Noah 地表模式
於中央氣象局全球模式之調整測試

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中央氣象局

- 緣起
- 調整項目
- 測試診斷及分析
- 未來方向

2012/9/20

Comparison of Land Surface Models

Layer 1 (10cm)

Layer 2 (30cm)

Layer 3 (60cm)

Layer 4 (100cm)

Tg : **Rnet – SH - Evap = G**

土壤含水量 溫度

Layer 1 (10cm)

Layer 2 (190cm)

Noah LSM(4 layers)

Operational

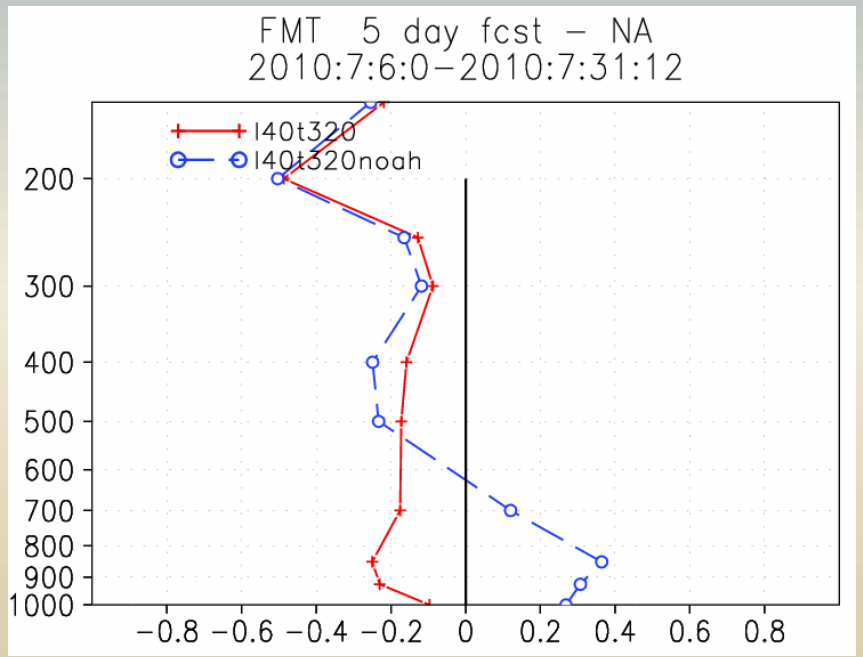
OSU LSM(2 layers)

