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Evaluting the GOES-5 reanalysis surface climate variables against the Lake Taihu observations

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Outline :

- Intruduction.
- Methods and Materials .
- Results and Discussions .
- Conclusions .
- Work in the future .

Introduction :

To analyse the climate of places that lack meterology data and to drive the models or to construct land surface forcing data.It's necessary to get the data before the conventional meteorological stations were constructed .

For the Lake Taihu Model , we need the reanalyse data before the year of 2010 to drive this model.but it's essential to evaluate the reanalyse data , for the assimilation processes contain some kind of uncertainties .

The main reanalysis data mostly used :

1 . National Centers for Enviromental Prediction/National Center for Atmospheric Research [NCEP/NCAR,referred to as NRA-1] .
NCEP released the new product from the Climate Forecast System Reanalysis[CFSR] .

2 . Europeran Center for Medium-Range Weather Forecast(ECMWF)with both ERA-40 and ERA-interim.

3 . NASA/GSFC Global Modeling and Assimilation Office(GMAO)developed a modern era reanalysis for 1979-ongoing[MERRA] .

Methods and Materials:

The Global Modeling and Assimilation Office(GMAO) has used its GEOS-5 atmospheric data assimilation system (ADAS) to synthesize data assimilation collected over the satellite era (from 1979 to the present) into an analysis that is as consistent as possible over time because it uses a fixed assimilation system.

MERRA: The Modern-Era Retrospective analysis for Research and Applications.

the surface climate variables :

- 1.grid of 1/2°latitude * 2/3°longitude .
- 2.grid of 1°latitude * 1.25°longitude .
- 3.grid of 1.25°latitude * 1.25°longitude .

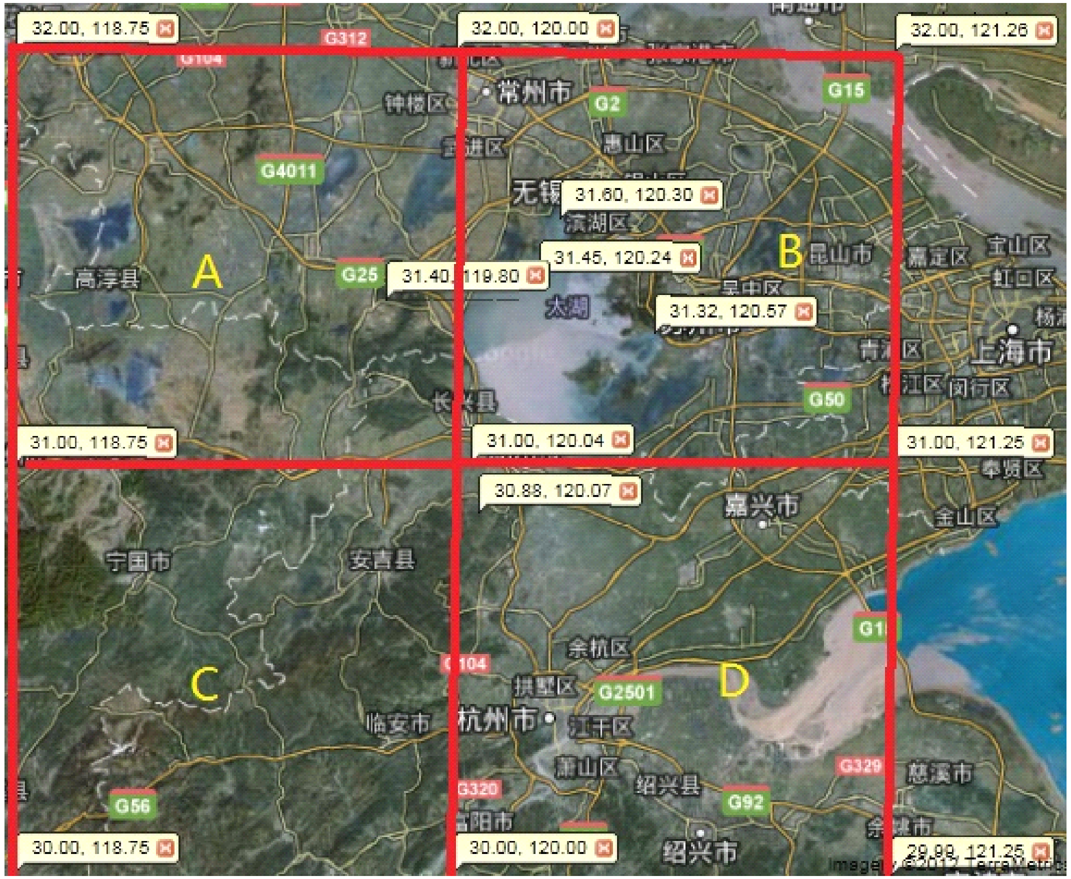
There are 2 kinds of downward longwave radiation ,one is absorbed longwave at the surface(LWGAB). it is 1/2°latitude * 2/3°longitude using model conventions and is hourly time-averaged. the other is surface downward longwave fluxwant (LWGDWN).it is 1°latitude * 1.25°longitude,using model conventions and is 3-hourly time-averaged .

Results and Discussions . :

Figure 1 . The picture divided into 9 grid cells

1.Absorbed longwave at the surface(LWGAB) .Taking into account that surface is gray body, and the absorption ratio of longwave remains as a constant which is close to 1. just take it as 0.95.

Yixing（31.386,119.833） in C（243，450）grid cell .
Huzhou（30.86,120.08） in F（242，451）grid cell .
Suzhou(31.32,120.57） in D（243，451）grid cell.
Wuxi（31.65,120.26）and MLW station in B（244，451）grid cell.



2.Surface downward longwave fluxwant(LWGDWN).it is 1*1.25° using model conventions and is 3-hourly time-averaged.

MLW station is lacated in B grid cell.

