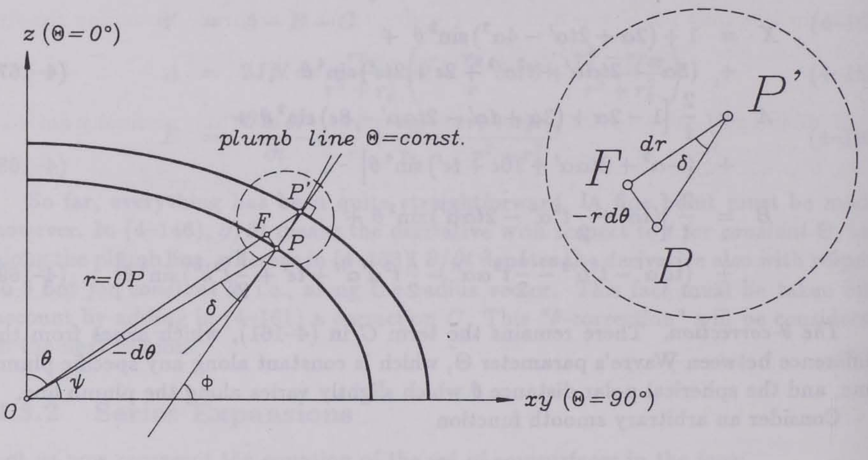

FIGURE 4.9: The θ-correction

$r = OP$; so to speak, in Fig. 4.8 we went from P' to P, whereas in Fig. 4.9 we go from P to P'). Thus

$$\frac{\partial \theta}{\partial r} = -\frac{\delta}{r} \quad , \tag{4–177}$$

where the very small angle δ is nothing else than the difference between the geographic latitude ϕ and the geocentric latitude ψ (Fig. 4.9), which is given by (1–76):

$$\delta = \phi - \psi = 2f\cos\theta\sin\theta \quad , \tag{4–178}$$

neglecting higher-order terms. (This is a standard formula from ellipsoidal geometry: to this accuracy, the level surfaces can be considered ellipsoids of revolution.) To the