Include **snow pack** & **frozen soil**

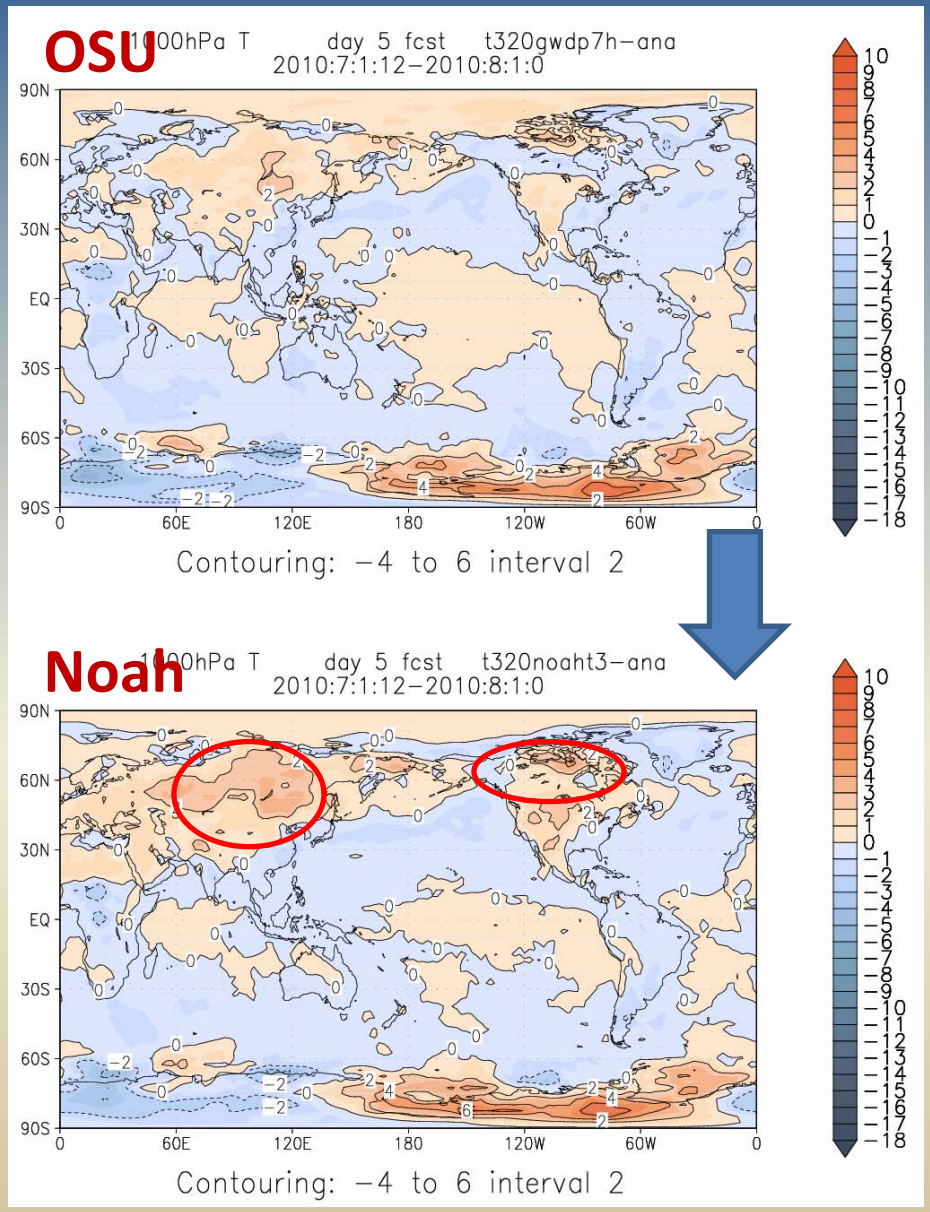
2010 Jul

- **Noah LSM 更新測試顯示**
  夏季低層大氣暖偏差增強

NA Day 5 T mean error

