

Brief Report of Work Shop on

From Dimming to Brightening and its Climate Implications

Date: May 20-21, 2007

Place: Nanjing, China

Sponsor: IRC/APRC

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Guang-Yu SHI and T. Hayasaka
CHACC/LASG/IAP/CAS, RIHN
shigy@mail.iap.ac.cn

Participants

- Lapan
- Korea
- China
- Nigeria?
- Total: 25, more than 30 students from the NUIST joint the Workshop

Main Topics

- Is it true? From Dmg to Brtnng
- What is the Causes? Clouds, Aerosols, Dynamics?
- Climate Implications
- Related Others

Climate Effects of Aerosols

- Direct
- Indirect
 - 1st
 - 2nd
- Semi-direct
- Others

Basically, to reduce the solar radiation reaching the ground and cooling the surface

Solar Radiation at Earth's Surface

- Martin Wild et al. (2005)
- From Dimming to Brightening: Decadal Changes in Solar Radiation at Earth's Surface

R E P O R T S

6 MAY 2005 VOL 308 SCIENCE

Fig. 1. Global distribution of surface observation sites used in this study. Sites measuring an increase in surface solar radiation after 1990 are marked in yellow; sites measuring a decrease are shown in brown. High-quality observation sites fulfilling the BSRN standards (12) are shown as triangles, other sites from the updated GEBA as crosses. Information from 300 sites over Europe and 45 sites over Japan are displayed as aggregated regional means. The majority of the sites show an increase in surface solar radiation after 1990.