Figure 2 . The picture divied into 4 parts in 1°*1.25°

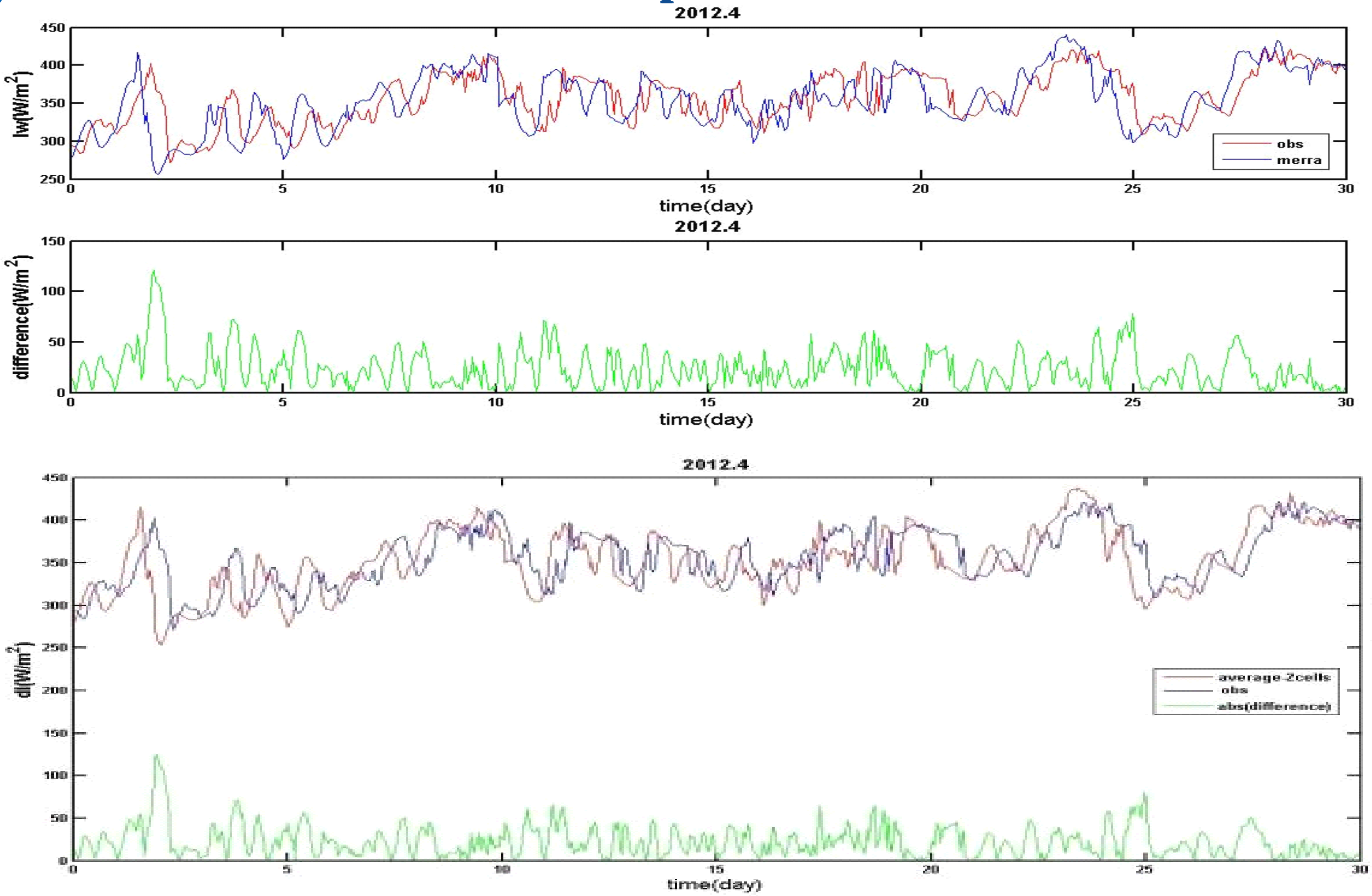


Figure 3 . Hourly time series of merra (the figure above and below is B cell data and average of B and D respectively) and observation data of downward longwave radiation in April 2012.The average difference is about 20.8(w/m^2) above,the below is about 22.87 .

