Assimilation of GLD-360 lightning data and satcast convective initiation data in the Rapid Refresh / RUC and lightning forecast guidance from nested HRRR runs

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OVERVIEW

(1) Preliminary evaluation of impact from assimilation of two novel convection indicators:

→ GDL-360 lightning data -- good long-range coverage
Especially helpful for oceanic convection

→Satcast cloud top cooling rate data – good CI
Helpful for avoiding model delay in storm development

(2) Preliminary evaluation of lightning parameters from HRRR 3-km forecasts
Qualitative assessment encouraging, additional refinement and assessment ongoing

Lightning / Satcast Assimilation Algorithm

LTG -- compute flash rate per RAP grid box in 40 min. period (-30→ +10)

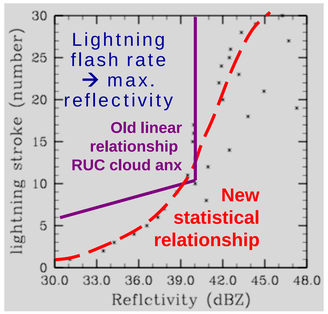
SATCAST → "proxy" flash rate = - 2 x cloud-top cooling rate (K/15 min)

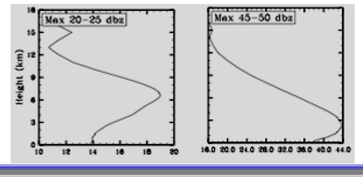
Use seasonally varying statistical relationship between flash rate and proxy column max reflectivity (replaces linear relationship in RUC)

Seasonally varying relationship between proxy column max refl. and vertical profile of reflectivity

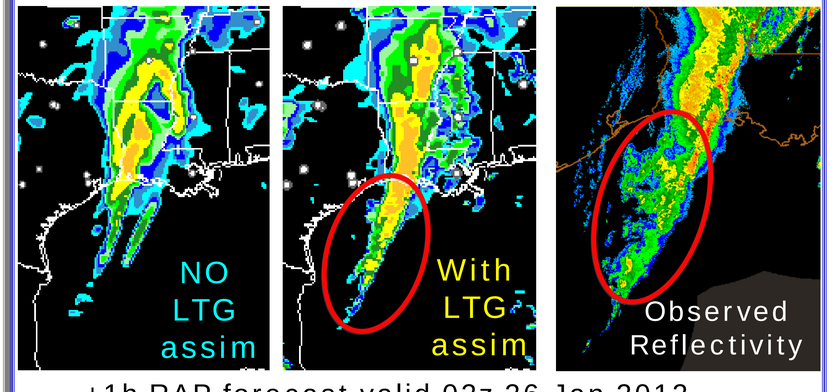
Use this proxy 3D reflectivity to obtain LH based temperature tendency for use in radar DFI