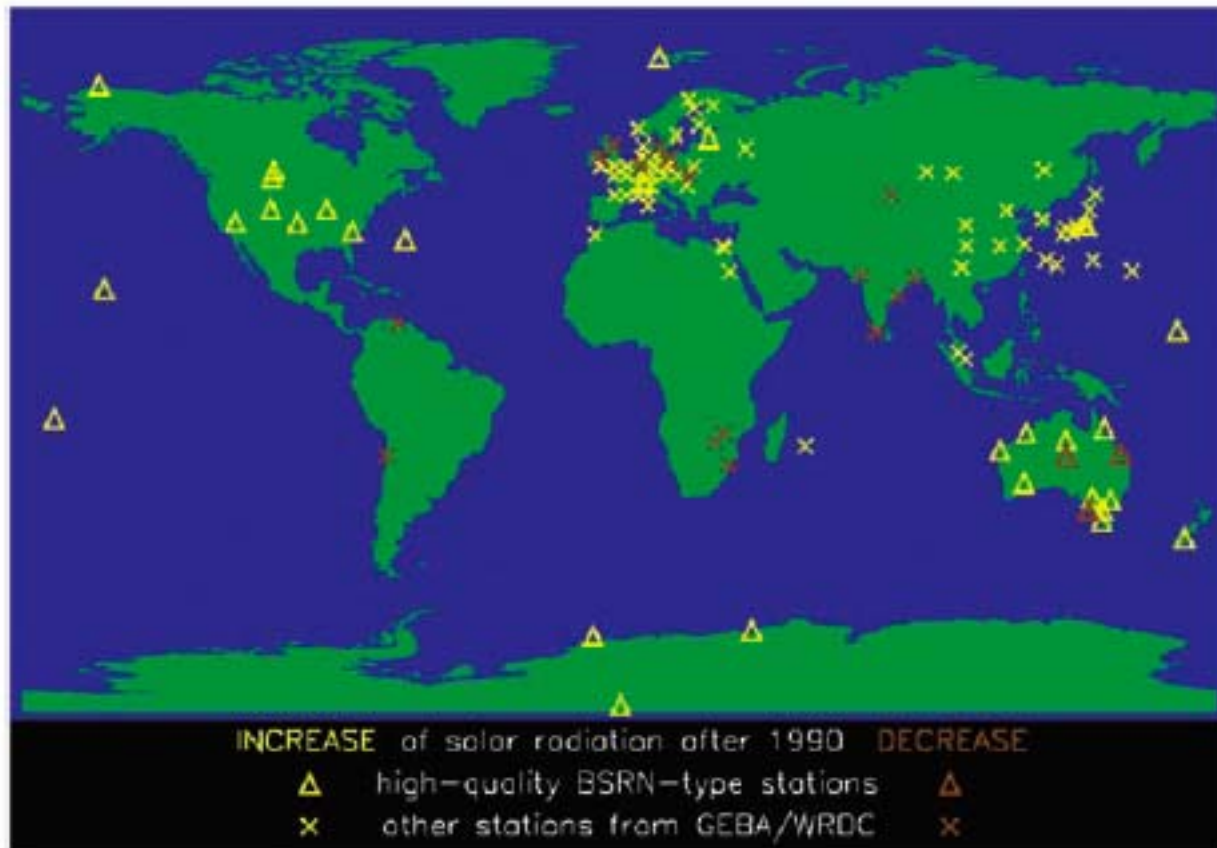
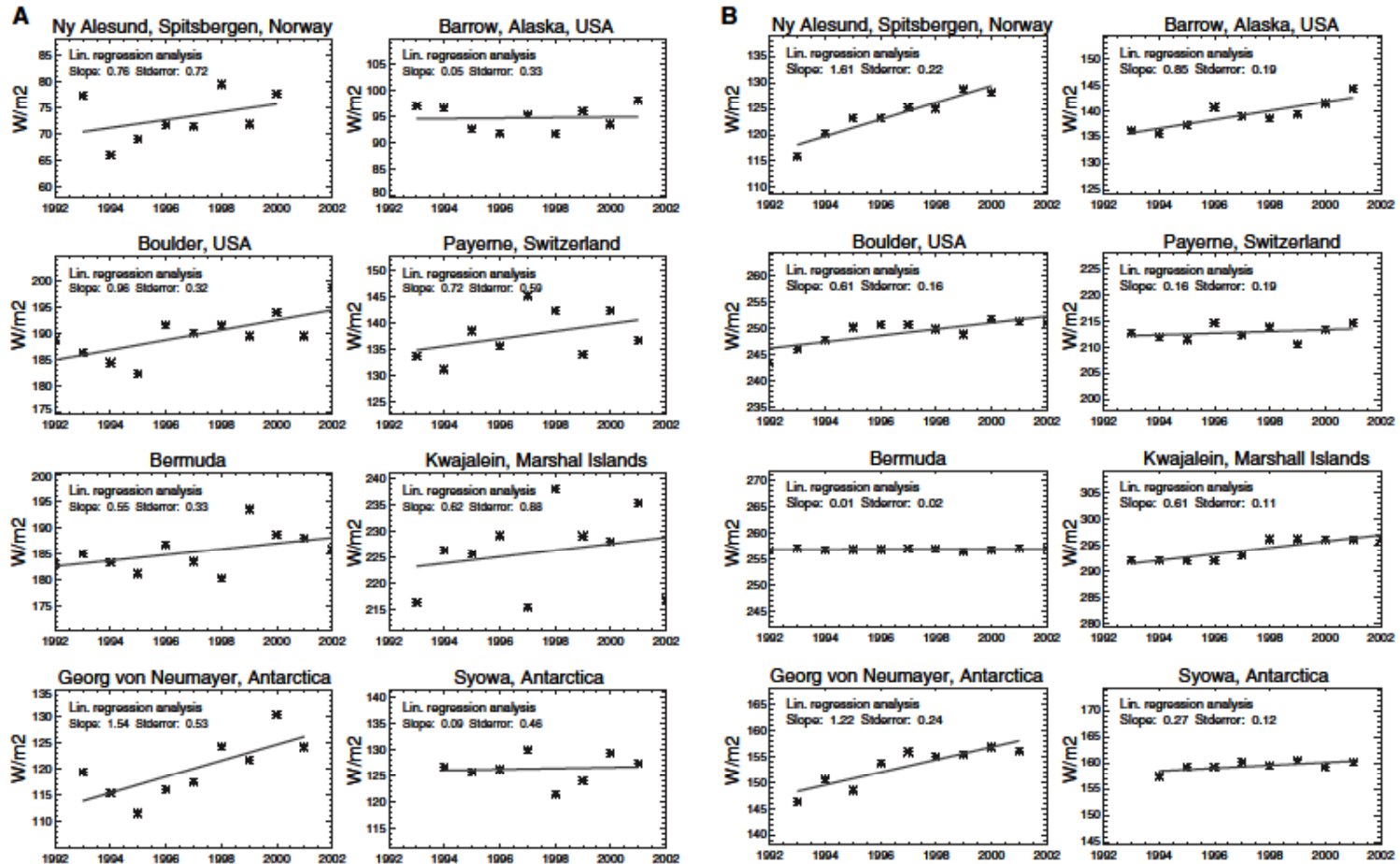