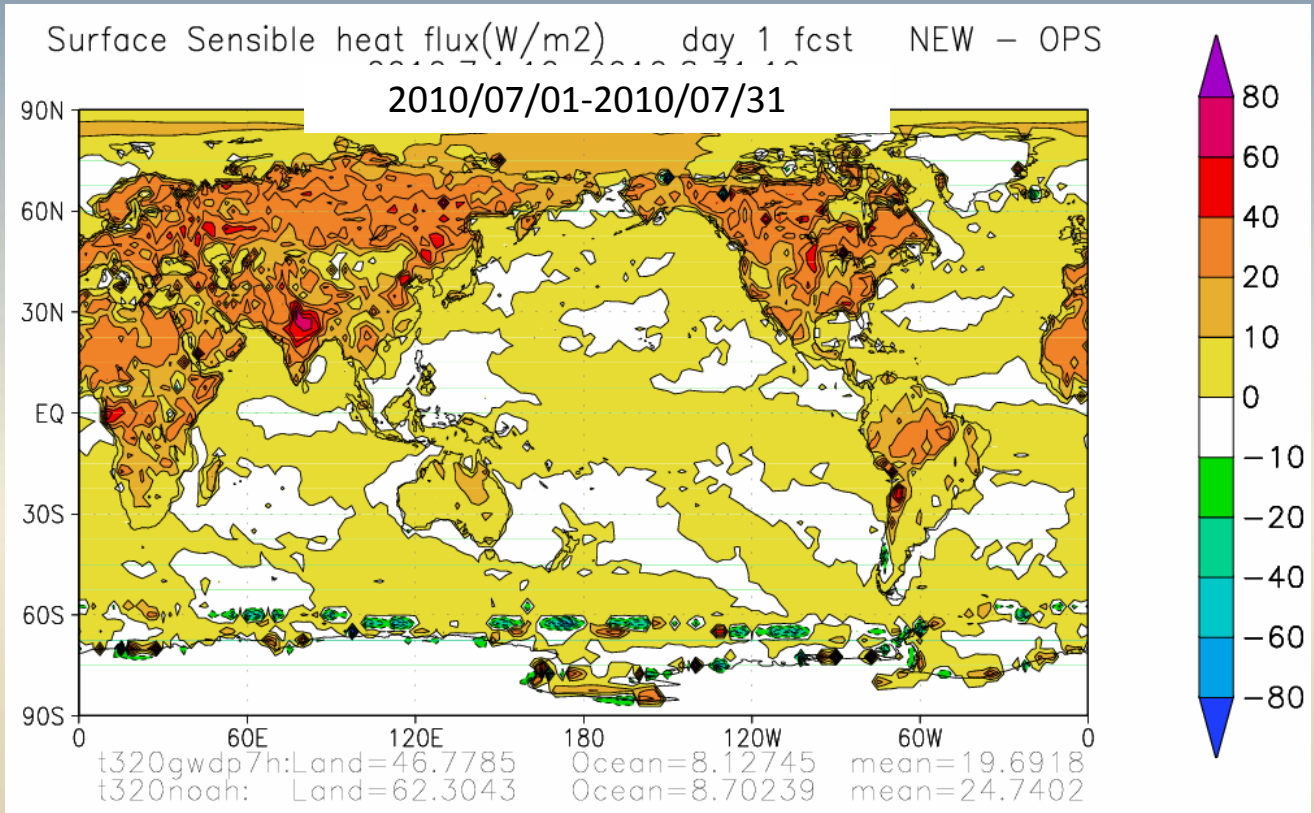


1000hPa T Day 5 - ana



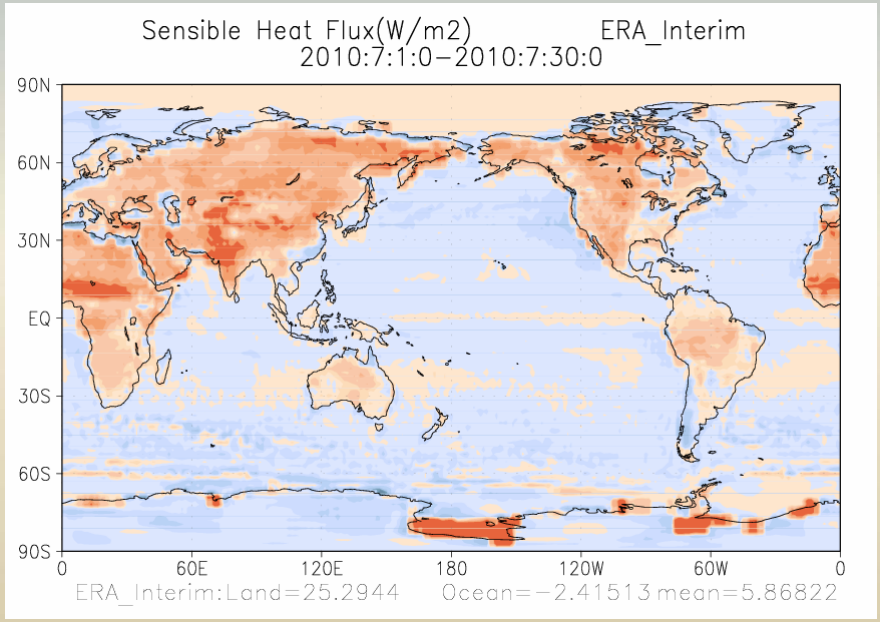
201007 monthly mean

Surface sensible heat flux (Noah –Ops)

