```
!
! This program computes TOA solar radiation for any
! location on Earth and any day of year. The
!
! Input: lat [the latitude in degress]
! j [the Julian day number or day of year]
!
! Output: q [the solar flux per unit surface area in Wmˆ-2]
! qdaily [daily mean value of q]
! h00 [the hour angle at sunrise or sunset in radians based on discrete time intervals
of one hour
! h0 [the hour angle at sunrise or sunset in radians]
! based on analytical form]
! qinte [daily mean value of q, from analytical form]
!
! Author: Gang Zhang 09/05/2010   Email: zhangg06@hotmail.com
!

program LAID_ex1_1
INTEGER :: ti=1
REAL :: s0 = 1367. !Wmˆ-2
REAL :: pi = 3.1415937


write(6,*) 'enter latitude in degrees (negative if in the southern hemisphere)'
read(5,*) lat
phi=lat*pi/180.0 !convert to radians

write(6,*) 'enter day of year (= 172 June 21 summer solstice; = 355 (Dec 21) winter sol
stice'
read(5,*) j

fe=1 + 0.033*cos(2.*pi*j/365.) !the eccentricity factor
delta=0.4093*sin(2*pi*j/365.0 - 1.405) !the solar declination in radians

DO
  qdaily=0.0 !daily mean value of q
  do i=1,24*ti
    t = i - 0.5/ti
    h = pi*(t-0.5*ti)/(0.5*ti)
    czen = sin(phi)*sin(delta)+cos(phi)*cos(delta)*cos(h)
    q = s0*fe*czen

    if (q<0.) q = 0. !negative means Sun is below horizon, set to zero
    if (q>0.) h00 = h !hour angle at sunset

    qdaily = qdaily + q !get daily cumulative
  enddo
  qdaily = qdaily / (24.0*ti) !daily mean

  ! h0 = acos(-tan(phi)*tan(delta)) !the hour angle at sunrise or sunset
  cos_h0=-tan(phi)*tan(delta)
  if (cos_h0>1.0) cos_h0=1.0
  if (cos_h0<-1.0) cos_h0=-1.0
  h0 = acos(cos_h0) !the hour angle at sunrise or sunset
  qinte = (s0*fe/pi)*(h0*sin(phi)*sin(delta)+cos(phi)*cos(delta)*sin(h0)) !daily mean i
```

```
n analytical form

  if ((abs(qinte-qdaily))>0.01) then
     ti=ti*2. !time interval=1./ti
  else
     EXIT
  end if
end do

write(6,*) 'Qdiscrete, Qanalytical,Hdiscrete,Hanalytical'
write(6,*) qdaily,qinte,h00*180./pi,h0*180./pi
write(6,*) 'Declination = ', delta*180./pi
write(6,*) 'Hanalytical = ', h0*180./pi
write(6,*) 'Latitude = ', phi*180./pi
write(6,*) 'Feccentricity = ', fe
write(6,*) '(1st) = ', h0*sin(phi)*sin(delta)
write(6,*) '(2nd) = ', cos(phi)*cos(delta)*sin(h0)
write(6,*) 'The fianl time inteval is', 1.0/ti

end
```