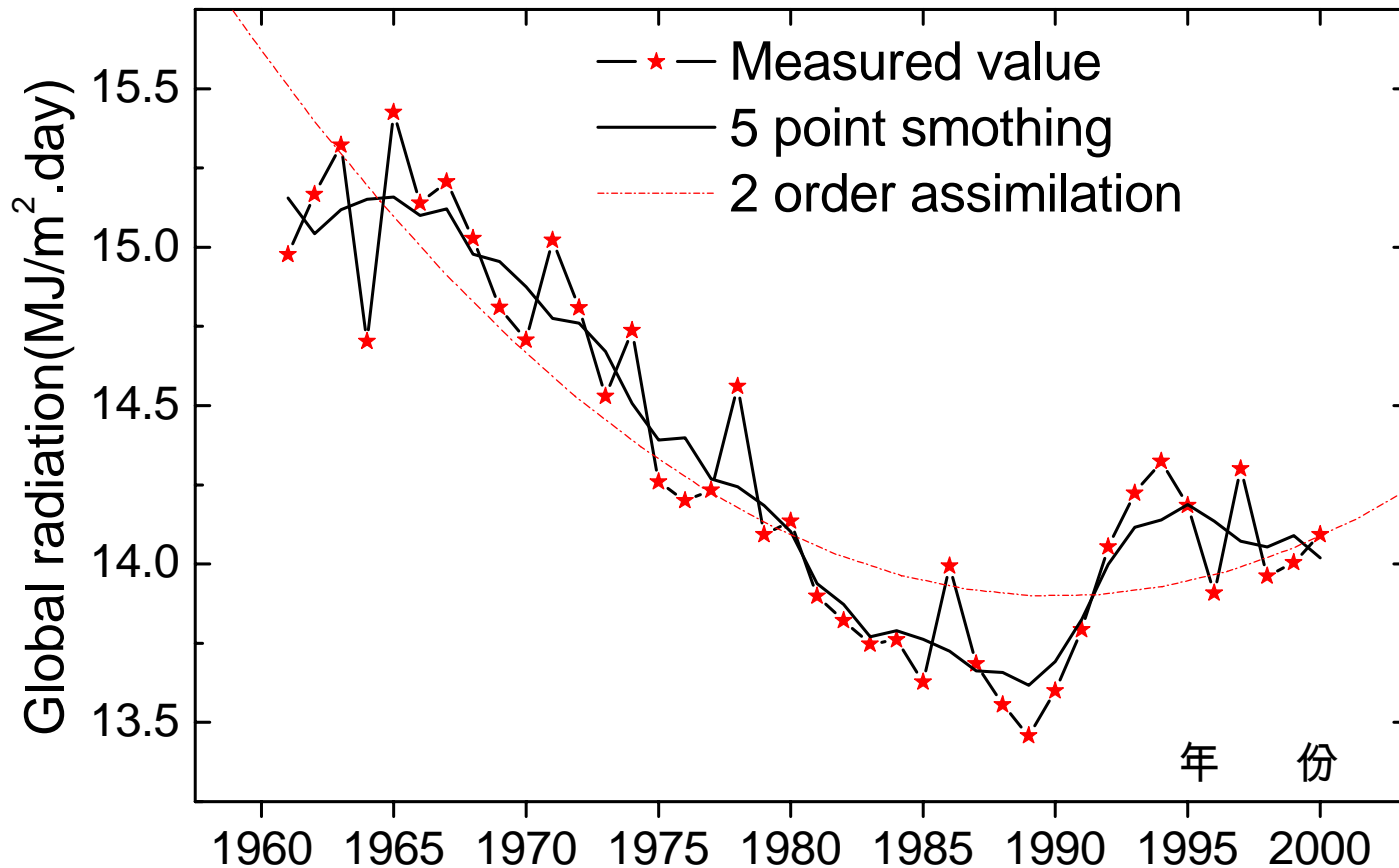