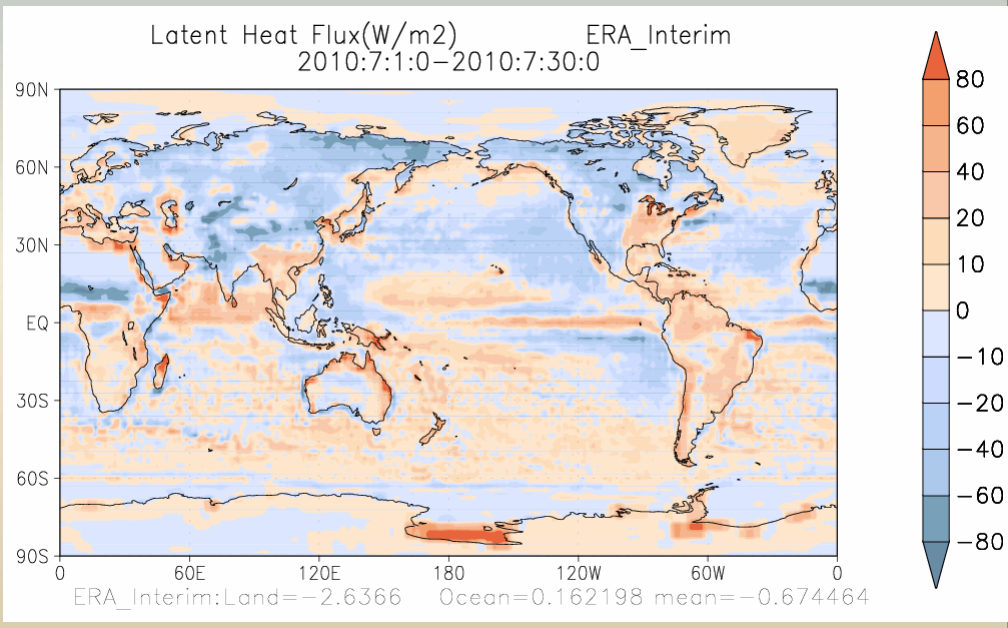


2010/07 monthly mean
Era-interim data

SH Noah-Era



LH Noah-Era



待解決問題： 夏季低層大氣偏暖

方向： 降低地表可感熱

- 可感熱傳遞效率過大？
- 可感熱/潛熱(Bowen ratio)過大？

- 目標：降低夏季陸面低層大氣暖偏差
- Test period： 夏 2010 Jul/01-Jul/31
- 測試項目

  sensible heat flux：引進thermal roughness length

  （降低可感熱傳送效率）

  latent heat flux：調降植物最小阻尼 rsmin

  （增加潛熱，間接降低 可感熱）

調整測試一
引進 Zt（thermal roughness length）

$$\text{Sensible Heat flux} = Ch \cdot U_1 \cdot (T_1 - T_g)$$

Ch = f (熱力穩定度，粗糙長度）

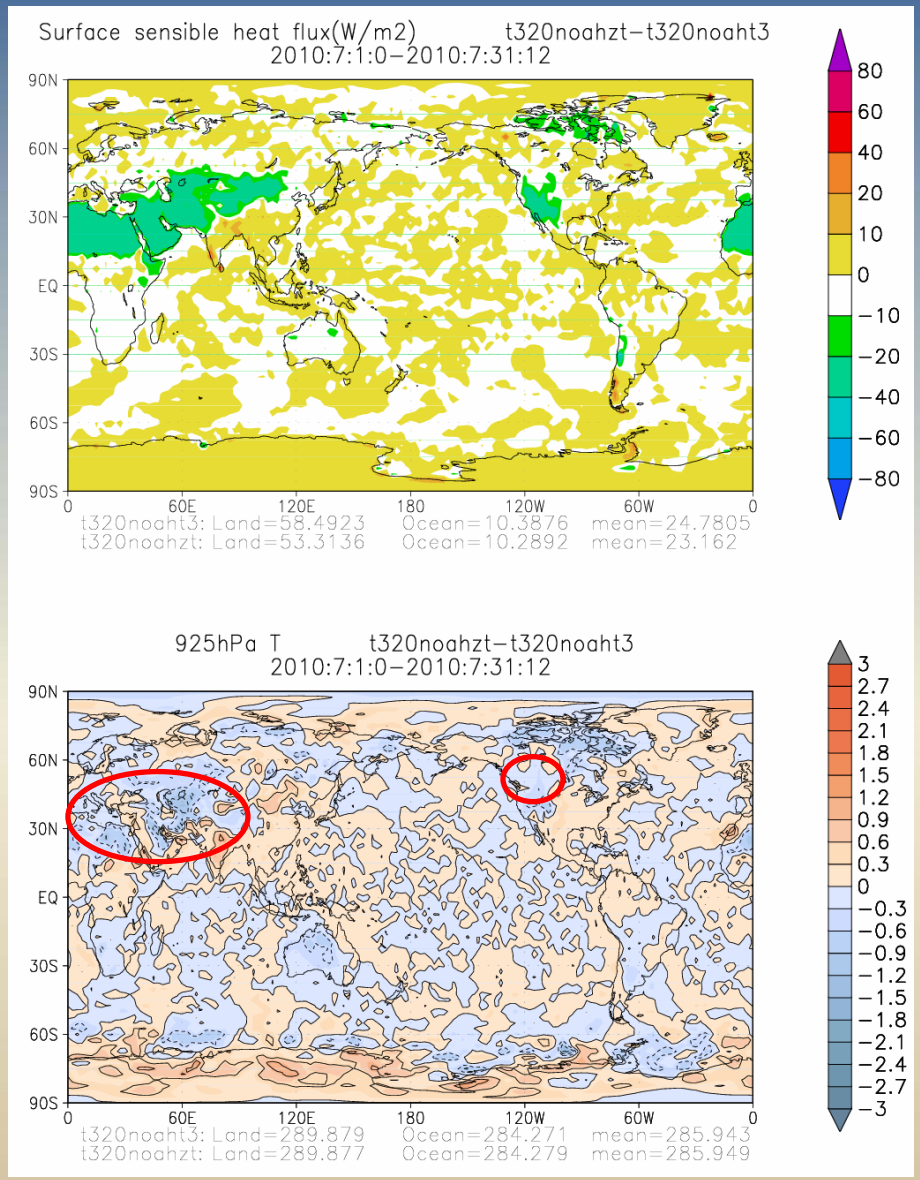
粗糙長度**(Original)**：地表粗糙長度（= 動量場摩擦消散）

(Modified)：另外引進 熱力粗糙長度（thermal roughness)

(Zeng and Dickinson 1998)

Zt (thermal roughness length) 調整測試

31 day averaged results in July 2010



Surface sensible heat flux

58.49 W/m2(land)

-5.1 ⇩

53.33 W/m2(land)

Temperature impact at 925hPa

調整測試植物最小阻尼（Rsmin, minimum stomatal resistance）

SH＝Rad – LH - GH

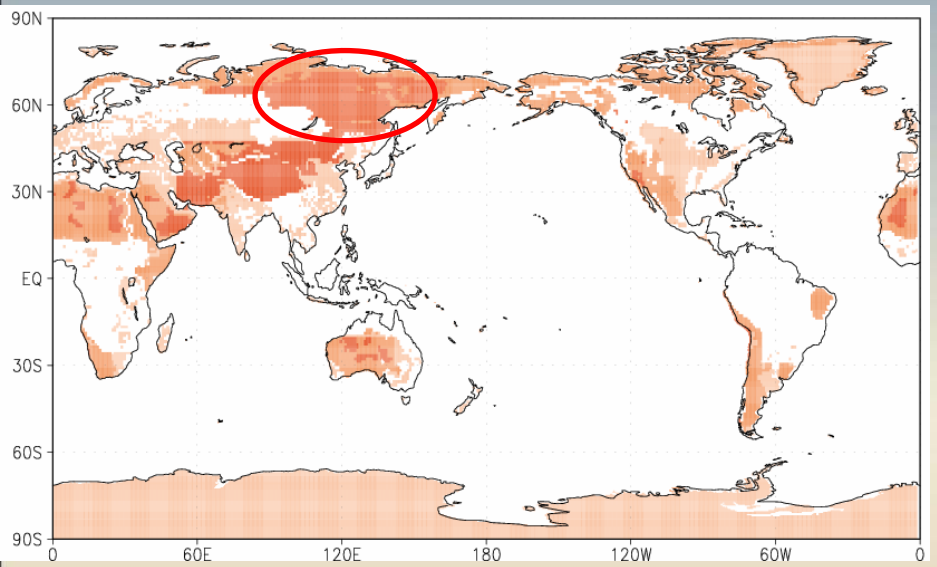
Latent Heat flux （= 直接蒸發edir +植物蒸散 et + 葉面再蒸發ec）

