**پیوست**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S3(MODIS) | S3(SSEbop) | S3(GLEAM) | Base model | parameter |
| E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-MODIS -ax - GLUE\1.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-SSEbop - ax - GLUE\1.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-Gleam - ax - GLUE\1.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - GLUE\1.jpg | ks |
| E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-MODIS -ax - GLUE\2.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-SSEbop - ax - GLUE\2.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-Gleam - ax - GLUE\2.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - GLUE\2.jpg | kg |
| E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-MODIS -ax - GLUE\3.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-SSEbop - ax - GLUE\3.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-Gleam - ax - GLUE\3.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - GLUE\3.jpg | ksn |
| E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-MODIS -ax - GLUE\4.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-SSEbop - ax - GLUE\4.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-Gleam - ax - GLUE\4.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - GLUE\4.jpg | Smax |
| E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-MODIS -ax - GLUE\5.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-SSEbop - ax - GLUE\5.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-Gleam - ax - GLUE\5.jpg |  | a(scale corrected factor) |
| E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-MODIS -ax - GLUE\6.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-SSEbop - ax - GLUE\6.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-Gleam - ax - GLUE\6.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - GLUE\5.jpg | Tl |
| E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-MODIS -ax - GLUE\7.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-SSEbop - ax - GLUE\7.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-Gleam - ax - GLUE\7.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - GLUE\6.jpg | Th |
| E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-MODIS -ax - GLUE\8.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-SSEbop - ax - GLUE\8.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - E-Gleam - ax - GLUE\8.jpg | E:\phd coarse\PHD thesis\Data\Wang model\Wang2 - GLUE\7.jpg | SN(1,1) |

جدول2. مقادیر فاصله انرژی پارامترهای مدل

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ks | Base model | Gleam | Ssebop | Modis |
| Base model | 0 | 1.3792 | 1.4943 | 1.3554 |
| Gleam |  | 0 | 0.0435 | 3.19E-04 |
| Ssebop |  |  | 0 | 0.0412 |
| Modis |  |  |  | 0 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| kg | Base model | Gleam | Ssebop | Modis |
| Base model | 0 | 0.0241 | 0.0073 | 0.2964 |
| Gleam |  | 0 | 0.0063 | 0.2221 |
| Ssebop |  |  | 0 | 0.2618 |
| Modis |  |  |  | 0 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ksn | Base model | Gleam | Ssebop | Modis |
| Base model | 0 | 0.0401 | 0.0226 | 0.0872 |
| Gleam |  | 0 | 0.0033 | 0.0154 |
| Ssebop |  |  | 0 | 0.0255 |
| Modis |  |  |  | 0 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Smax | Base model | Gleam | Ssebop | Modis |
| Base model | 0 | 2.07E+03 | 2.90E+03 | 1.02E+03 |
| Gleam |  | 0 | 98.2591 | 276.2259 |
| Ssebop |  |  | 0 | 698.6612 |
| Modis |  |  |  | 0 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| a(scale corrected factor) | Base model | Gleam | Ssebop | Modis |
| Base model |  |  |  |  |
| Gleam |  | 0 | 0.6079 | 3.84 |
| Ssebop |  |  | 0 | 2.318 |
| Modis |  |  |  | 0 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tl | Base model | Gleam | Ssebop | Modis |
| Base model | 0 | 1.1439 | 0.0907 | 10.1104 |
| Gleam |  | 0 | 0.6388 | 4.4818 |
| Ssebop |  |  | 0 | 8.5002 |
| Modis |  |  |  | 0 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Th | Base model | Gleam | Ssebop | Modis |
| Base model | 0 | 0.0333 | 0.0015 | 0.102 |
| Gleam |  | 0 | 0.0362 | 0.0226 |
| Ssebop |  |  | 0 | 0.1008 |
| Modis |  |  |  | 0 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SN(1,1) | Base model | Gleam | Ssebop | Modis |
| Base model | 0 | 0.1086 | 0.6002 | 3.2183 |
| Gleam |  | 0 | 0.2376 | 2.3822 |
| Ssebop |  |  | 0 | 1.1549 |
| Modis |  |  |  | 0 |

