University of Colorado
Department of Civil, Environmental and Architectural Engineering
CVEN 5333 Physical Hydrology & Hydroclimatology
Homework #2
Due October 6th, 2022
Topics: Global Hydrology, Terrestrial Radiation, Atmospheric Moisture, Precipitation, Thunderstorm

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Global Hydrology – Budyko Curves

1.Dingman Chapter 2, Problem 5

2. Dingman Chapter 2, Problem 7

Solar Radiation

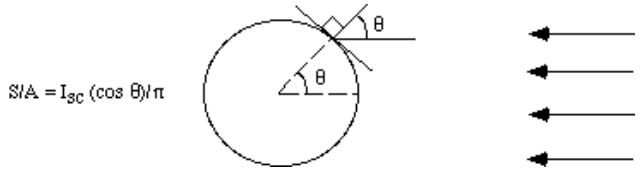
3.Shuttleworth book Q2
(http://civil.colorado.edu/~balajir/CVEN5333/HWs/Shuttleworth-Q1-2.pdf)

Global Temperature Model

Dingman handout –
https://civil.colorado.edu/~balajir/CVEN5333/Lectures/DingmanCh3.pdf

4. Refer to Dingman handout above. In Box 3.2 the input energy quantities were global totals. They could equally well have been global averages per unit area. Recognizing that A is in the denominator of 3B2-4, the input energy per unit area is S/A, Q_e/A, Q_h/A and W/A etc. This form of the model is more convenient for application of the model regionally. The solac constant has the value I_{sc} = 1367 W/m^2

(a) Now consider the distribution of energy with latitude. Given S/A inputs that depend upon latitude (neglecting tilt or seasonal effects) calculate T_s at latitudes of 15^o and 45^o North. Compare your results to global temperature distribution maps (Fig 3.12 in the handout).



(b) What do you think is the reason for discrepancies in the results from (a) and the figure.

Summarize and discuss your findings.

5. In the model described in Box 3-2 in the Dingman handout above, the greenhouse effect can be modeled by increasing the fraction, *f,* of longwave radiation from the surface that is absorbed in the atmosphere. Use Excel or R to explore the sensitivity of T_s to increases in *f.* Graph Ts as a function of f ($f < 1$)

Atmospheric Water Vapor

6.Shuttleworth Q1
(http://civil.colorado.edu/~balajir/CVEN5333/HWs/Shuttleworth-Q1-2.pdf)
7.Bras book Chapter 3 problem 8
8. Chow Book Problem 3.2.2
Compare the results using the Pseudo-adiabatic diagram.

Column Precipitable Water & Thunderstorm Models
9. Chow Book Problem 3.2.5
10. Chow Book Problem 3.3.7
11.Chow Book Problem 3.3.8
12. Chow Book Problem 3.4.7