$$et \propto \frac{1}{Rsmin} * (\text{植物覆蓋率})$$

阻尼係數愈小，植物蒸散量愈大，間接導致可感熱降低

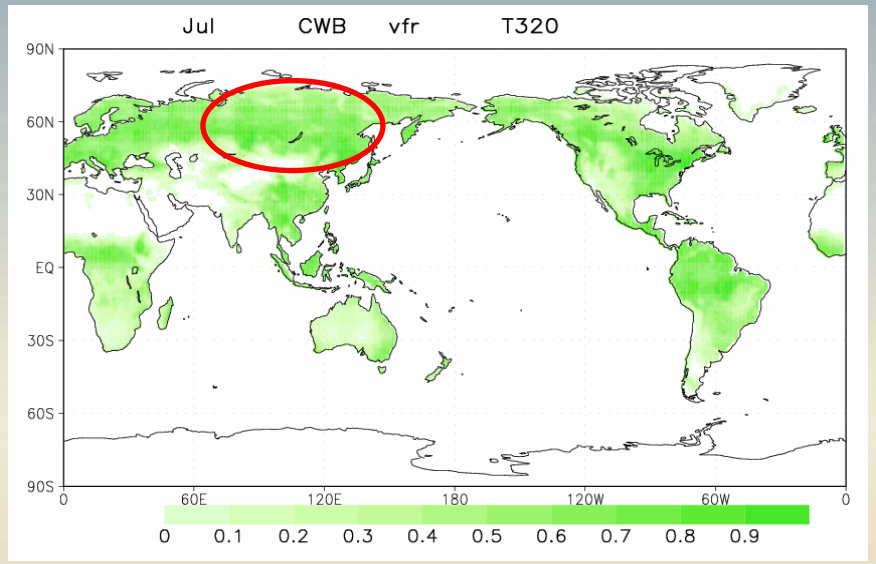
最小阻尼係數變化

顏色愈深 → 減小比例愈大



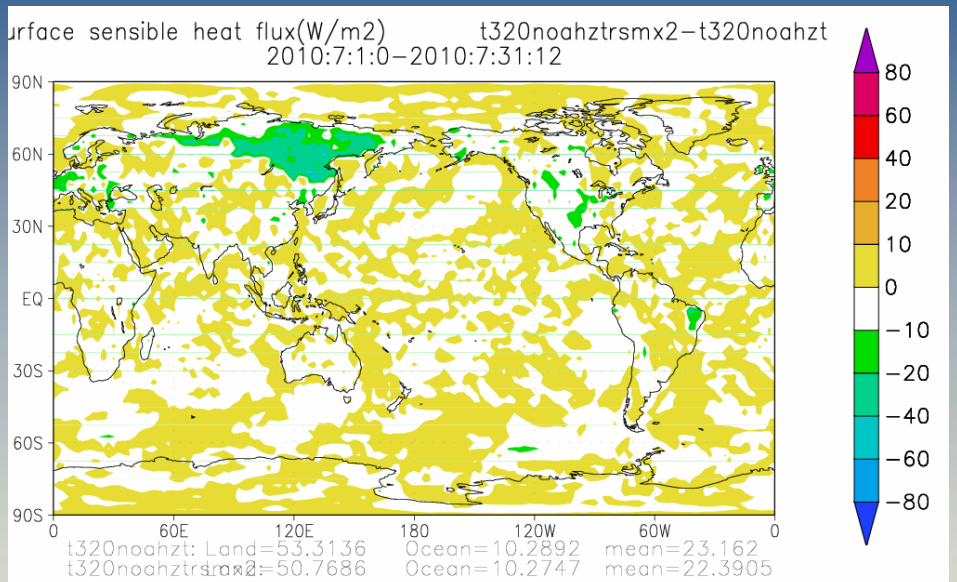
7月植物覆蓋率

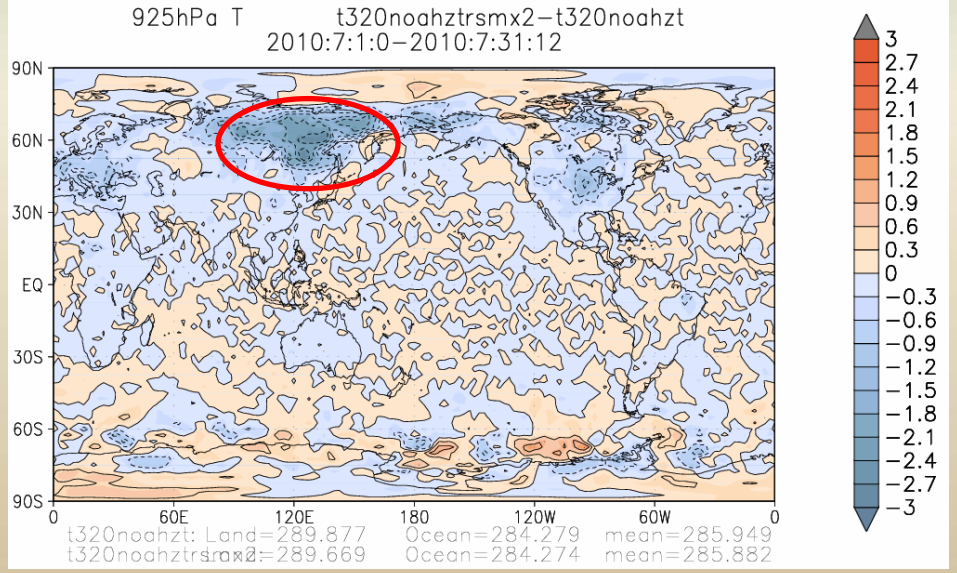
顏色愈深→覆蓋率愈大



Et(rsmin)變化對可感熱之敏感性測試

30 day averaged results in July 2010





Surface sensible heat flux