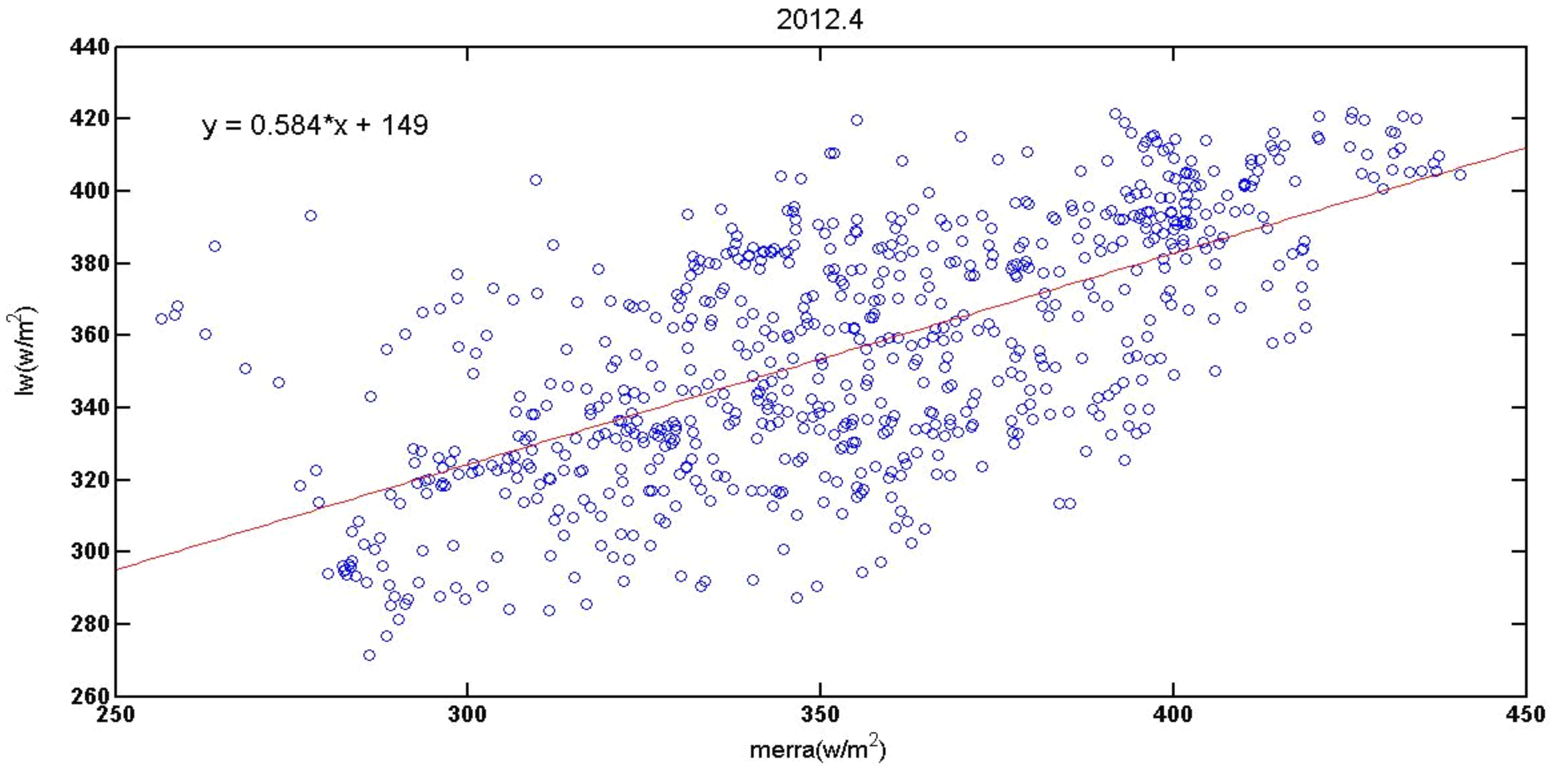


Figure 4 . Scatter diagram of the downward long wave data (merra,observation) in April 2012. Fitting straight line:y=0.584*x+149,R-square: 0.4339 RMSE: 25.58

Use the equation y=0.5834*x+149.29 with merra data of 2011.4 to calculate and contrast it with the real obs of 2011.4 . the correlation coeffience is 0.72 and the average difference is 20.2w/m^2 .

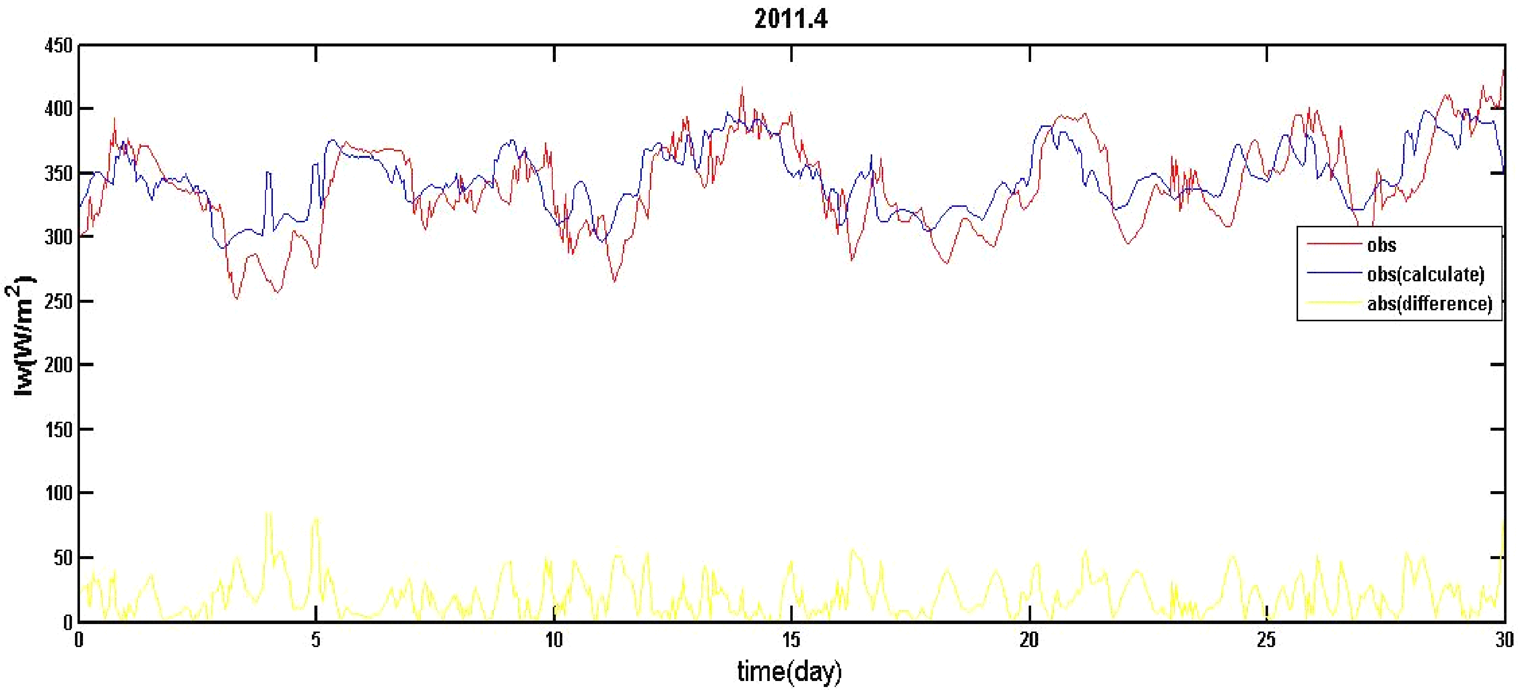


Figure 5 . Hourly time series of real observation data and the data(calculated).

The obs data always Lags behind merra about 6-7hours , if put the obs data ahead 7 hours and they are in good accordance with each other , the average difference is 12.48w/m^2 , the correlation coeffience is 0.9 .