Radar DFI induces storm-scale convergent / divergent winds



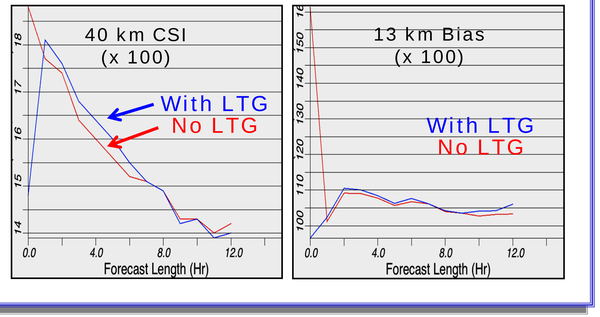


Real-time parallel LTG assimilation test



+1h RAP forecast valid 02z 26 Jan 2012

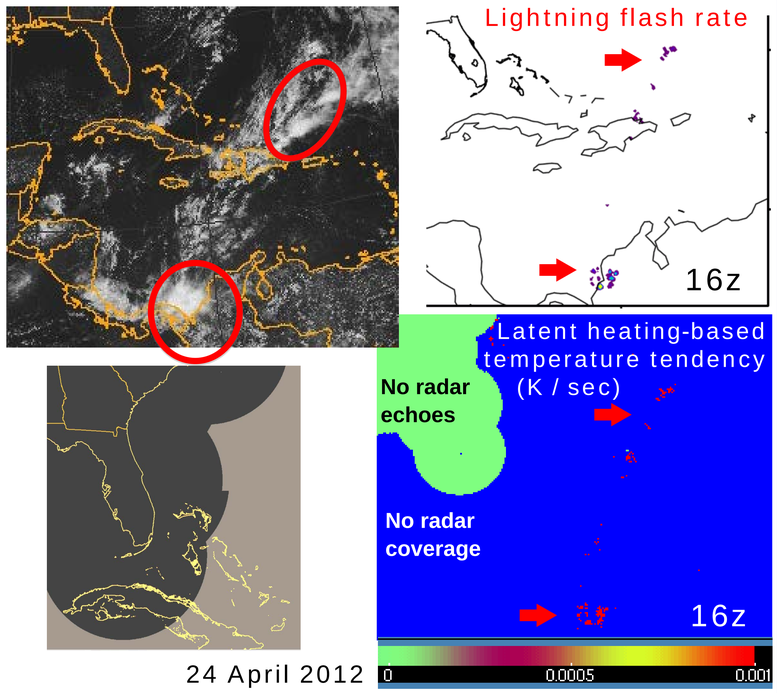
Refl. ≥ 20 dBZ
24 – 26 April 2012 - CONUS



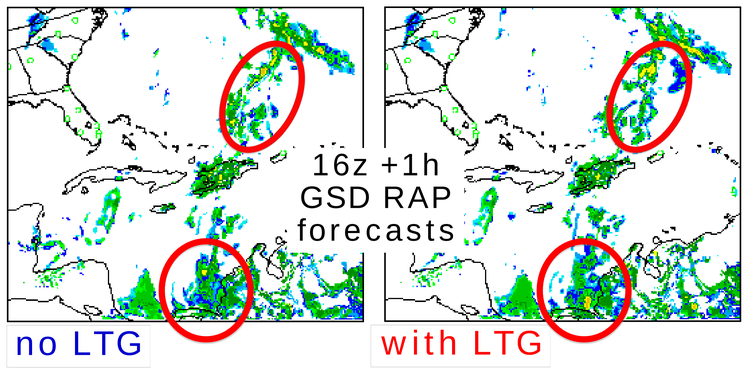
Slight improvement in RAP skill with lightning assimilation

Assimilation of GLD-360 lightning data

Extended range coverage very helpful for initializing oceanic convection in GSD real-time RAP version 2

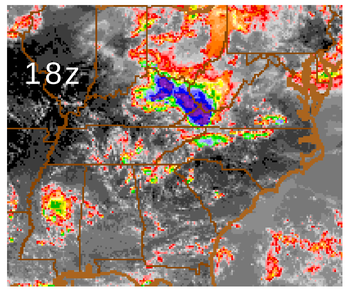


24 April 2012

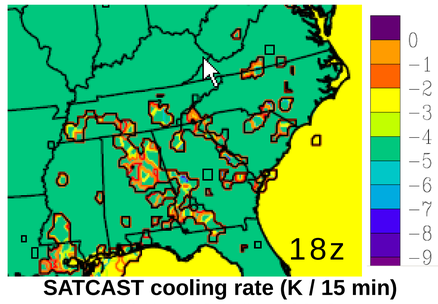


Assimilation of "satcast" cloud-top cooling rate CI-indicator data

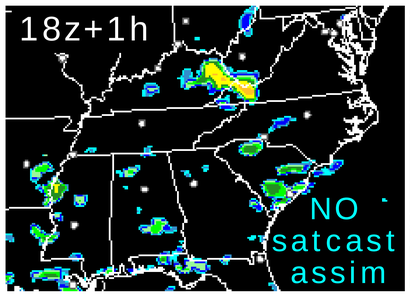
Cloud-top cooling rate very helpful for initializing developing convection in GSD real-time RAP version 2