Fig. 2. Time series of annual mean surface solar radiation measured at worldwide distributed sites from BSRN. Shown are the eight longest records from BSRN covering the period 1992 to 2002 for (A) all-sky conditions and (B) clear-sky conditions (24). Solar radiation increases at all sites under both all-sky and clear-sky conditions over this period. Units $W\ m^{-2}$.

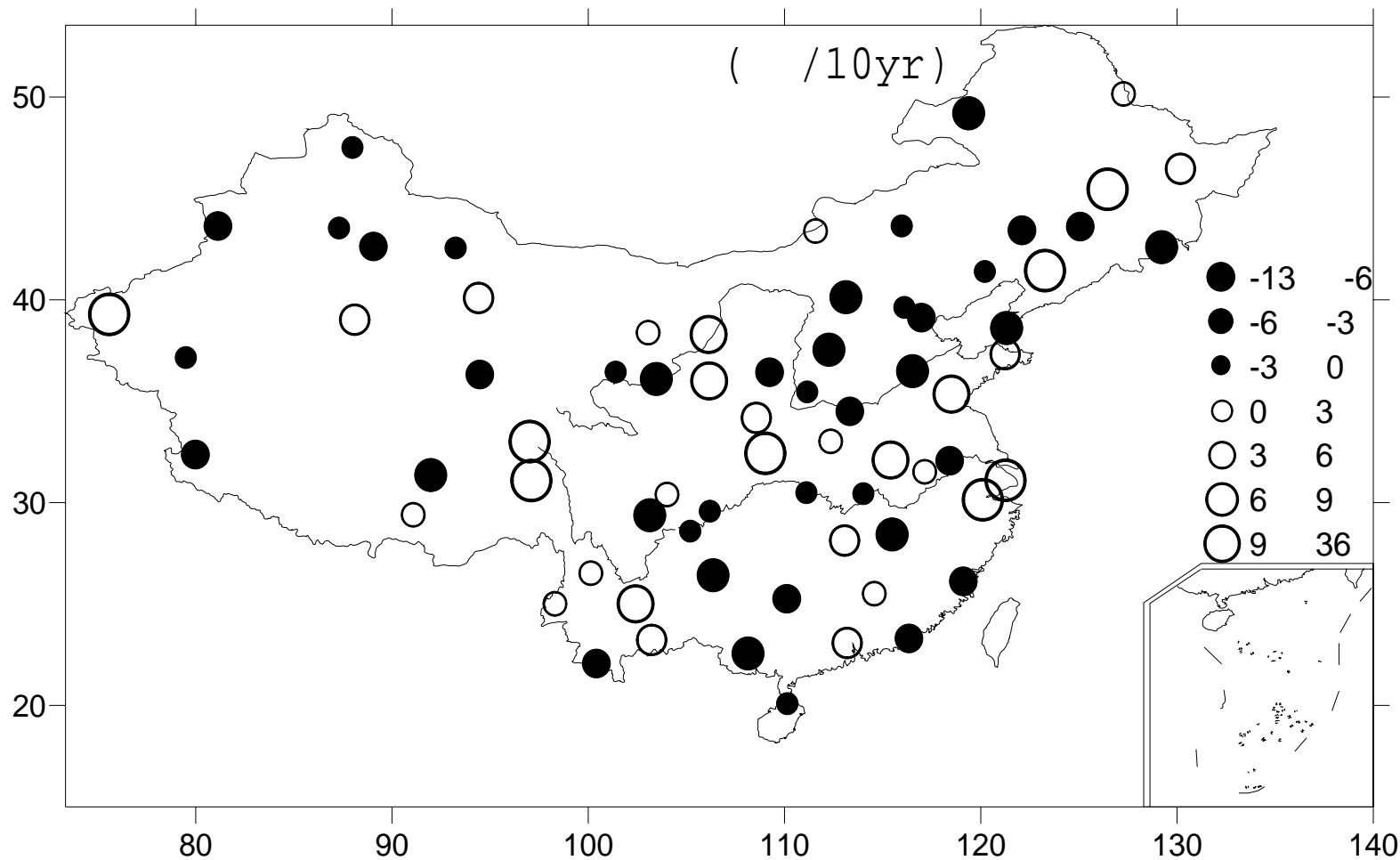


Changes in SSR during 1960-2000 over China

(Shi et al., 2007, JAMC, in press)