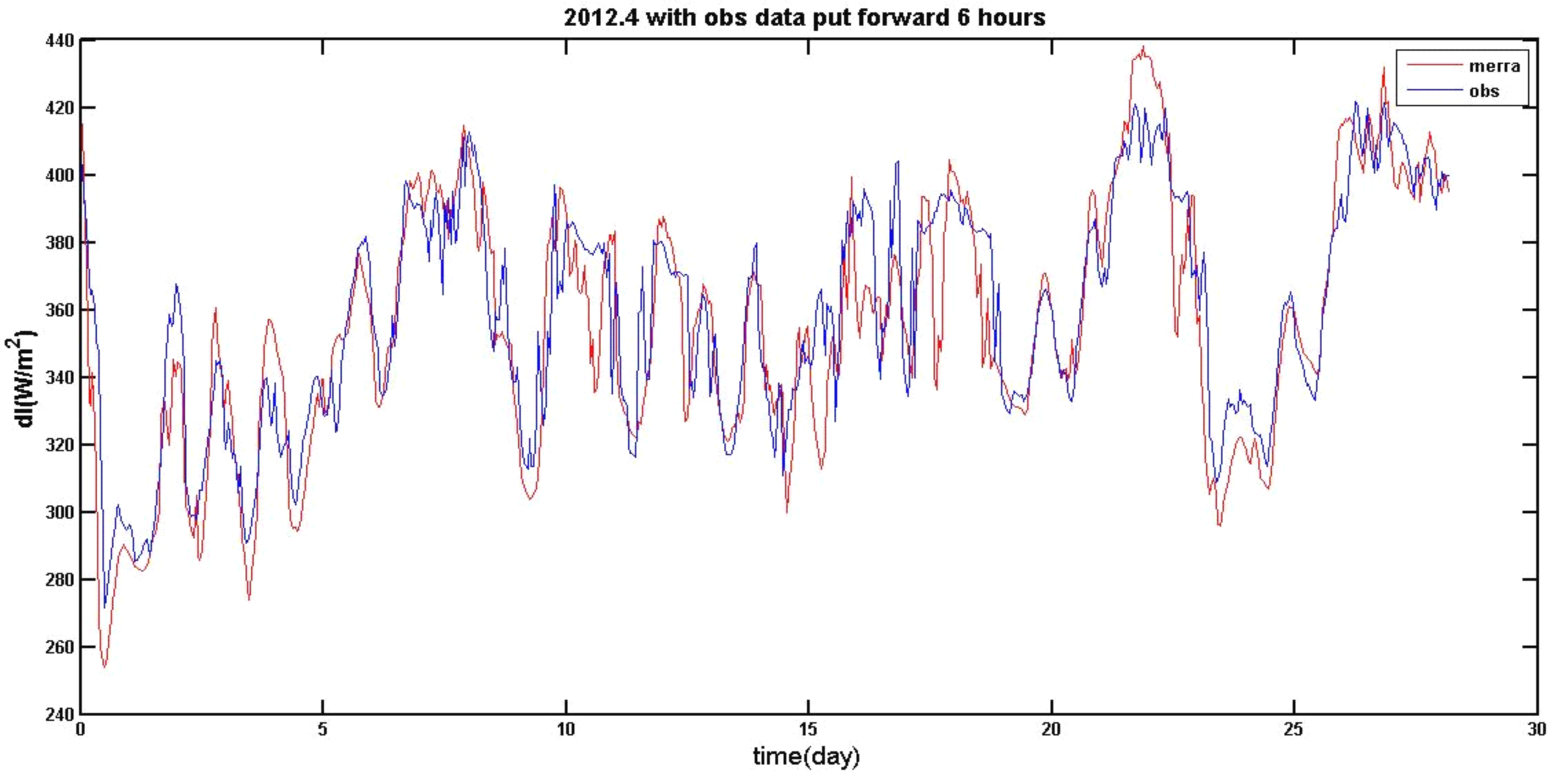
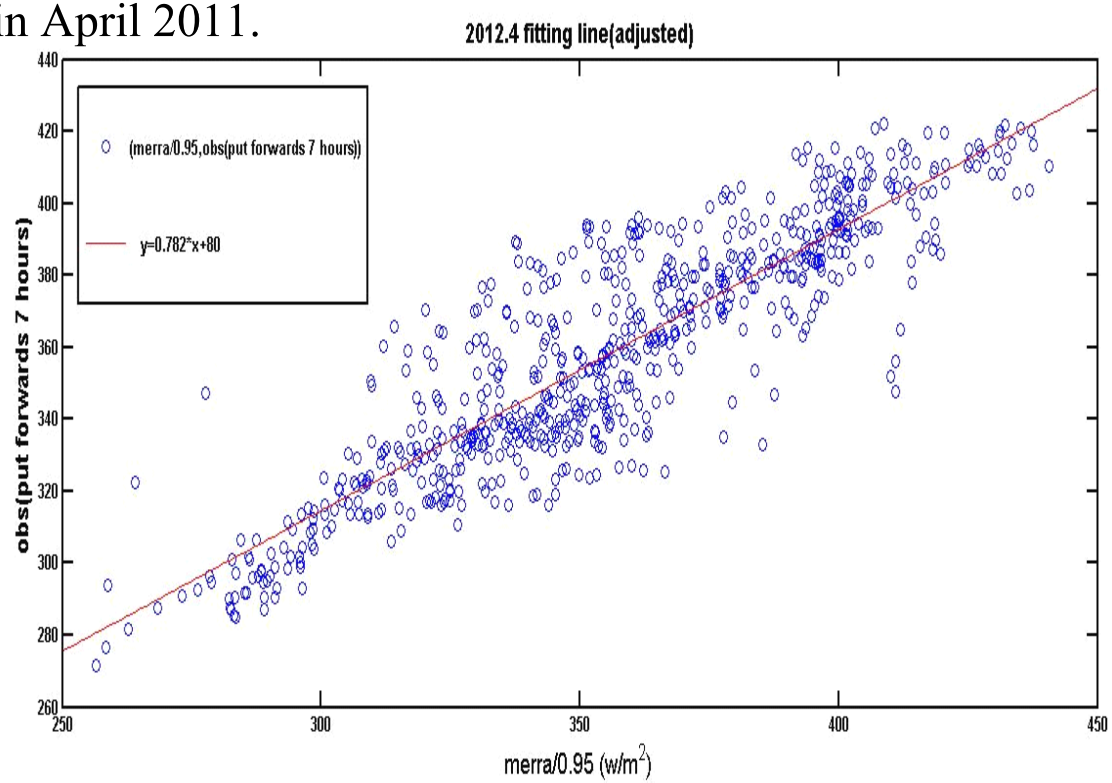


Figure 6 . Hourly time series of obaservation data(put ahead 6 hours) and merra

Put the obs data ahead 7 hours and get the fitting line of obs(adjusted) and merra , using it to get the calculated the data and contrast it with the real observation data in April 2011.



Goodness of fit:
SSE: 1.61e+005
R-square: 0.7864
Adjusted R-square: 0.7861
RMSE: 15.45

Figure 7 . Scatter diagram of the DL data(merra,observation(adjusted)) in April 2011 and the fitting line is y=0.782*x+80.R^2=0.7864.

