Задание 1-6.

Расчет областей захваченных, локально-захваченных и высыпаю
частиц для прогноза радиационной опасности.

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Код

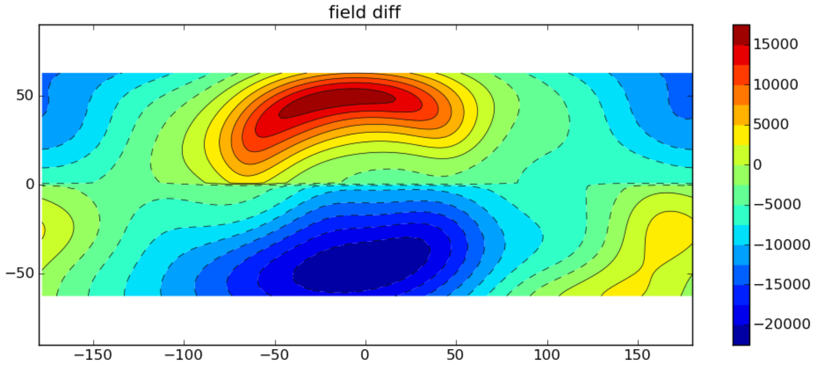
```
program task6
external igrf_gsm, t89c
real :: xx(1000), yy(1000), zz(1000), len
        open (unit=1, file='data.dat')

R0=1.+300./6371.
Rll=1.+100./6371.
RLIM=60.0
IOPT=1

call recalc(2000,90,1,1,1)
do long = -179, 180
do lat = -63,63
  print *, long, lat
  THETA = (90-lat)*3.14/180.0
  PHI = long*3.14/180.0
  call sphcar(R0,THETA,PHI,XGEO,YGEO,ZGEO,1)
  call geogsm(XGEO,YGEO,ZGEO,XGSM,YGSM,ZGSM,1)
  if (lat.lt.0) then
    dir = -1.
  else
    dir = 1.
  end if
          call igrf_gsm(XGSM,YGSM,ZGSM,HX,HY,HZ)
  call trace(XGSM,YGSM,ZGSM,dir,RLIM,Rll,IOPT,PARMOD,T89C,
     _ IGRF_GSM,XF,YF,ZF,XX,YY,ZZ,L)
  if (sqrt(xf**2+yf**2+zf**2).gt.2.) then
     print *, 'Error: line from ', lat, long, ' isn''t closed'
     print *, sqrt(xf**2+yf**2+zf**2)
     stop 1
  end if
  call igrf_gsm(xf,yf,zf,HXf,HYf,HZf)
  field = sqrt(HX**2+HY**2+HZ**2)
  field_delta = field - sqrt(HXf**2+HYf**2+HZf**2)

  !! len = int (1-B/Bm)*ds
  len = 0.
  Bm = sqrt(HX**2+HY**2+HZ**2) ! or on R11?
  do i=1, L-1
     ds = sqrt((xx(i)-xx(i+1))**2+(yy(i)-yy(i+1))**2+
     _             (zz(i)-zz(i+1))**2)
     call igrf_gsm(xx(i),yy(i),zz(i),Hxx,Hyy,Hzz)
     B = sqrt(Hxx**2+Hyy**2+Hzz**2)
     if (B.lt.Bm) then
len = len + sqrt(1-B/Bm)*ds
     end if
  end do

  write (1, ’(2i8,4f10.2)’) long, lat, field, field_delta, len
end do
c   write (1, *) ’’
end do
end program
```

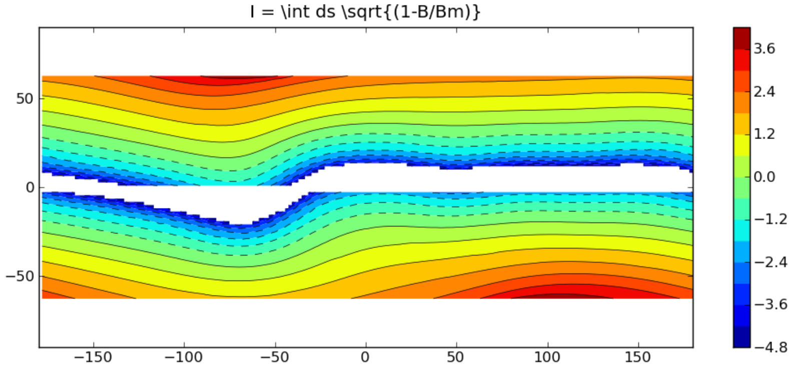
Программа для визуализации

```
#!/usr/bin/python

from matplotlib.mlab import griddata
import numpy as np
import matplotlib.pyplot as plt

def plotone(x,y,z):
    #z = np.maximum( z, 0.001); z = np.minimum( z, 10 );

    xi = np.linspace(-180,180, 200)
    yi = np.linspace(-90,90, 100)
    zi = griddata(x, y, z, xi, yi)

    CS = plt.contour(xi,yi,zi,15,linewidths=0.5,colors='k')
    CS = plt.contourf(xi,yi,zi,15,cmap=plt.cm.jet)
    plt.xlim(np.min(xi),np.max(xi))
    plt.ylim(np.min(yi),np.max(yi))
    plt.colorbar() # draw colorbar


plt.figure(num=None, figsize=(12, 10), dpi=90, facecolor='w', edgecolor='k')

data = np.genfromtxt("data.dat")

x = data[:,0]
y = data[:,1]

print x

plt.subplot(2, 1, 1);plotone(x,y,data[:,3])
plt.title('field diff')

plt.subplot(2, 1, 2);plotone(x,y,np.log(data[:,4]))
plt.title('I = \int ds \sqrt{(1-B/Bm)}')

plt.savefig("lines.png")
```

Результат

Вывод


field diff
50
0
−50
−150
−100
−50
0
50
100
150
15000
10000
5000
0
−5000
−10000
−15000
−20000


I = \int ds \sqrt{(1-B/Bm)}
50
0
−50
−150
−100
−50
0
50
100
150
3.6
2.4
1.2
0.0
−1.2
−2.4
−3.6
−4.8