کد متلب مدل بیلان ونگ بهبود یافته :

Function [Qc,S,E,Qsn,error]=Wang(a,b,c,d,f,g,h,data)

% Data.txt includes /Rainfall Evaporation Temprature Runoff/

P(:,1)=data(:,1);

Eva(:,1)=data(:,2);

T(:,1)=data(:,3);

Q(:,1)=data(:,4);

[m ~]=size(data);

ks=a;

kg=b;

ksn=c;

Smax=d;

S(1,1)=0;

Th=max(f,g);

Tl=min(f,g);

SN(1,1)=h;

for i=2:m

if (T(i,1)<Tl)

PSN(i,1)=P(i,1);

elseif (T(i,1)>Th)

PSN(i,1)=0;

else

PSN(i,1)=(Th-T(i,1))\*P(i,1)/(Th-Tl);

end

PR(i,1)=P(i,1)-PSN(i,1);

Qs(i,1)=ks\*PR(i,1)\*min(S(i-1,1)/Smax,1);

Qg(i,1)=kg\*min(S(i-1,1),Smax);

E(i,1)=min(S(i-1,1)/Smax,1)\*Eva(i,1);

AlphaMelt=ksn\*exp((T(i,1)-Th)/(Th-Tl));

SN(i,1)=(SN(i-1,1)+PSN(i,1))/(1+AlphaMelt);

Qsn(i,1)=AlphaMelt\*SN(i,1);

Qc(i,1)=Qs(i,1)+Qg(i,1)+Qsn(i,1);

S(i,1)=max((S(i-1,1)+P(i,1)-Qc(i,1)-E(i,1)),0);

if (S(i,1)>Smax)

Qc(i,1)=Qc(i,1)+S(i,1)-Smax;

S(i,1)=Smax;

end

end

out=[Q Qc];

II=(real(Qc(:,1))~=Qc(:,1));

if (sum(II)==0)

[KGE,MSE,NMSE,NC,CC]=Evaluation(out,1);

if (KGE<0)

error=0.01;

elseif ne(sum(sign(Qc)),m-1)

error=0.01;

else

error=KGE;

end

else

error=0;

end

Parameters

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Scenarios | | **S1** | **S2** | | | **S3** | | | **S4** | | |
| Base model | S2(GLM) | S2(SSE) | S2(MOS) | S3(GLM) | S3(SSE) | S3(MOS) | S4(GLM) | S4(SSE) | S4(MOS) |
| ks | **a** | 0.28 | 0.21 | 0.15 | 0.30 | 0.40 | 0.25 | 0.33 | 0.21 | 0.34 | 0.29 |
| kg | **b** | 0.00 | 0.02 | 0.08 | 0.06 | 0.06 | 0.00 | 0.00 | 0.03 | 0.00 | 0.08 |
| ksn | **c** | 0.11 | 0.05 | 0.02 | 0.11 | 0.00 | 0.17 | 0.28 | 0.00 | 0.18 | 0.05 |
| Smax | **d** | 269.99 | 259.95 | 280.00 | 259.85 | 187.84 | 289.98 | 209.04 | 230.00 | 250.00 | 202.00 |
| Tl=min(f,g) | **f** | -10.00 | -12.00 | -12.00 | -12.00 | -2.05 | -9.03 | -6.35 | -12.00 | -10.02 | -12.00 |
| Th=max(f,g) | **g** | -3.77 | 0.01 | -0.22 | 2.64 | 3.53 | -2.80 | 0.25 | 2.90 | -3.09 | 4.00 |
| SN(1,1) | **h** | 0.02 | 0.00 | 39.95 | 27.53 | 33.64 | 0.14 | 0.02 | 31.15 | 0.00 | 39.86 |