53.31 W/m2(land)

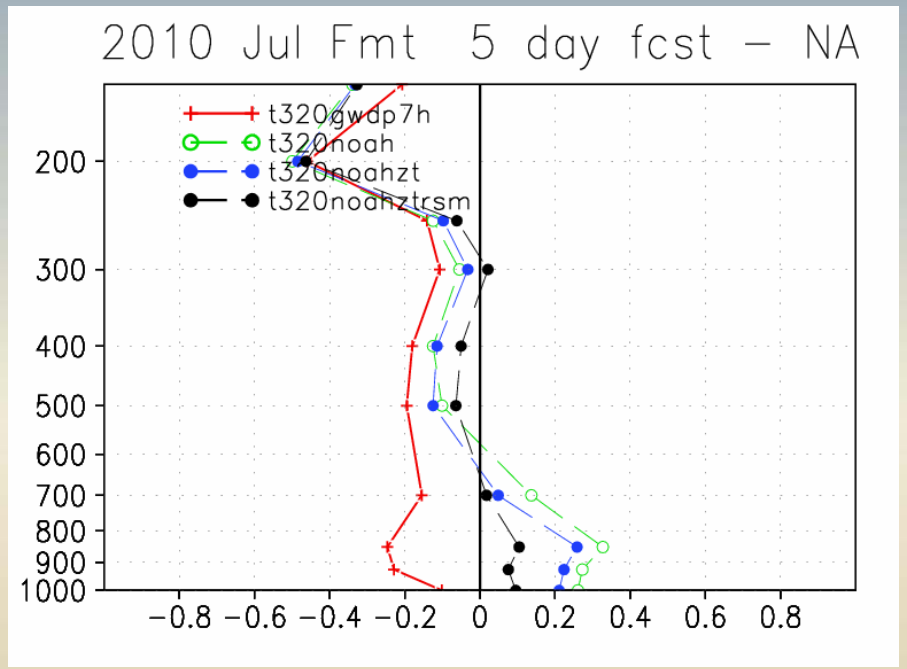
-2.5 ⇩

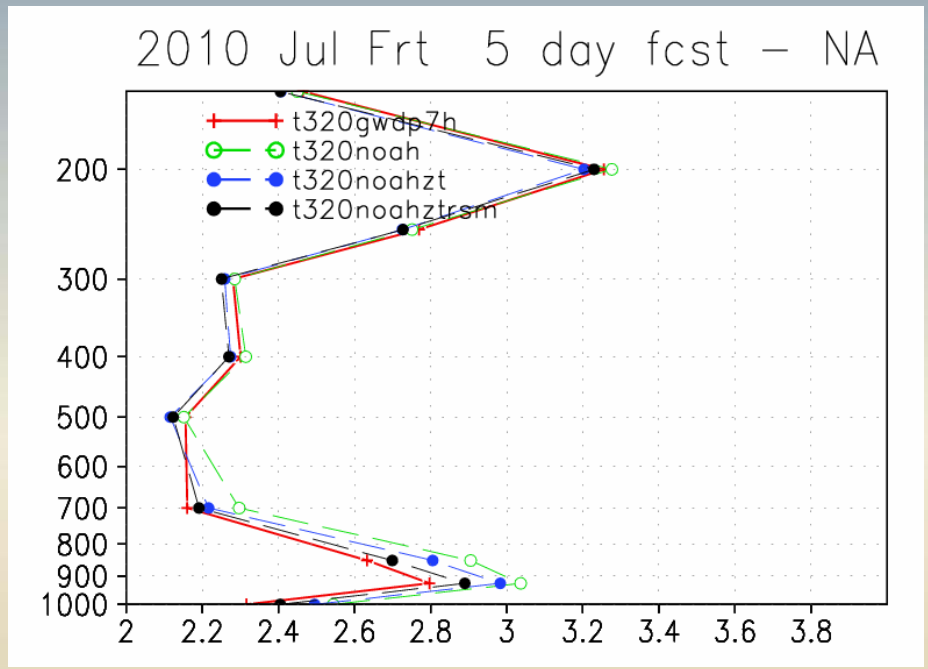
50.76 W/m2(land)

Temperature impact at 925hPa

2010 Jul 夏

T (mean error) **NA** **T (rms error)**





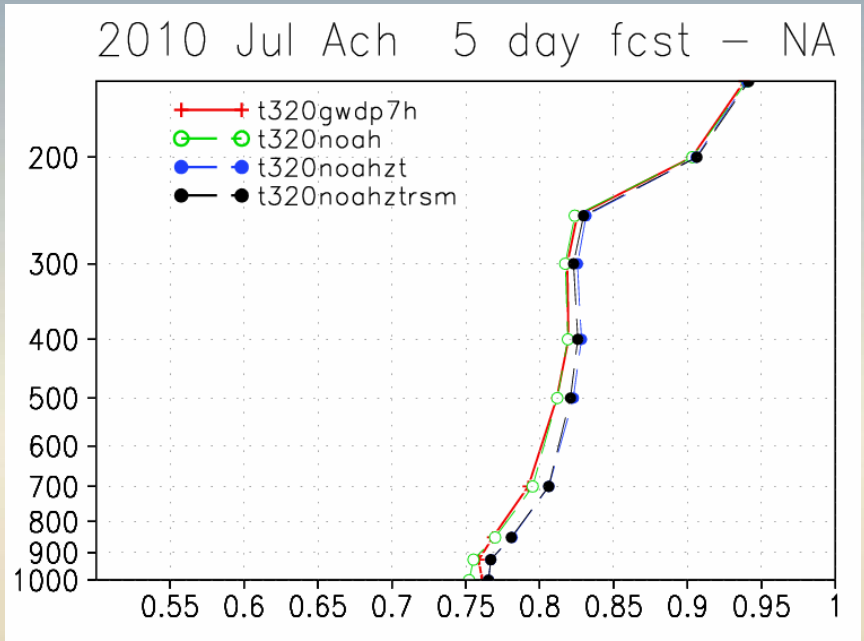
Ops ---------

Noah_zt ---------

Noah_zt+rsmin ----------

2010 Jul 夏

ACH(NA)



