GPS－地上受信機

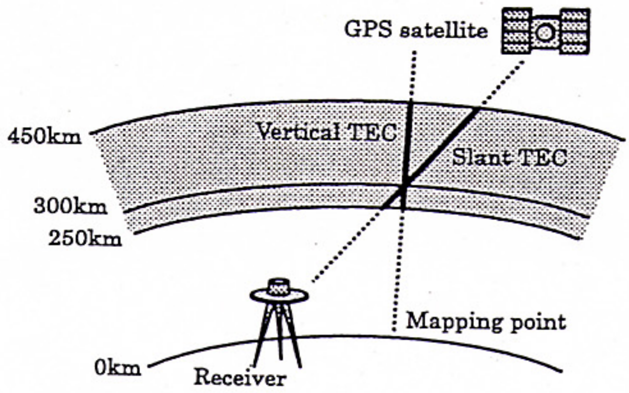


Figure 2.1: Conversion of the slant TEC to the vertical TEC. It is assumed that the ionosphere is a thin shell which upper and lower boundary is 450km and 250km altitudes, respectively. The vertical TEC is mapped on the ionospheric shell which is assumed to be located at the 300km altitude.

GPS－LEO 受信機

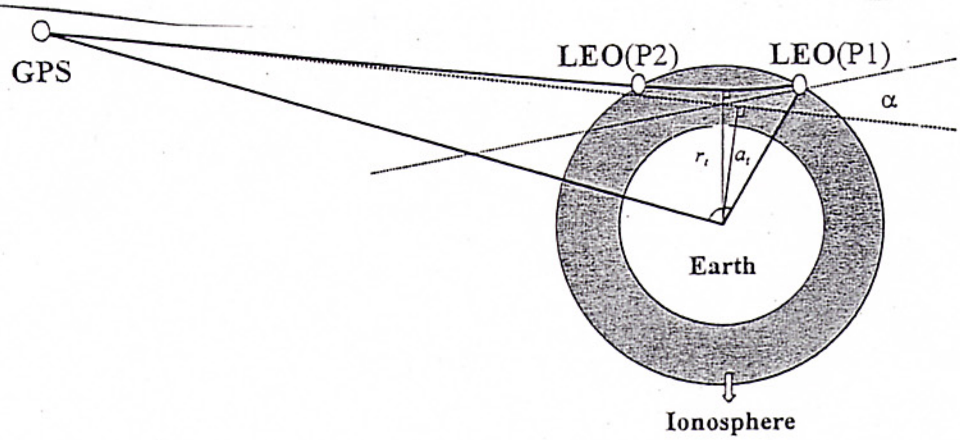


Fig. 1. Illustration of the geometry of the ray, bending angle α, and impact parameter a used in the GPS-LEO occultation problem for ionosphere observations.

GPS 衛星は 2 周波（f_1＝1.57542 GHz and f_2 ＝1.22760 GHz）の信号を送信し、地上や衛星軌道上の GPS 受信機がそれを受信する。

電子密度の経路積分（TEC）

$$T(t) = \int_{ray} dl \rho(\vec{x},t)$$

f_i の遅延

$$L_i(t) = D_{s.l.}(t) - \alpha T(t) / f_i^2 + \sigma + c_{sat}^i + c_{rec}^i + c_{align}^i + \left(D^i(t) - D_{s.l.}(t)\right) + noise$$

$$\alpha \approx 40.30 \ m^3/s^2$$

"tomographic equation"

$$L_I = L_2 - L_1 \approx -\gamma \int_{s.l.} dl \rho(\vec{x}) + c_{sat}^I + c_{rec}^I + c_{align}^I$$

