

Extraterrestrial solar radiation

The extraterrestrial solar radiation can be estimated from simple geometric relationships. The [distance between the sun and the earth](#) d_{se} is needed. The formula for the extraterrestrial incoming radiation S_{ext} reads:

$$S_{ex} = 15.392 \cdot d_{se} \cdot (\omega_s \cdot \sin(\phi) \cdot \sin(\delta) + \cos(\phi) \cdot \cos(\delta) \cdot \sin(\omega_s))$$

The result is in mm/day of water that can be evaporated with the corresponding amount of energy. ϕ is the latitude.

[extraterrestrial-radiation.py](#)

```
from pylab import *
from numpy import *
def extraterrestrialradiation(latitude,J):
    ds=0.4093*sin(2*pi/365*J-1.405)      # to be replaced by class
    sha=arccos(-tan(latitude)*tan(ds))  # to be replaced by class
    dse=1+0.033*cos(2*pi/365*J)
    Sext=15.392*dse*(sha*sin(latitude)*sin(ds)+cos(latitude)*cos(ds)*sin(sha))
    return Sext
latitude=31
J=arange(1,365,1)
plot(J,extraterrestrialradiation(latitude,J))
ytext = ylabel('extraterrestrial radiation in mm/day')
xtext = xlabel('Julian day')
show()
```

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