Ops ---------

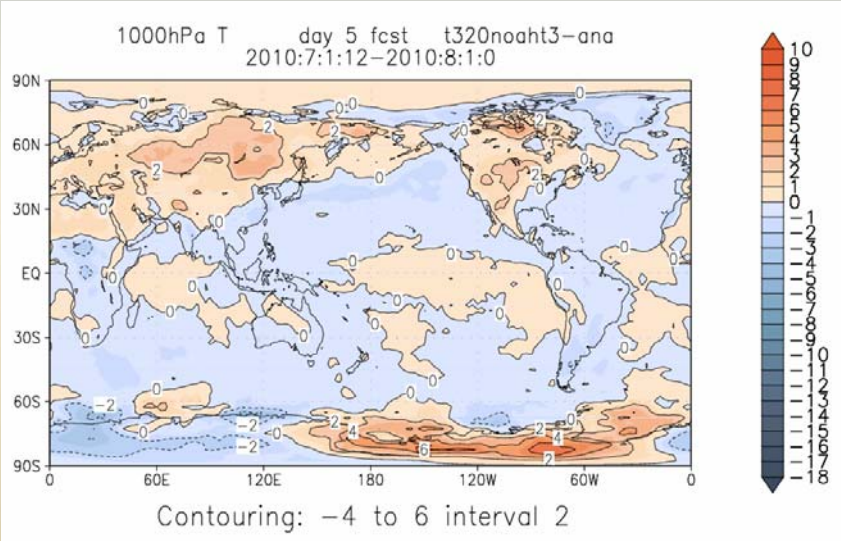
Noah_zt ---------

Noah_zt+rsmin ---------

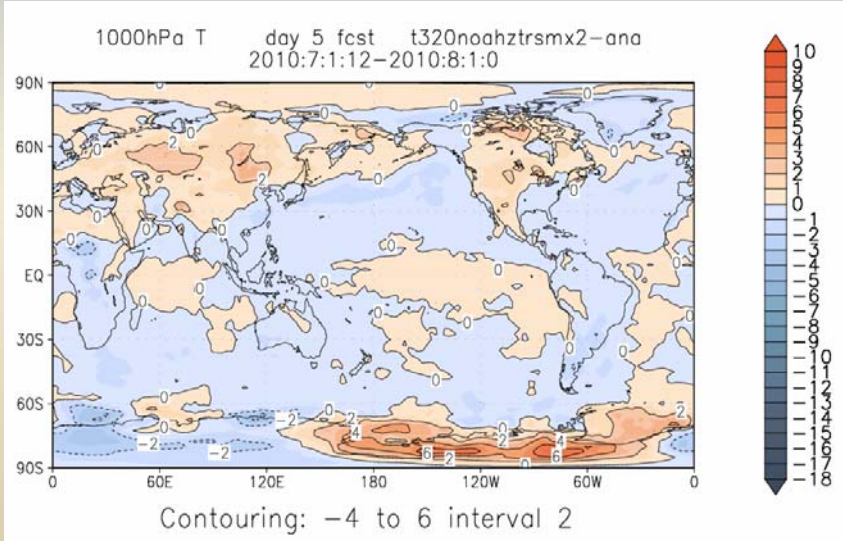
小結：

透過調整測試，有效降低低層大氣的暖偏差

1000hpa　T(day 5 fcst) – T(ana)



Noah 調整前



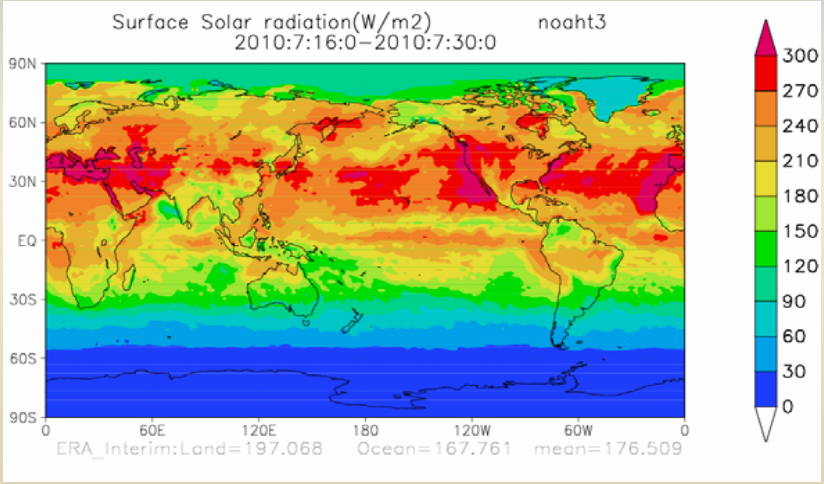
Noah 調整後

未來方向

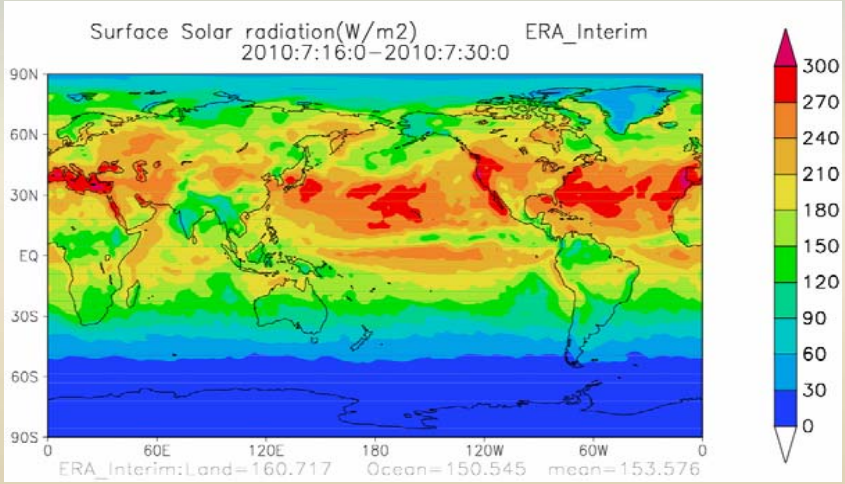
◘ GFS 潛在問題：地表短波輻射淨通量 過大

➢ 雲輻射過程（雲量偏少?)