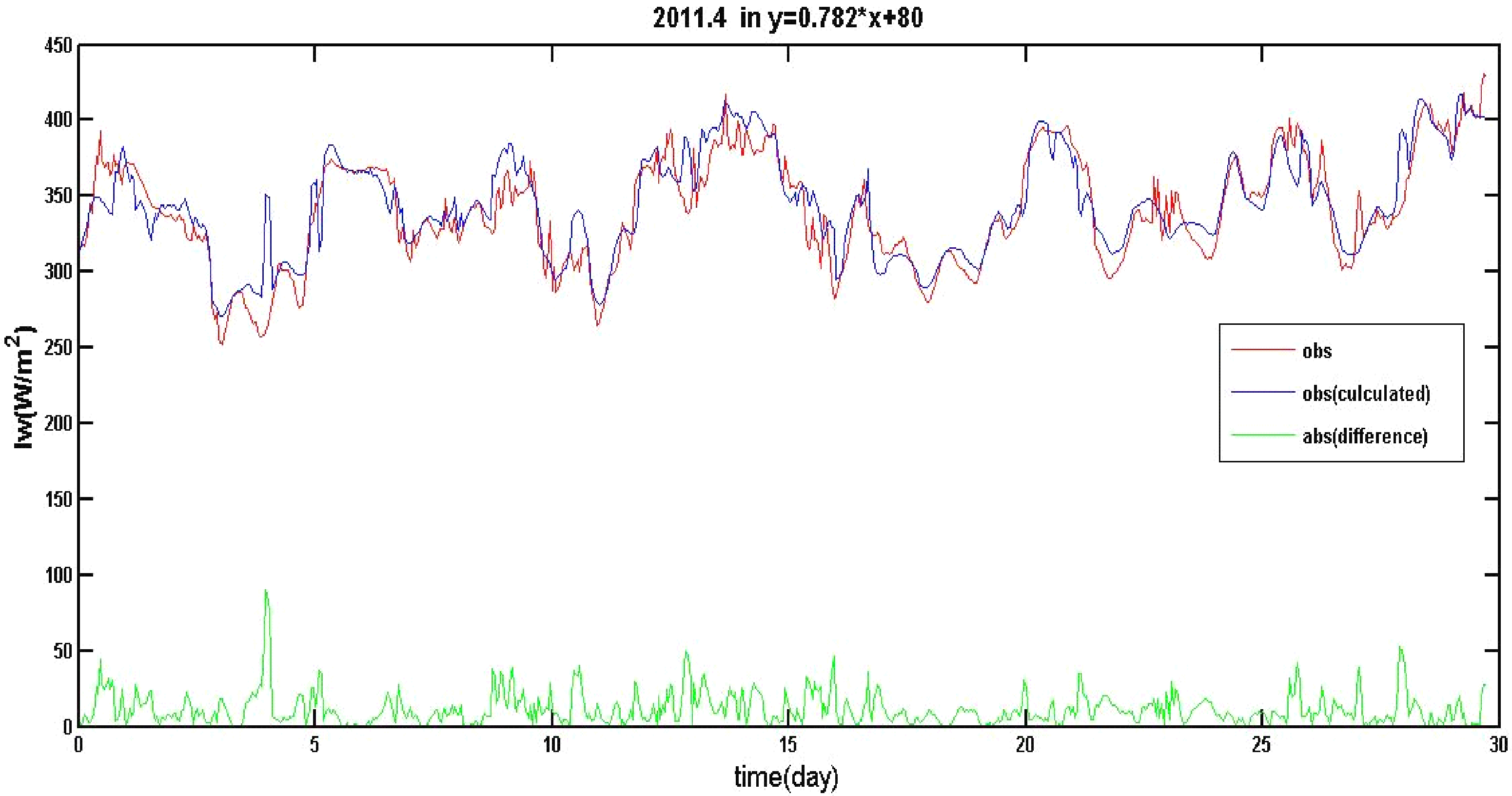


Figure 8 . Hourly time series of real observation data (put ahead 7 hours) and data(caluculated from merra) , the average difference between obs and data(calculated) is 11.6w/m^2 . the correlation coeffience is 0.90 .

Daily scale: the daily scale merra data is in good accordance with that of observation data.