$$\gamma = \alpha\left(1/f_1^2 - 1/f_2^2\right) \approx 1.05\times10 \ m^3$$

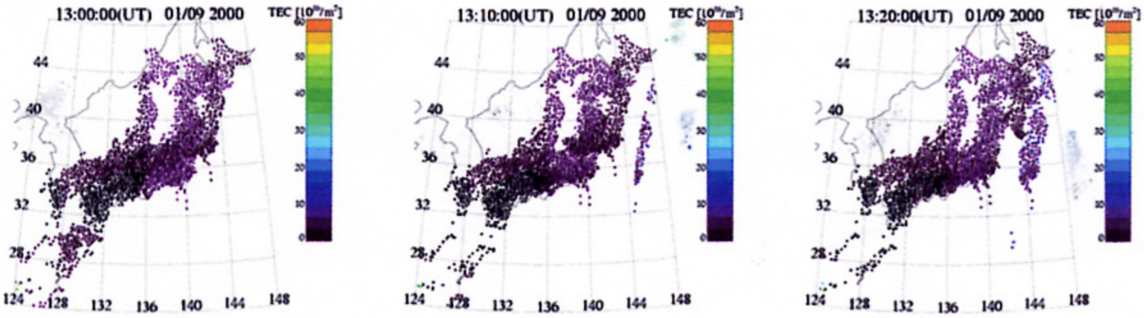
・・・十分に経路が与えられると・・・

電子密度

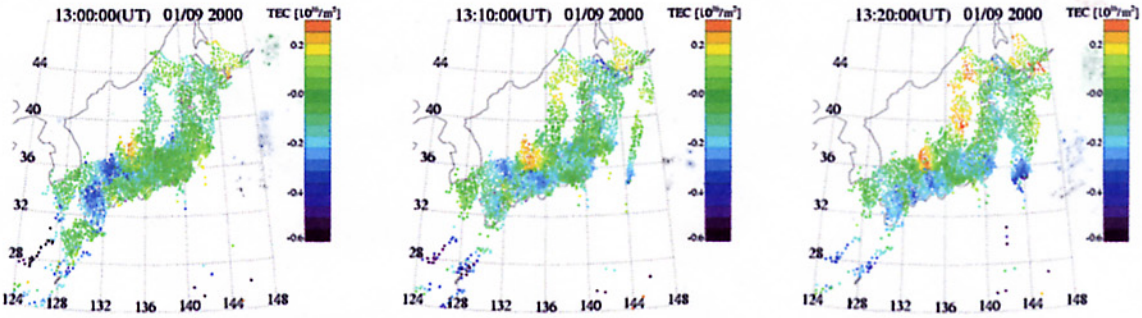
$$\rho(\vec{x},t) = \sum_J a_J(t) \Psi_J(\vec{x}) + q(\vec{x},t)$$

