Physik, M. Sc.

Astronomische Beobachtungsmethoden

First lab - Determination of the Geographical Latitude

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Gruppe 02

Informationen

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1 Introduction

The aim of this laboratory session is to determine the geographical latitude of the experimenter by simply measuring the zenith angle of the sun. This is done using a device called a theodolite. The theoretical background and the setup are explained below.

2 Theoretical description

$$\tau(t,l,\alpha) = \Theta(t,l) - \alpha = \Theta_{\mathrm{G}}(t) - l - \alpha = \Theta_{\mathrm{G}}(0) + t\left(\frac{366.24}{365.24}\right) - l - \alpha \tag{2.1}$$

$$b = \begin{cases} \pi - arcsin(cosz/X) - Y, & (b+Y) > \pi/2 \\ arcsin(cosz/X) - Y, & -\pi/2 \geq (b+Y) \leq \pi/2 \\ -arcsin(cosz/X) - \pi - Y, & (b+Y) < -\pi/2 \end{cases}$$

where $X = sin\delta\sqrt{1+(cos\tau/tan\delta)^2}$ and $Y = arctan(cos\tau/tan\delta)$
Linear Interpolation for UT = t - Δt and Δt=2h for CEST:

$$\alpha^{sun}(t) = \alpha_1^{sun}(0UT) + \frac{UT}{24\mathrm{h}}(\alpha_2^{sun}(0UT) - \alpha_1^{sun}(0UT)) \tag{2.2}$$

$$\delta^{sun}(t) = \delta_1^{sun}(0UT) + \frac{UT}{24\mathrm{h}}(\delta_2^{sun}(0UT) - \delta_1^{sun}(0UT)) \tag{2.3}$$

Average refraction for T = 10degC and pressure of 101kPa:

$$\bar{R}(z_{\mathrm{b}}) = 1/\tan\left((90\,\mathrm{deg} - z_{\mathrm{b}} + \frac{7.31\,\mathrm{deg}^2}{90\,\mathrm{deg} - z_{\mathrm{b}} + 4.4\,\mathrm{deg}})\right) \tag{2.4}$$

$$R(z_{\mathrm{b}},T,p) = \bar{R}(z_{\mathrm{b}})\left(\frac{p\,[\mathrm{kPa}]}{101}\cdot\frac{283}{273+T\,[^{\circ}\mathrm{C}]}\right) \tag{2.5}$$

$$\boxed{z = z_{\mathrm{b}} + i + R(z_{\mathrm{b}},T,p) \pm \phi_1 - \phi_2} \tag{2.6}$$

3 Procedure

4 Interpretation

4.1 Calculation of geographical latitude

4.2 Questions

5 Results and Discussion

A Append A

A.1 Teilanhang X

Literaturverzeichnis