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جامعة عين شمس

التوثيق الالكتروني والميكروفيلم



نقسم بللله العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأفلام قد اعدت دون آية تغيرات



يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15-20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of 15 – 25c and relative humidity 20-40 %



ثبكة المعلومات الجامعية





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STUDIES ON SOLAR AND TERRESTRIAL RADIATION TRANSFER THROUGH THE EARTH-ATMOSPHERE SYSTEM, INCLUDING ATMOSPHERIC GREENHOUSE EFFECT

A THESIS

Submitted to Faculty of Science (Qena)
South Valley University

For The Degree Of Ph.D. Of Science (Physics)

By

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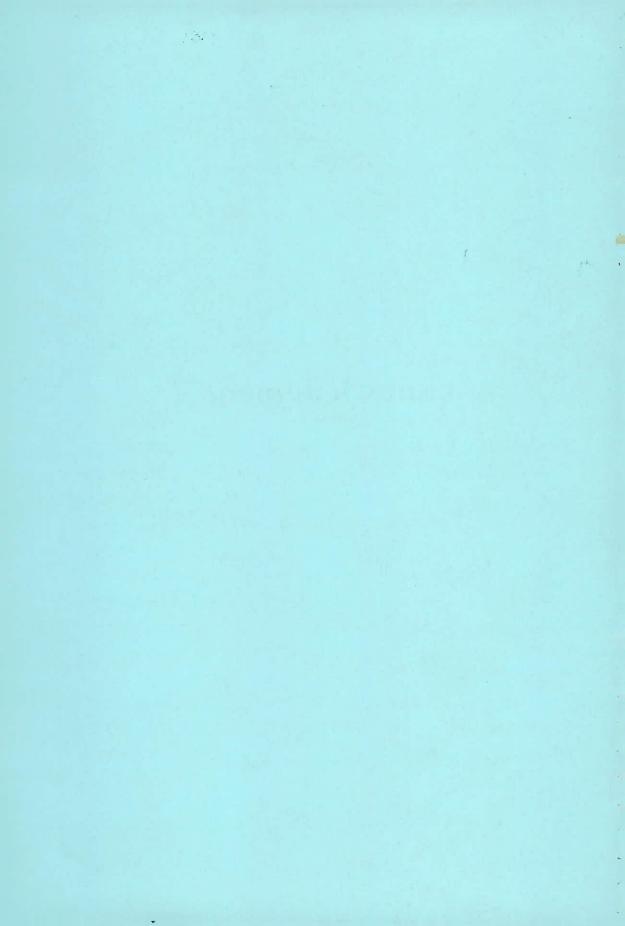
South Valley University

1998

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Acknowledgment



Acknowledgment

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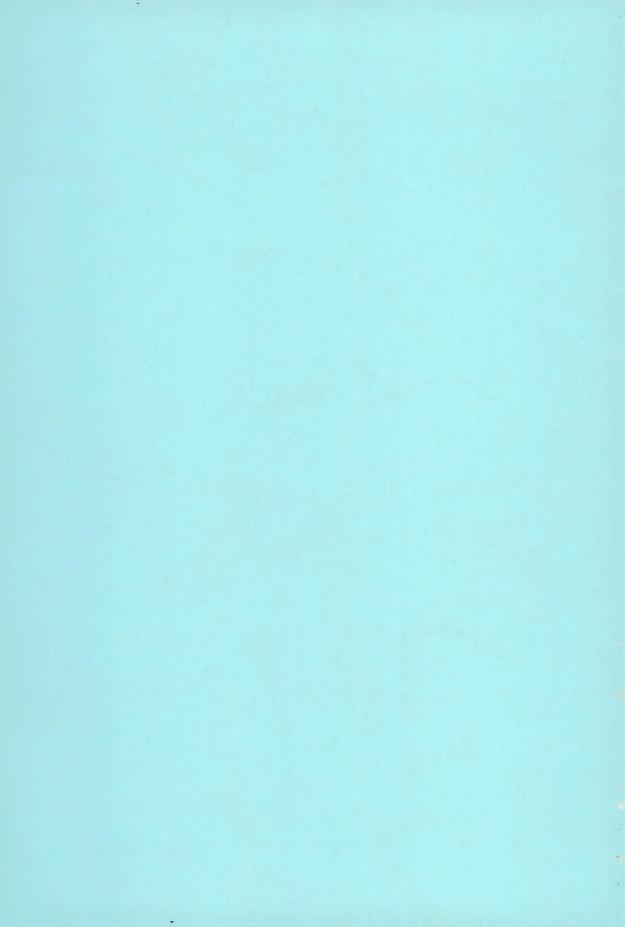
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Abstract