Trend of SSR during 1991-2000 over China



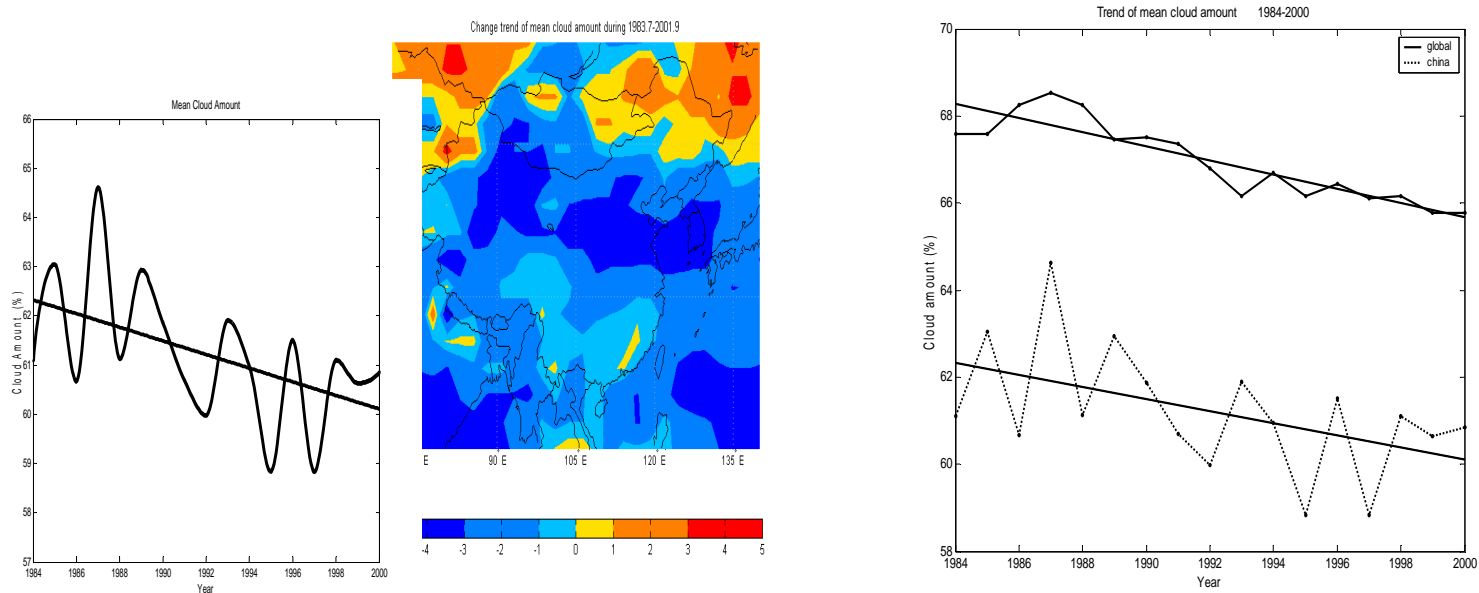
Factors Affecting the SSR

- Change in Solar Activity
- Changes in Earth's Atmospheric composition which absorb and/or scatter the solar radiation
 - GASEs, O₃, H₂O etc.
 - Clouds
 - Aerosols
- Others: Dynamics Processes?

Changes in Clouds over China (1984- 2000)

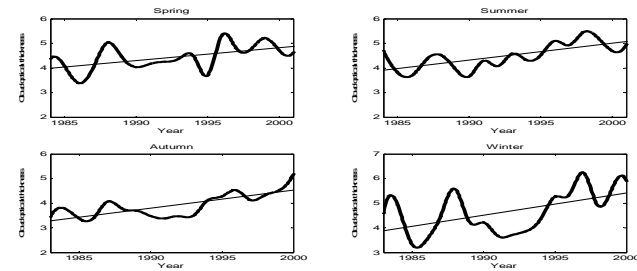
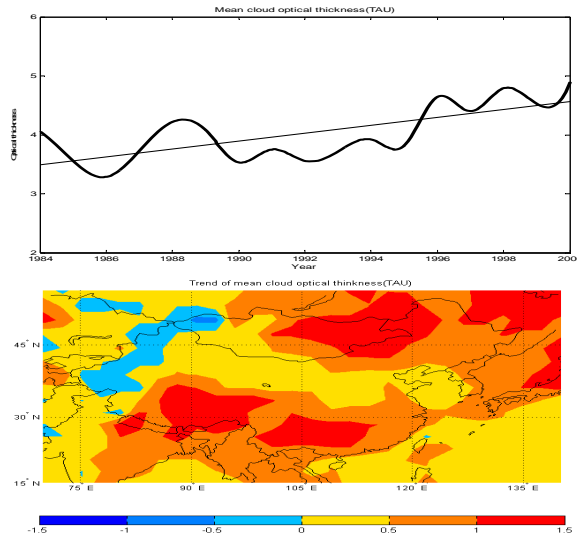
(Ding and Shi, 2005)