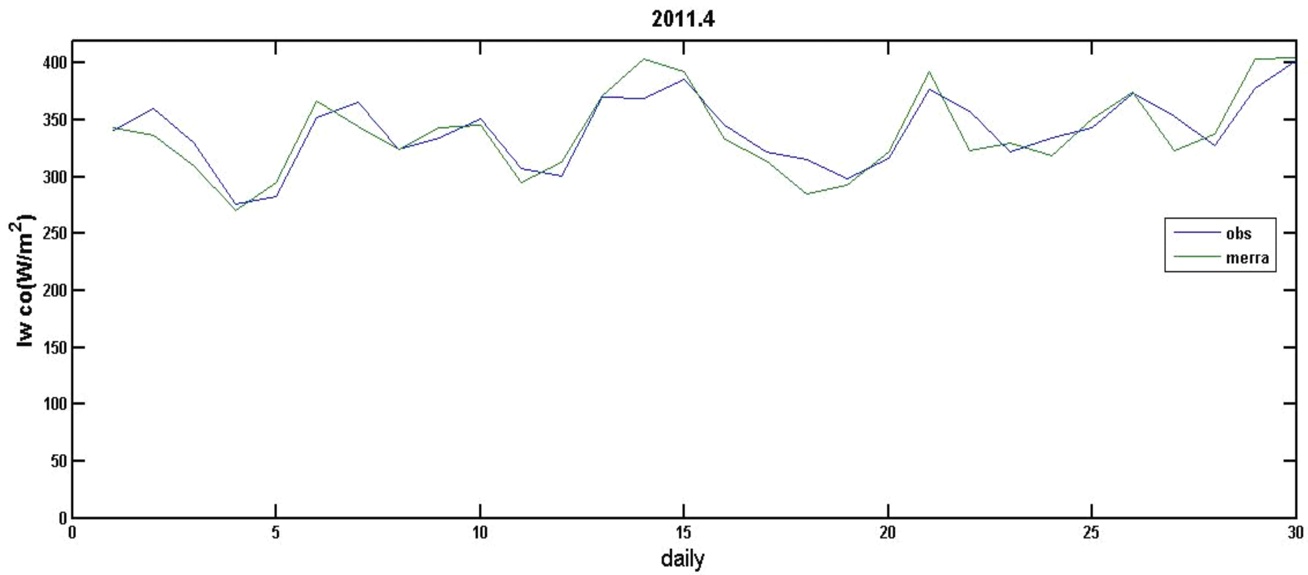
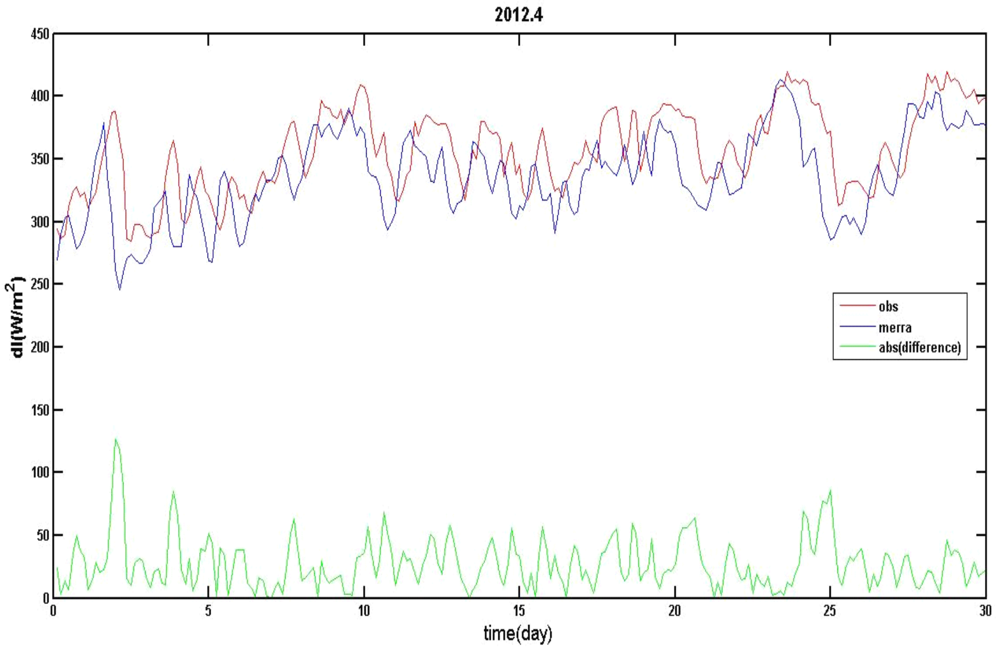


Figure 9 . Daily time series of the avervage observation and merra downward long waveradiation data in April 2011 .



The average difference is 27.6.and the correlation coeffience is 0.67

Figure 10 . Merra and obs in April 3-hourly time-averaged

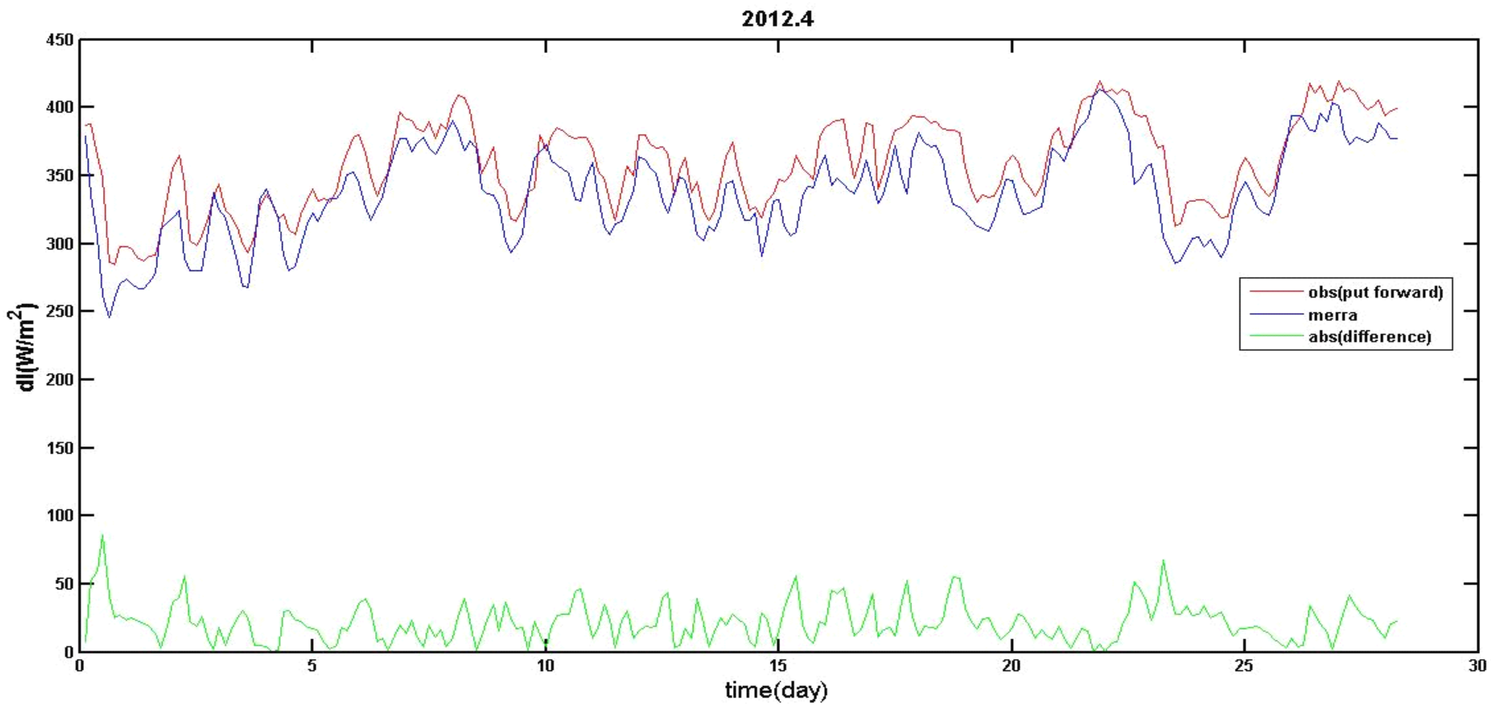


Figure 11 . Merra and obs (put forwards 6 hours) in April 3-hourly time-averaged
The average difference is 21.6.and the correlation coeffience is 0.905.

