

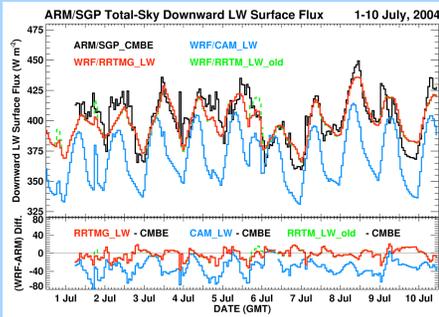
# Assessment of Radiation Options in the Advanced Research WRF Weather Forecast Model

Michael J. Iacono and Thomas R. Nehr Korn, *Atmospheric and Environmental Research, Inc., 131 Hartwell Avenue, Lexington, MA 02421 USA*

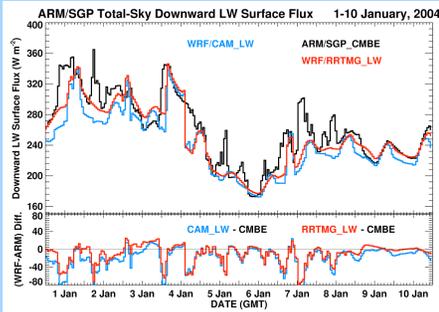
## WRF Longwave Radiation

Downward LW surface flux at SGP from 10-day WRF forecasts compared to ARM/CMBE LW flux

1-10 July 2004



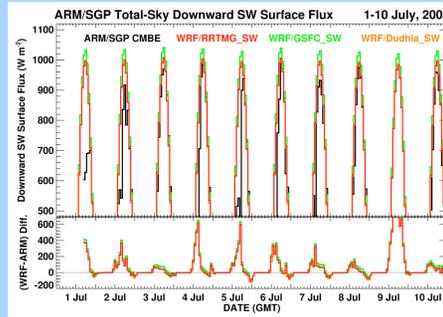
1-10 January 2004



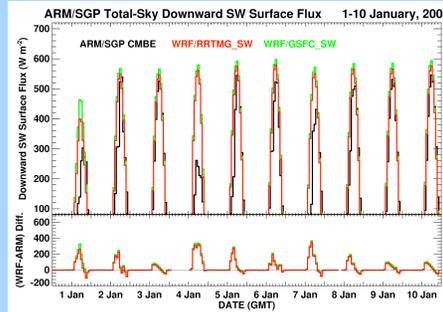
## WRF Shortwave Radiation

Downward SW surface flux at SGP from 10-day WRF forecasts compared to ARM/CMBE SW flux

1-10 July 2004



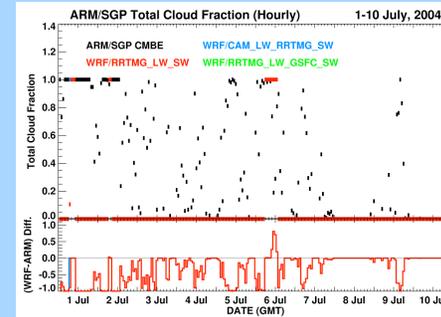
1-10 January 2004



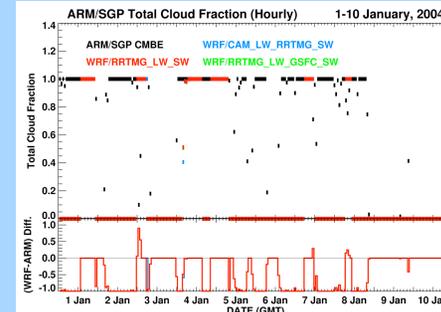
## WRF Cloud Fraction

Maximum cloud fraction in any layer from 10-day WRF forecasts compared to ARM/CMBE total cloud

1-10 July 2004



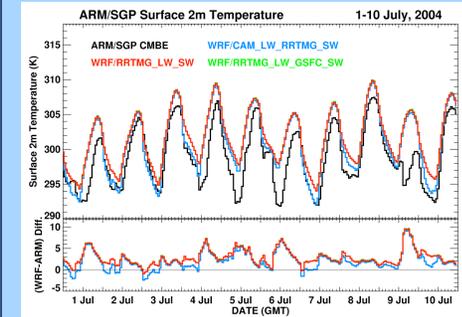
1-10 January 2004



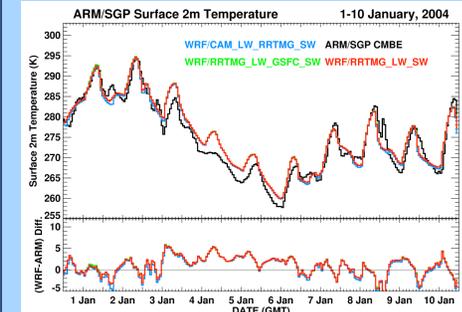
## WRF 2-meter Temperature

Surface 2-meter temperature at SGP from 10-day WRF forecasts compared to ARM/CMBE 2-m temp.