Trend of Total Cloud Amount (1984-2000)(Global and China)



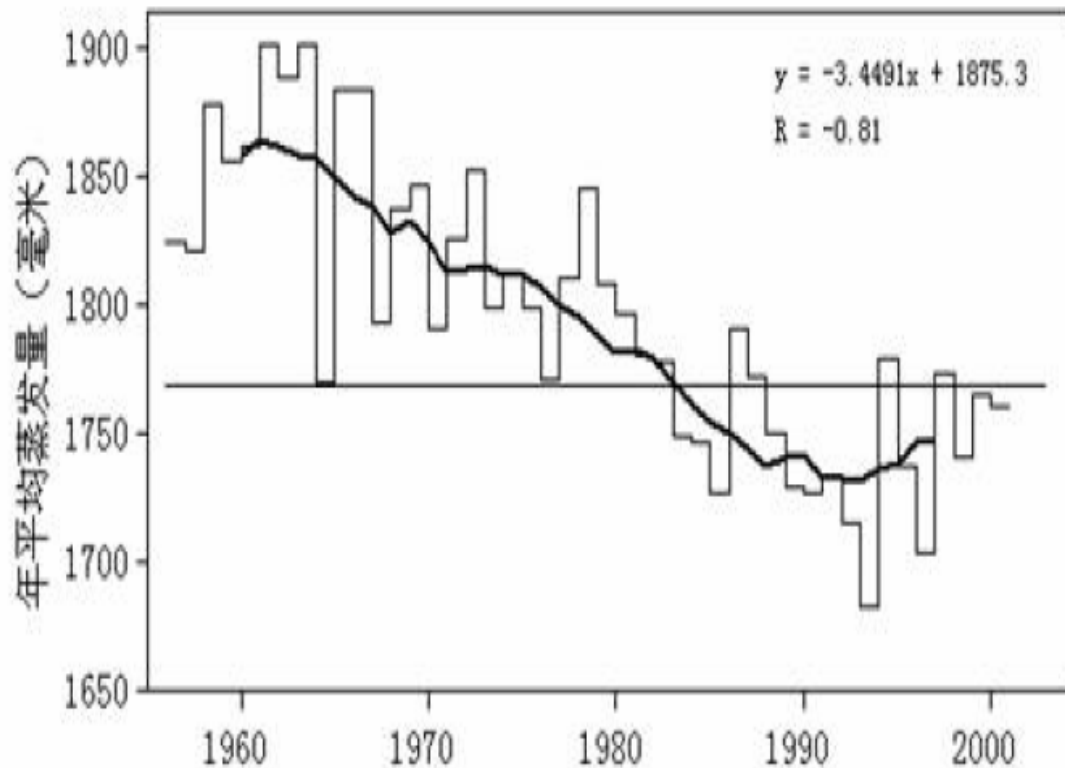
- 在气候显著变暖和全球总云量趋于减少的背景下，中国地区云量也在减少，减少约3.6%
- 新疆西部和东北部分地区，呈增加态势
- 中部少云地区的云量减少较为显著；多云地区总云量的变化不大