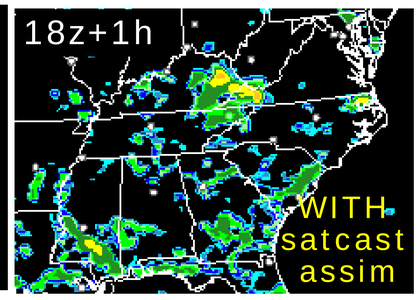
IR image 1815UTC 5 July 2012



SATCAST cooling rate (K / 15 min)
1815 UTC 5 July 2012



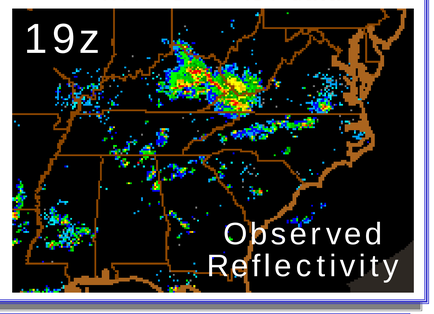
RAP 1h fcst reflectivity valid 1900 UTC 5 July 2012.
NO SATCAST data.



RAP 1h fcst feflectivity valid 1900 UTC 5 July 2012.
WITH SATCAST data.

Assimilation of "Satcast" cooling rates provides more realistic short-range forecast of convective initiation and development

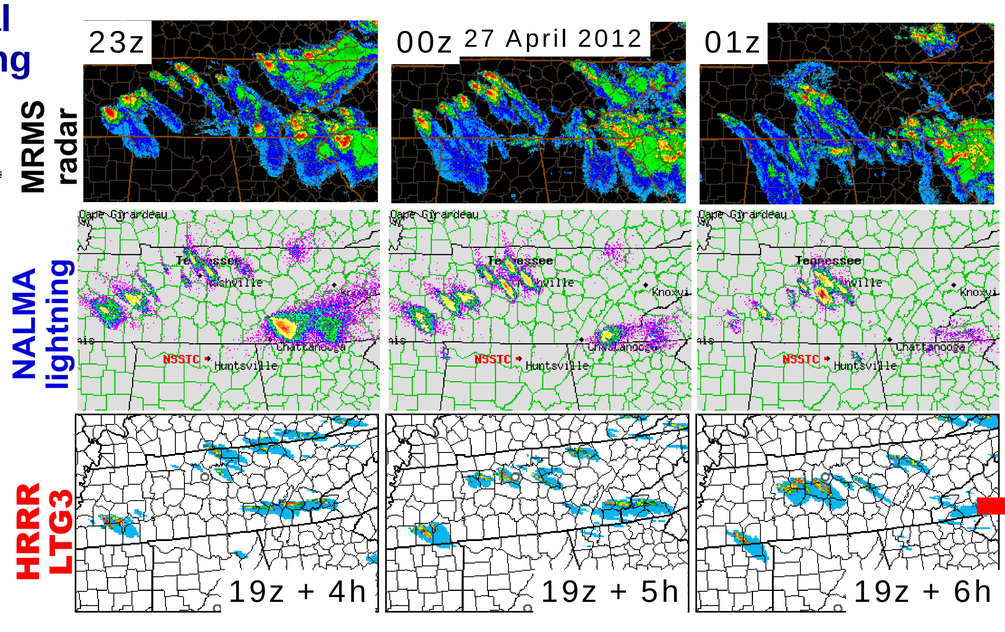
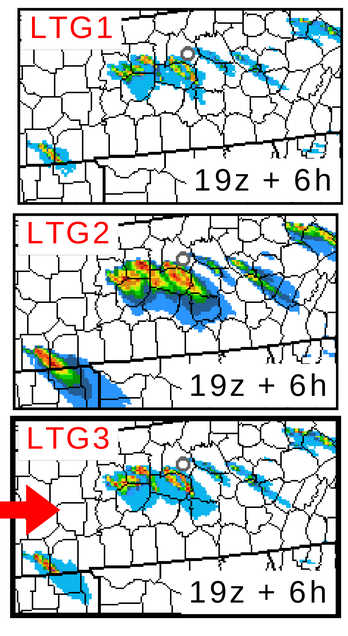
Nested HRRR runs planned



Experimental HRRR lightning forecast guidance

LTG1
Graupel flux a -15 C

LTG2
Vertical integrated ice

LTG3
0.95 LTG1 + 0.05 LTG2

McCaul algorithm
(2011 version, Updated to new version , July 2012)