日本上空における TEC の 2 次元分布図

GEONET TEC（絶対値）

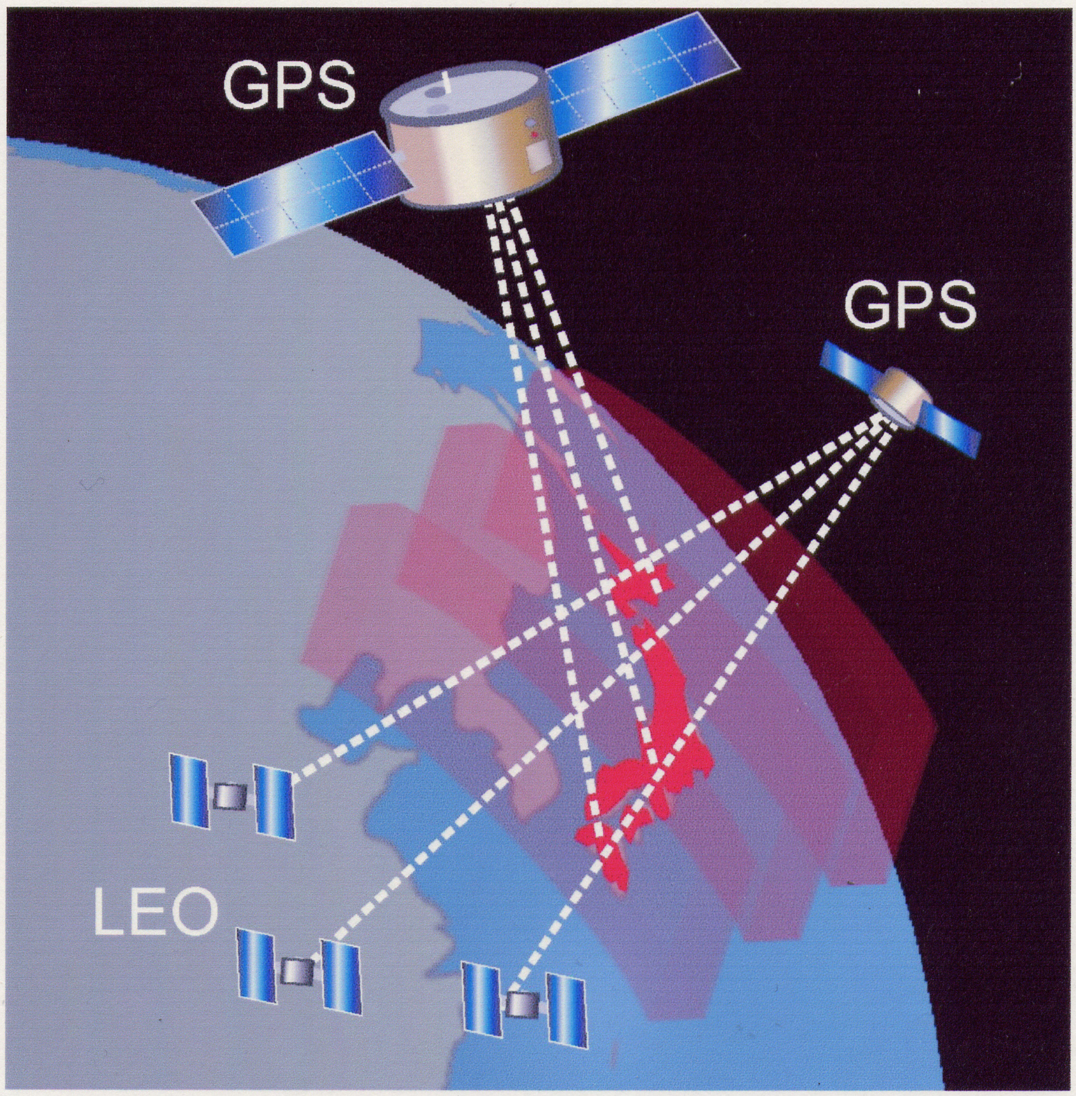


GEONET perturbation TEC（変動成分）



空間分解能　**0.15** 度×**0.15** 度

時間分解能　**10** 分


GPS
GPS
LEO

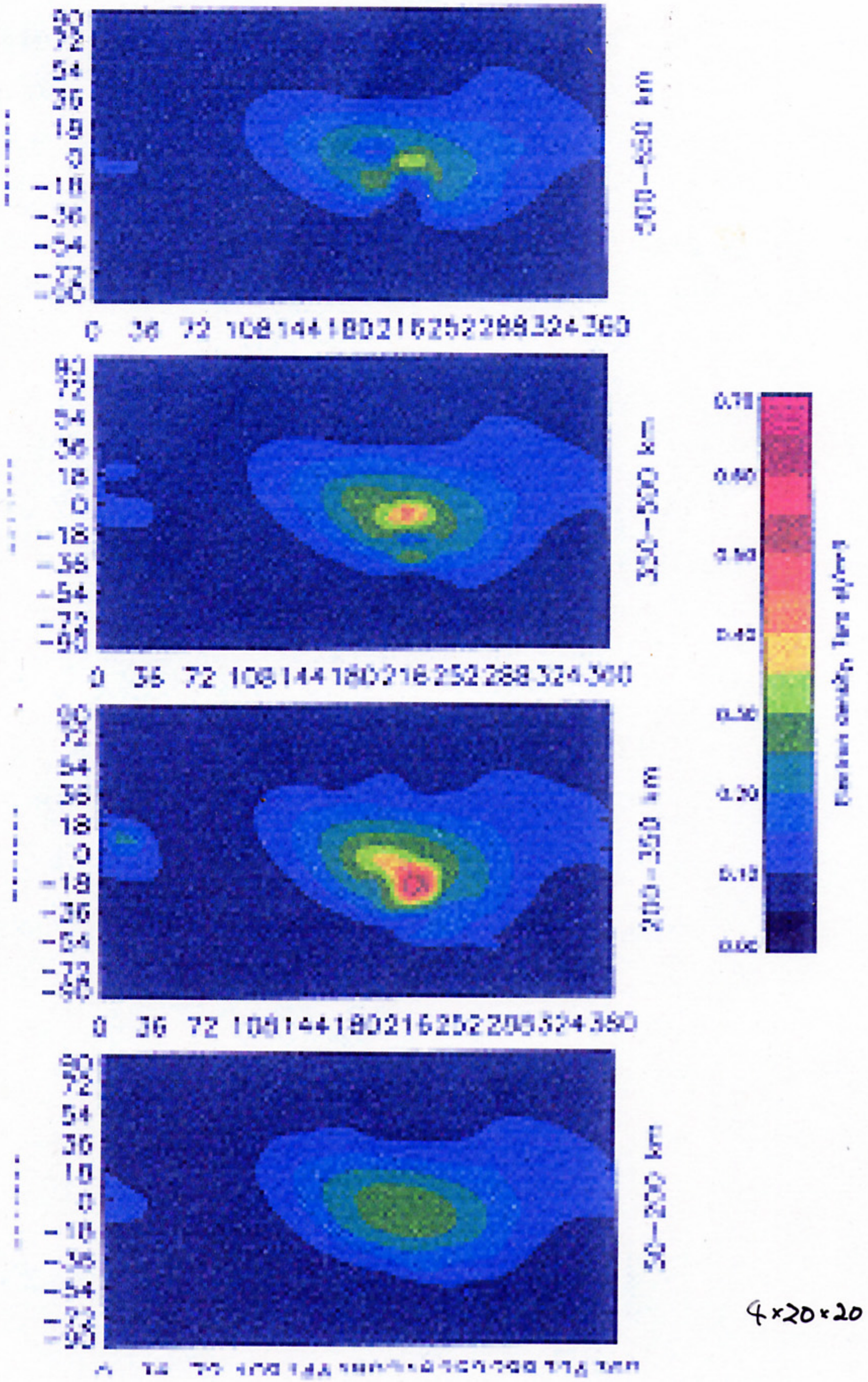


Figure 4. The solution from the combined data, UT 21-24, Nov 2nd, 1996. In these coordinates, the Sun is at 217° Right Ascension, and -14° declination.

(A. Rius et al. 1997)