Abstract

This work deals with very interesting problem concerning studies on solar and terrestrial radiation transfer through the Earth-atmosphere system, including atmospheric greenhouse effect. Greenhouse gases (H₂O, CO₂, O₃, CH₄, N₂O and CFCs), aerosols, and clouds play an important role in climate change. Most of these parameters are effective absorbers and/or scatterers, and this may perturb the energy balance on the Earth. Consequent warming or cooling in the Earth-atmosphere system may occur, such as increase in the Earth's surface temperature due to greenhouse warming effect, cooling due to aerosol scattering, or change in meteorological conditions. The evidence that human activities are altering the concentration of these greenhouse gases and the other parameters in the atmosphere and intensifying the greenhouse effect is incontrovertible, but there is a considerable uncertainty about the consequences for climate change processes.

The modeling objective of this study is to give an improved understanding of how changing greenhouse gases concentration, aerosols and clouds affect on the variability of solar and terrestrial radiation of the Earth-atmosphere system, radiative forcing, rate of temperature change and the equilibrium warming. A research program of data analysis and radiative transfer modeling using standard and local atmospheric conditions for specific location has been carried out by applying the developed Streamer radiative transfer model given by (J. Key, Univ of Colorado U.S.A) during the time period from 1982 to 1992.

The methodology of this study is totally devoted to : description on the location of study, measuring methods of greenhouse gases, collecting data from ground and satellite measurements, applied model, computational methods involving theoretical equations and FORTRAN programs (Appendices A, B and D) are designed to calculate the following (a): net shortwave and longwave radiative fluxes; (b): rate of temperature change; and (c): equilibrium warming of the most greenhouse gases.

The Streamer radiative transfer model has been applied for calculating the radiative flux components at different altitudes due to changing the concentration of some greenhouse gases (H₂O, CO₂ and O₃), aerosols and

cloud parameters during the period from 1982 to 1992. The modeling output results indicated that H_2O and CO_2 within the shortwave spectral bands and at different solar zenith angles are considerably absorbers for solar radiation within the shortwave bands (0.78-1 and 2.91-4 μ m) and (1.64-2.13 μ m), respectively, and effective absorbers and emitters for thermal radiation within the longwave bands (4.17-500 μ m) and (12.2-19.2 μ m), respectively. Whereas O_3 is effective absorber for ultraviolet solar radiation within the UV band (0.28-0.36 μ m), while it is also a considerable absorber and emitter for thermal radiation within the IR band (7.94-10.9 μ m). The combined effect of all gases in cloud-free and cloudiness sky conditions is investigated. For aerosols, the results indicated that it is a good scatterers for solar radiation and considerably absorber for longwave radiation. Also, the combined effect of all gases including aerosols in cloudless and cloudiness sky conditions are investigated.

The results of cloud radiative forcing indicated that due to the reflection of solar radiation, clouds have negative radiative forcing (cooling). While due to the absorption of longwave radiation, they have positive radiative forcing (heating). The net radiative effect of clouds yield cooling and it is greater at the upper atmosphere than that given at the Earth's surface.

The rate of temperature change per day in the presence of water vapor, carbon dioxide and ozone has been calculated at different altitudes. The results indicated that the radiative heat exchange at tropospheric region by H₂O, CO₂ and O₃ produce cooling of 1.63, 0.26 and 0.01 °C/day, with 85.7, 13.8 and 0.5 % from the total by all gases, respectively. The combined effect of all gases (H₂O, CO₂ and O₃) in cloudless and cloudiness sky conditions at tropospheric region produces cooling of 1.59 and 1.79 °C/day, respectively. Cooling rate near Earth's surface is reduced from 2.12 °C/day in cloudless conditions to about 1.0 °C/day in cloudiness sky conditions.

In the stratosphere layers, the rate of temperature change due to ozone effect on thermal radiation is -0.03 °C/day. On other hand, the results of the computed rate of temperature change due to the absorption of ultraviolet solar radiation by ozone at three different solar zenith angles (30°, 45.5° and 75°) shows maxima heating at 40 km of 3.4, 3.18 and 1.95 C/day, respectively. The net radiative heat exchange due to ozone effect shows