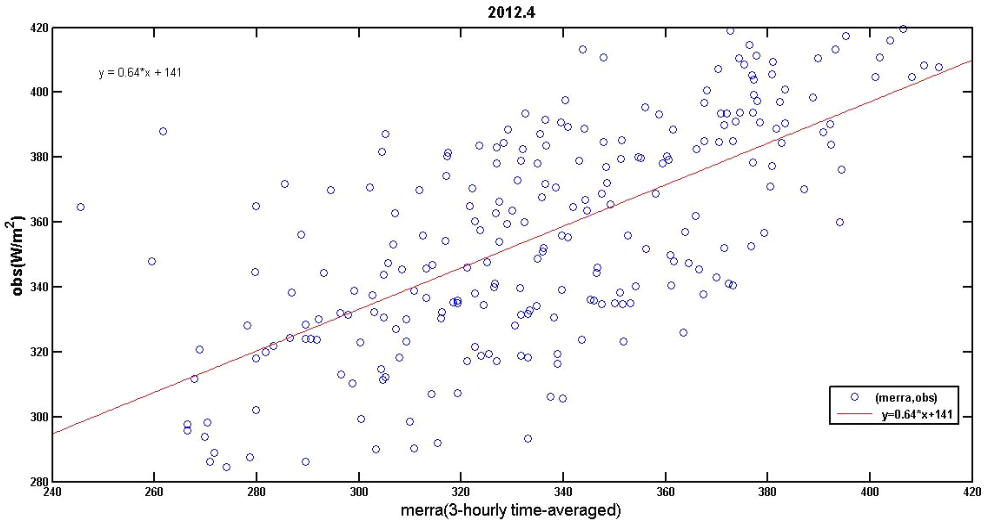


Figure 12 . Scatter diagram of the data(merra,observation) in April 2011.

Goodness of fit:

SSE: 1.477e+005

R-square: 0.4486

Adjusted R-square: 0.4463

RMSE: 24.91

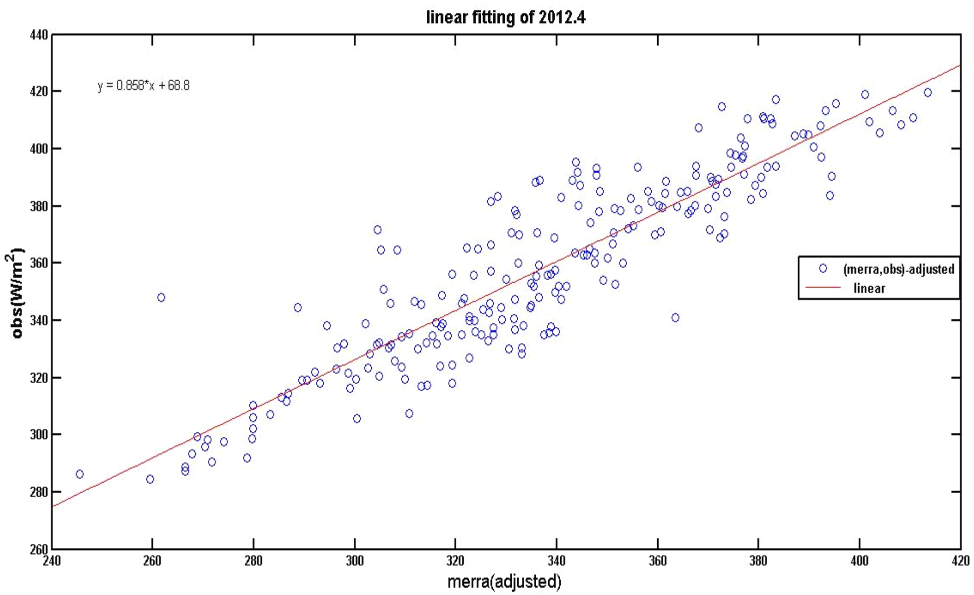


Figure 13 . Scatter diagram of data(merra,observation) in April 2011. put obs forwards 6 hours.

Goodness of fit:

SSE: 4.391e+004

R-square: 0.8177

Adjusted R-square: 0.8169

RMSE: 14.03

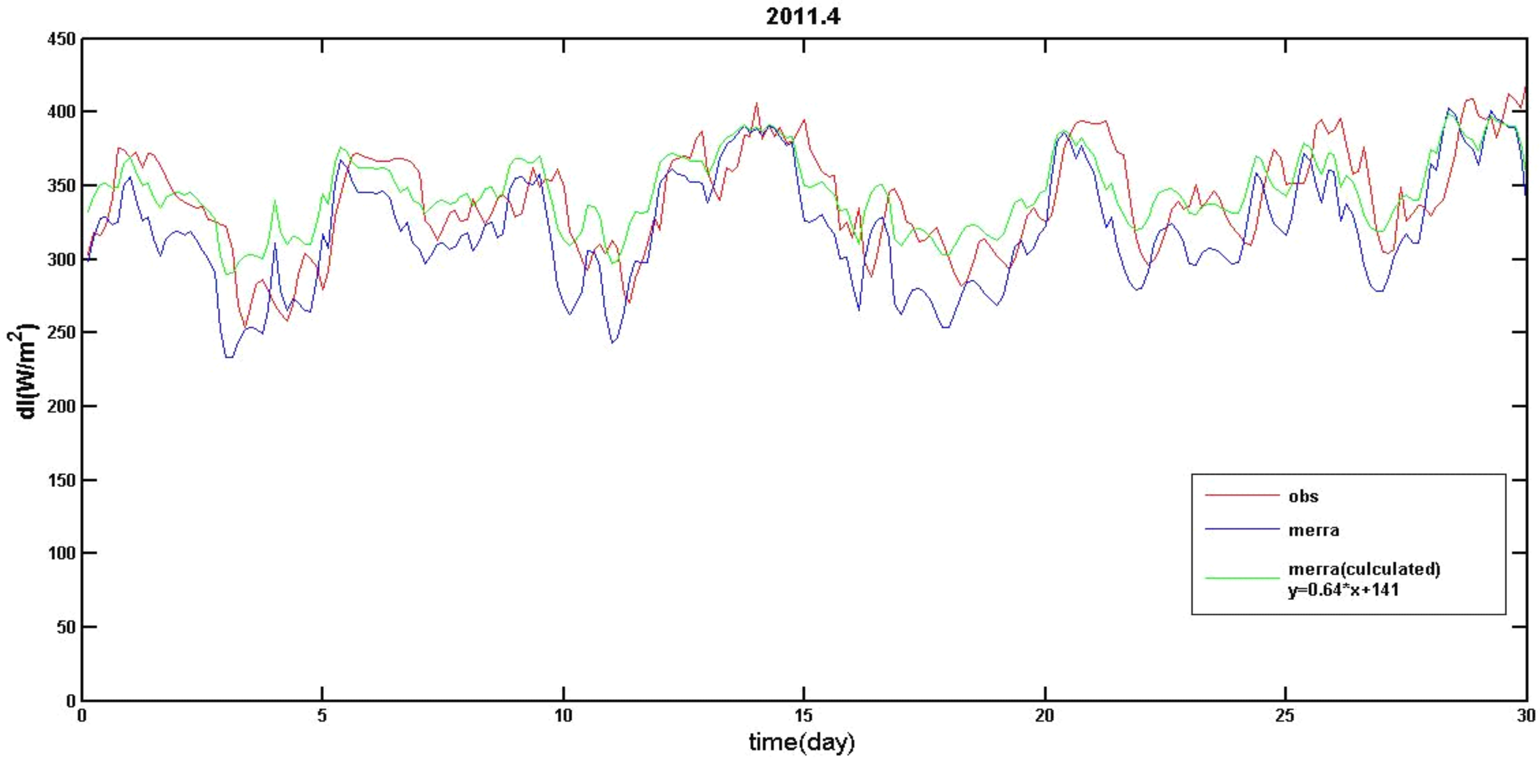


Figure 14 . Use the fitting equation:y=0.64*x+141 to calulate data , and contrast it with the real observation data in April 2011.the average abs(difference) between data(culculated) and obs(real) is 19.8 w/m^2,correlation coeffience is 0.72. and the abs(diffence) between obs(real) and merra reaches as big as 27.7 w/m^2.

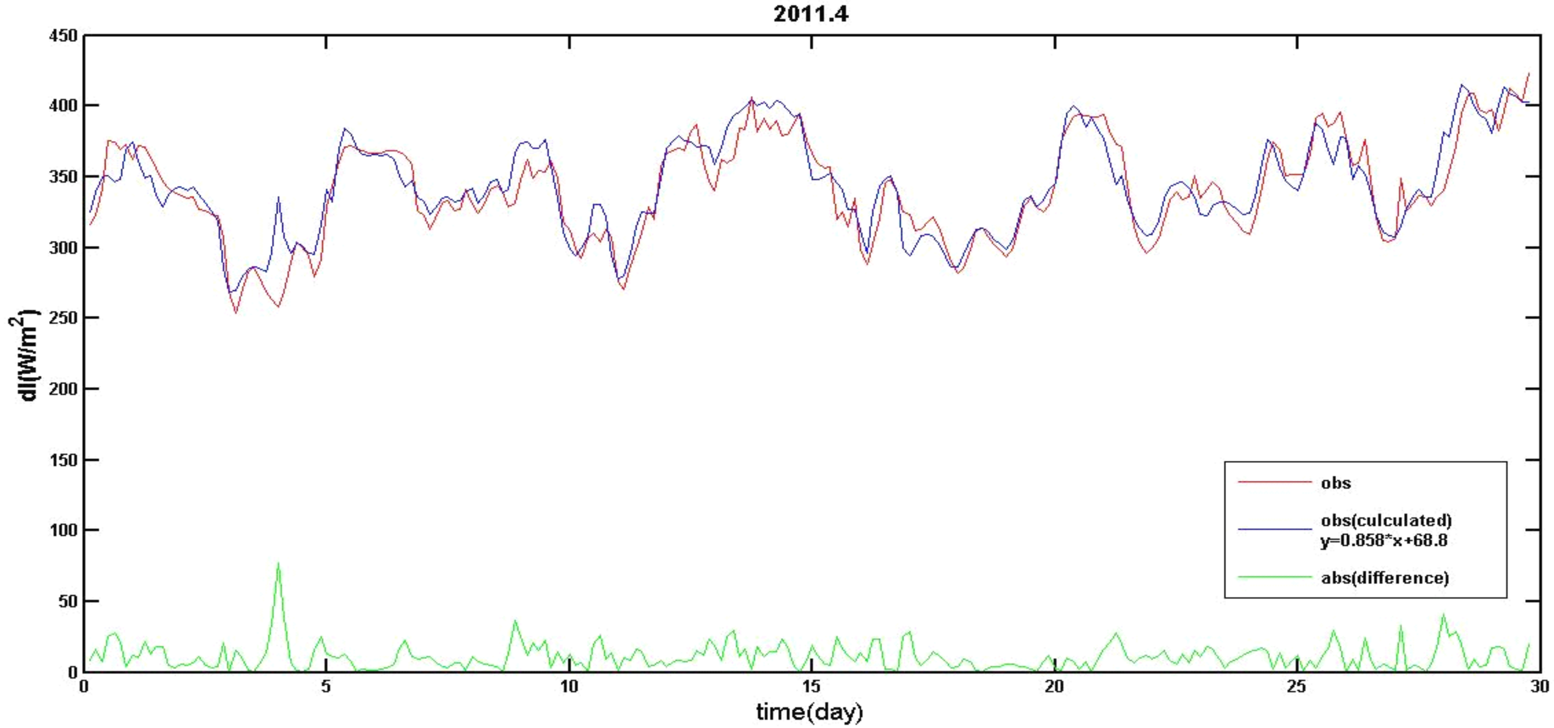


Figure 15 . Use the fitting equation:y=0.858*x+68.8 to calulate obs,and contrast it with the real observation data in April 2011.the average abs(difference) between data(culculated) and obs(real) is 10.95 w/m^2,correlation coeffiencl is 0.917.

Discussions:

Why the merra down longwave radiation data is not in good accordance with observation and the obs data always Lags behind merrab about 6-7 hours ?

It may have used the interpolation or the erros in the data is conducted from many kinds of models and the time in merra maybe Universal Time Coordinated.

Conclusions :

The hourly-averaged absorbed longwave at the surface(LWGAB) performs well，and it involves less interpolation than surface downward longwave fluxwant(LWGDWN) , but the absorption constant should be adjusted .

Work in the future :

Evaluate the specific humidity,downward shortwave radiation , T_s , u , and do interpolation to get the half hour data from them .

Thank You ！