Surface net Solar radiation flux



CWB_noah



Era_interim

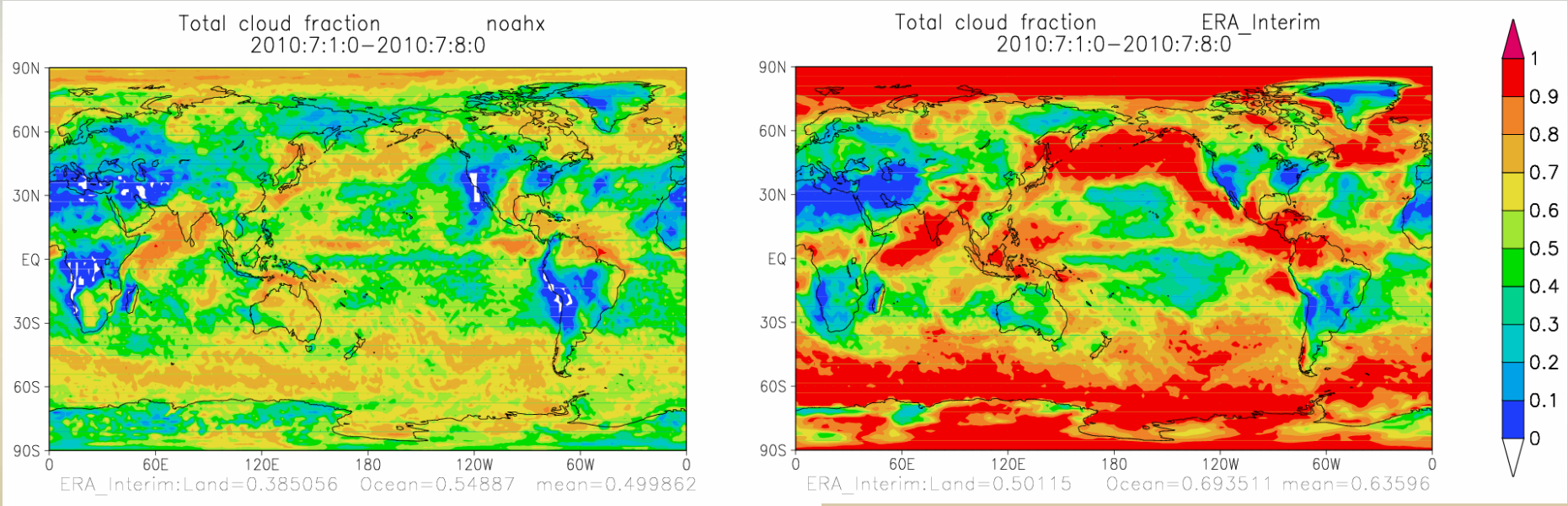

Thanks
NATIONALGEOGRAPHIC

2010/07 /01-08 mean

Total cloud

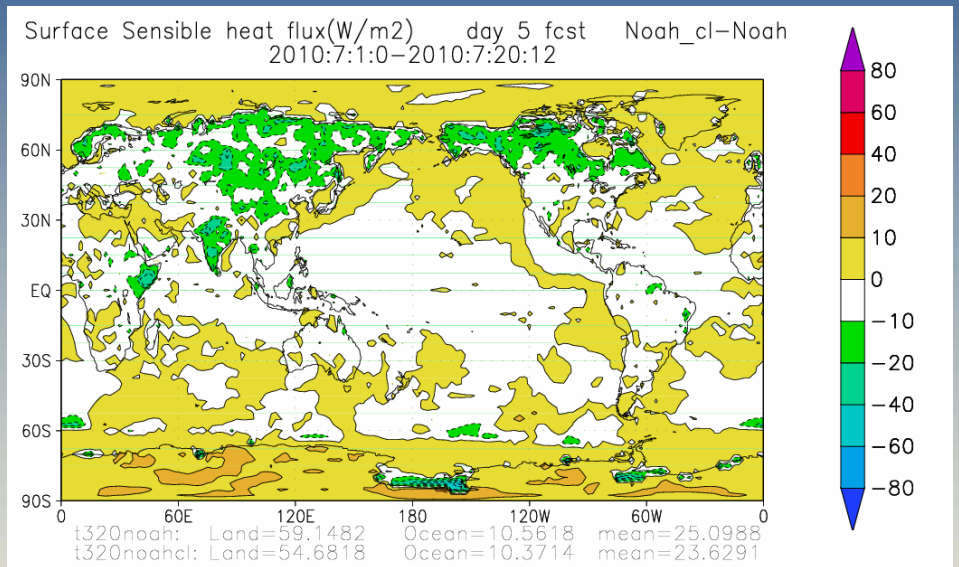
Noah 0.499

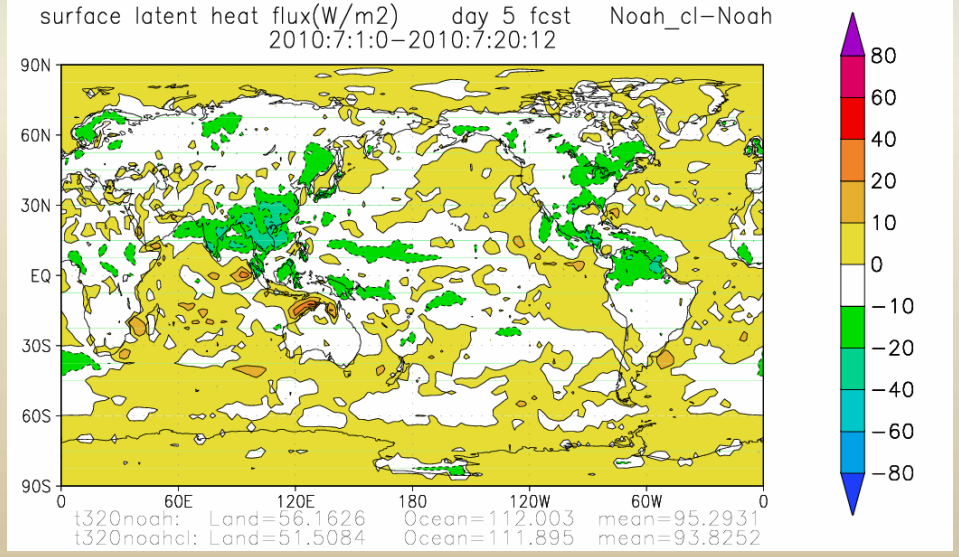
Era-interim 0.635



201007 20 day- mean

Surface sensible heat flux





rad-cloud 敏感測試 增加雲量

Noah SH

59.1 W/m2(land)

54.6 W/m2(land)

Noah LH

56.1 W/m2(land)

51.5 W/m2(land)

Rad-cloud 增加雲量 敏感測試
T（mean error）