SUGGESTED SOLUTION (ODD)

CHAPTER 21

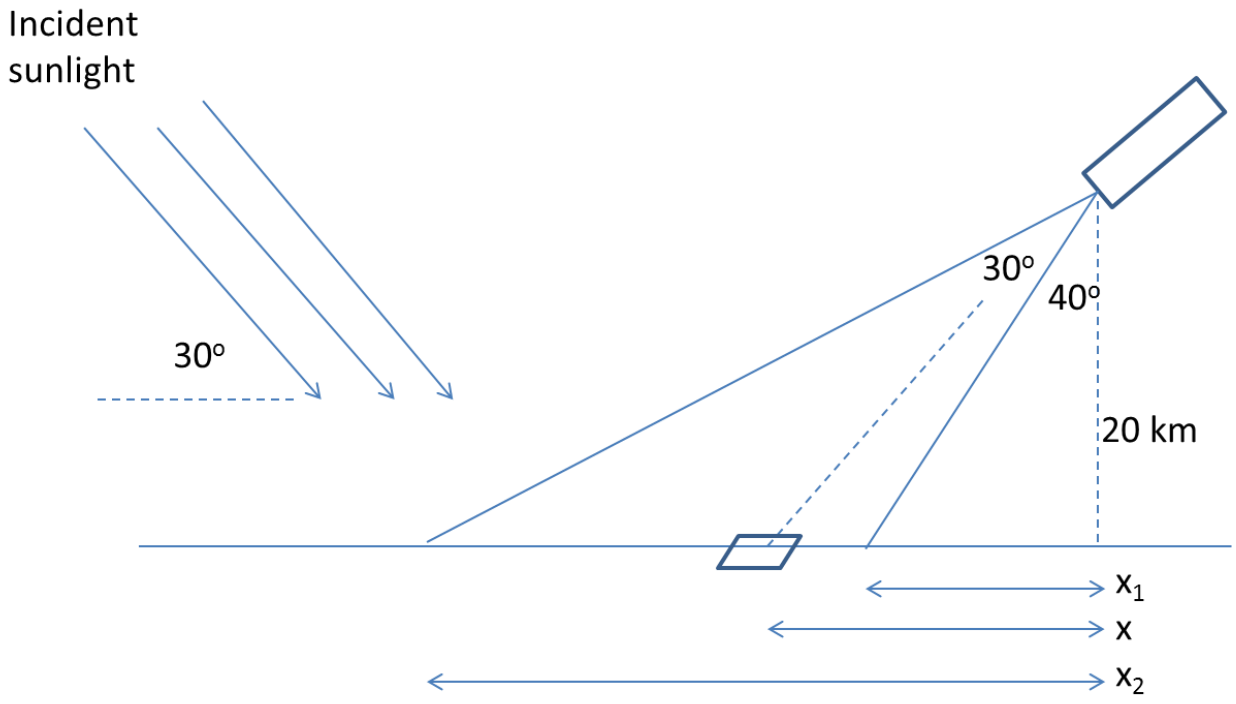
21-1. A sensor to collect PI using a push-broom scan pointed off nadir is shown below flying into the paper.

a. What is the distance x_1 from nadir to the near edge of the collected swath?

b. What is the distance x_2 from nadir to the far edge of the collected swath?

c. Suppose the surface of all the area images is rough, except for one ground pixel where the surface is perfectly smooth. Based on the geometry shown of the collection, at what distance from nadir must this pixel be located so that the received radiation is much larger than that of any other pixel in the scene?

d. What value of index of refraction must this smooth surface material have so that the difference between the horizontal component and the vertical component of the received radiation is the largest



SUGGESTED SOLUTION:

a) Distance x_1 from nadir to the near point of the swath.

$$\frac{x_1}{20\ \text{km}} = \tan 30^\circ \qquad \text{Hence, } x_1 = 11.5\ \text{km}$$

b) Distance x_2 from nadir to the far point of the swath.

$$\frac{x_2}{20\ \text{km}} = \tan 70^\circ \qquad \text{Hence, } x_2 = 55.9\ \text{km}$$

c) Distance x from nadir to a smooth bright pixel.

For specular reflection from a smooth surface, the angle of incidence must equal the angle of reflection; in this case, $\theta_{inc} = \theta_{ref} = 60^\circ$.

$$\frac{x_2}{20\ \text{km}} = \tan 30^\circ \qquad \text{Hence, } x = 34.6\ \text{km}$$

d) Index of refraction n value so that ρ_H-ρ_V is the largest.

This occurs at Brewster's angle, where $\rho_V = 0$.

$$\tan 60^\circ = n \qquad \text{Hence, } n = 1.73$$