Averaged Optical Depth of Clouds



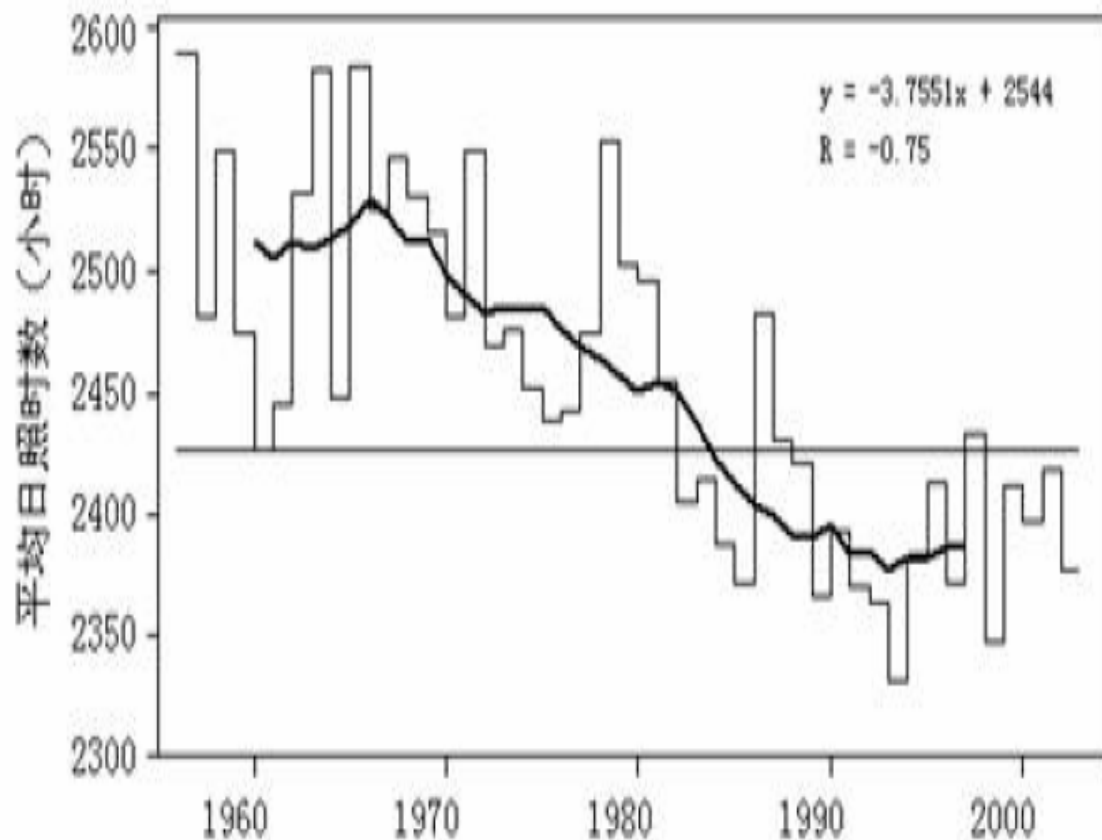
- 在1984 - 2000年间，中国地区平均云光学厚度呈显著增加趋势，增幅约为1.
- 大部分地区云的光学厚度呈增加的趋势，其中，青藏高原东南部地区，西南地区以及大兴安岭一带地区，增加最显著
- 中国地区平均云光学厚度近年来在各个季节都有增加，其中冬季增加最为显著