1-10 July 2004



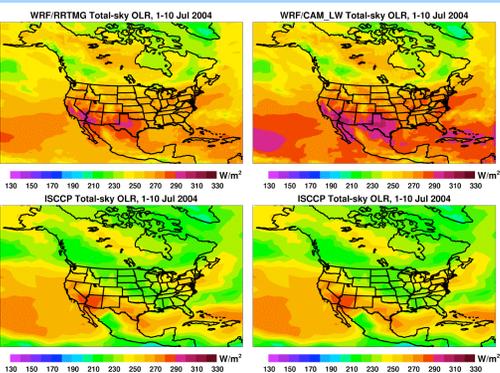
1-10 January 2004



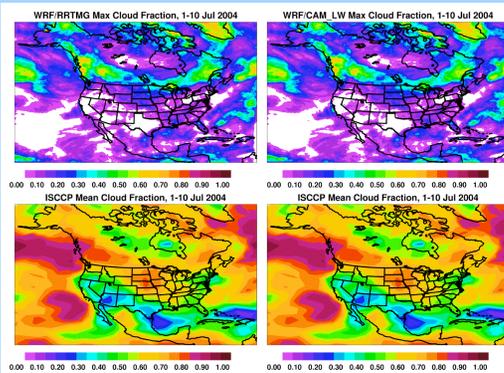
## Regional Comparison of WRF Radiation to ISCCP for 1-10 July 2004

Ten-day mean comparisons are between a sequential series of multi-day WRF forecasts using NARR data assimilation and ISCCP. Highly deficient cloud amounts have significant impacts on radiative fluxes.

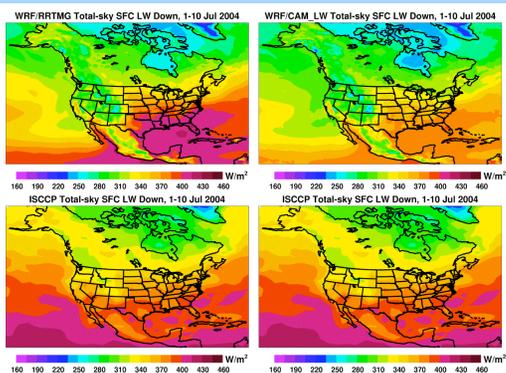
### Outgoing Longwave Radiation



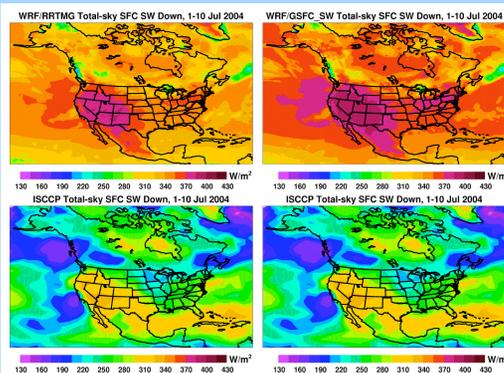
### Cloud Fraction



### Downward Longwave Surface Flux



### Downward Shortwave Surface Flux



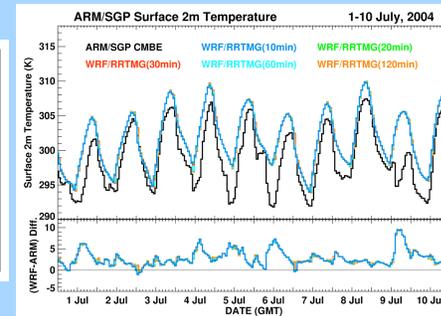
## Impact of Radiation Frequency on WRF Flux and Temperature

Comparison of WRF radiation and surface temperature for 1-10 July, 2004 using the RRTMG radiation running at different frequencies of the radiation calculation (10, 20, 30, 60 and 120 minutes).

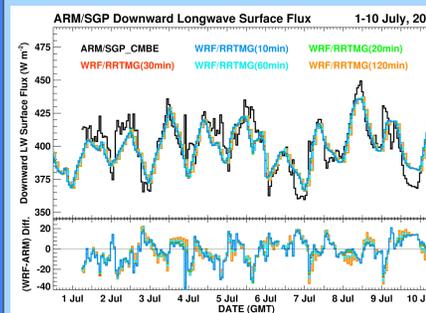
### Mean and RMS Differences

Radiation Frequency	Longwave Surface Down Flux ( $W m^{-2}$ )		Shortwave Surface Down Flux ( $W m^{-2}$ )		2m Temperature (K)	
	Mean Diff.	RMS Diff.	Mean Diff.	RMS Diff.	Mean Diff.	RMS Diff.
RADT						
10 min.	-2.05	10.76	63.68	165.78	2.83	1.83
20 min.	-2.15	11.15	64.29	148.20	2.83	1.76
30 min.	-2.14	10.83	63.97	157.54	2.84	1.80
60 min.	-2.10	10.79	63.89	161.48	2.84	1.81
120 min.	-2.22	12.10	64.41	155.01	2.86	1.73

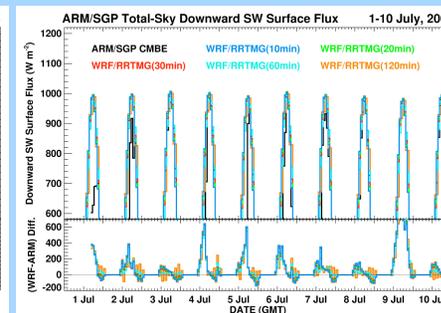
### 2-meter Surface Temperature



### Downward Longwave Surface Flux



### Downward Shortwave Surface Flux



#### Acknowledgment:

This work was supported by the Department of Energy Atmospheric Science Research (ASR) Program under grant DE-FG02-92ER61549.

#### Reference:

AER RT web site: [rtweb.aer.com](http://rtweb.aer.com)  
 Iacono, M.J., J.S. Delamere, E.J. Mlawer, M.W. Shephard, S.A. Clough, and W.D. Collins, (2008). Radiative forcing by long-lived greenhouse gases: Calculations with the AER radiative transfer models. *J. Geophys. Res.*, 113, D13103. doi:10.1029/2008JD009944.