Annually averaged Evaporation during 1956-2002 over China



1956-2002年全国年平均蒸发量变化曲线

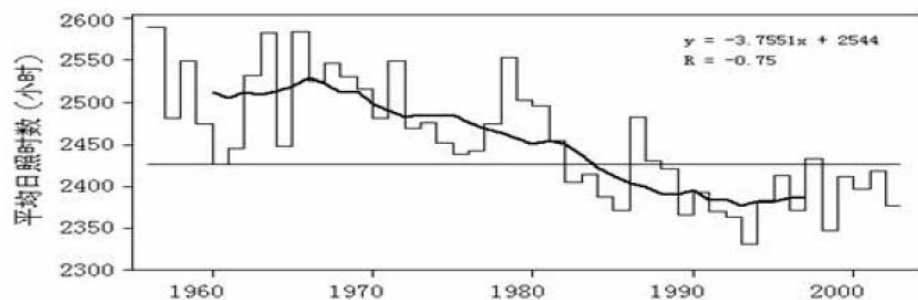
Sunshine Duration



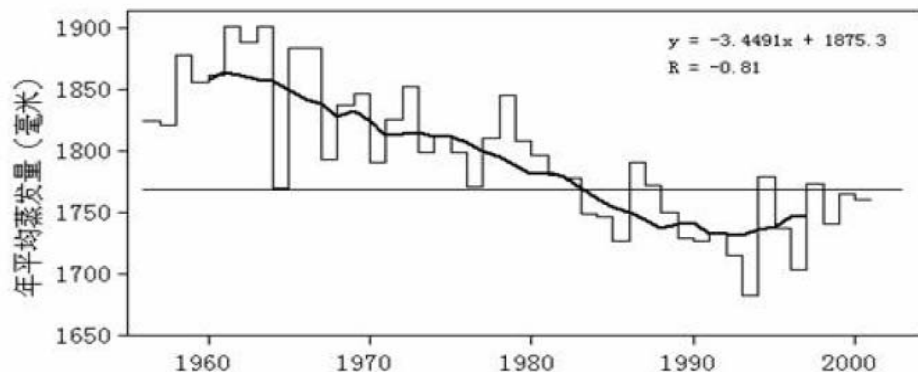
1956-2002年全国年平均日照时数变化曲线

Trends of Sunshine and Evaporation are Consistent

日照与蒸发的变化



1956-2002年全国年平均日照时数变化曲线



1956-2002年全国年平均蒸发量变化曲线

SSR and Pan Evprtn

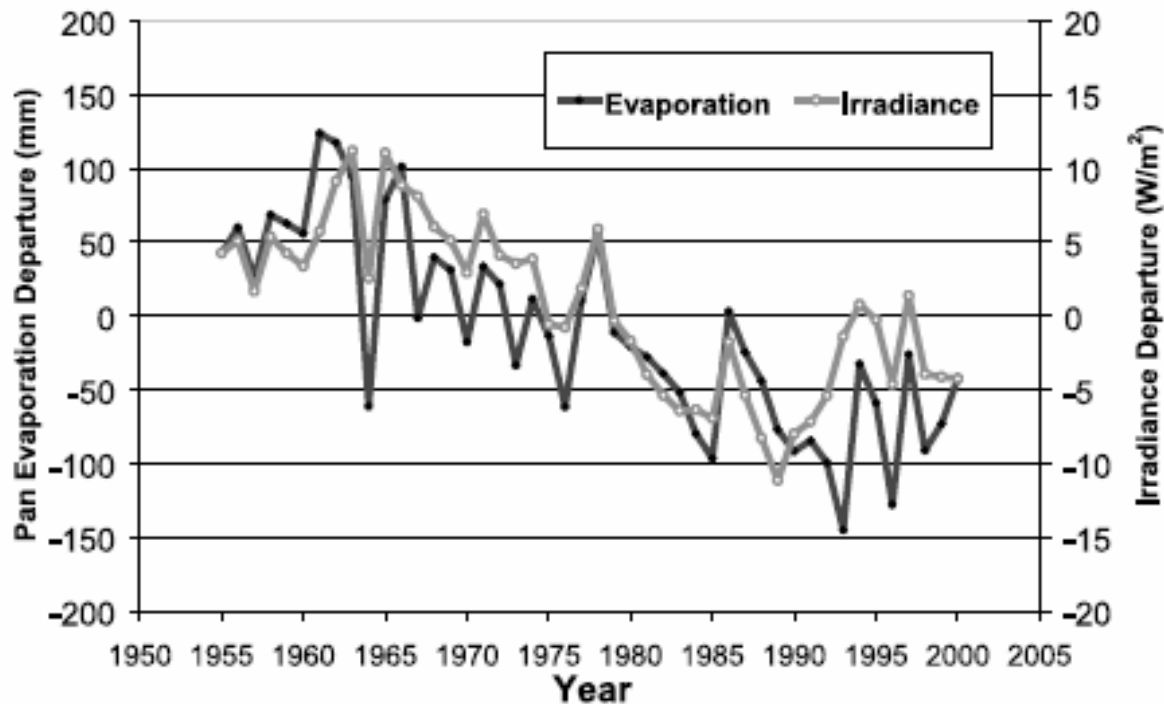


Figure 2. Time series of annual departures of pan evaporation and solar irradiance for 1955–2000, averaged over all stations in China.

Brief Summary

- Reconcilable Physical Quantities
 - SSR
 - Sunshine Duration
 - Pan Evaporation
- Not Consistent
 - SSR-Clouds
 - Ts-P.E

Summary

- The QC procedures have no significant effect on the long-term trend of surface solar radiation over China.
- 1961 – 1990: Dimming, about 4.61%/10yr.
 - Aerosols? Clouds?
- 1990 – 2000: Brightening, about 1.76%/10yr.
 - What caused the brightening?
- 1961 – present: Temperature increasing
 - How can we understand the relation with SW radiation trend? - Evaporation process? Absorbing aerosols? Dynamics? Other climate system?
 - **SST might respond to SW radiation trend.**

Conclusion Remarks

- We could not be able to attribute the causes of 'from dimming to brightening' to the changes in solar activity and clouds
- Aerosols are not 'A Good Candidate' as no body believe the aerosol emission in China was dramatically decreased after 1990
- We need a factor which affects SSR efficiently and has been turned over around 1990. **What it is?**