Assimilation of Cloud Clear Radiance of Megha-Tropiques SAPHIR in NCMRWF GFS (T574L64)

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Introduction

- Data assimilation is a major component of numerical weather prediction and involves combining information coming from a forecast model together with available observations, thus providing ‘analyses’ of the atmosphere.
- Data assimilation is usually performed in a sequential manner, with a time series of ‘assimilation cycles’, including a model integration, and a correction due to observations.
- Radiance data contains cloud and precipitation signal. Clouds are considered as a source of noise that need to be removed or corrected for.

GFS T574L64 Model (NGFS) of NCMRWF

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Global Model T574L64 10day FCST

- Observation quality checks & monitoring
- Global Analysis (GSI) Initial state
- Global Forecast Model (9 hr Fcst first guess)
- Statistical Interpolation Model (location specific FCST)
- 4 times a day for 00,06,12,18 UTC

Identification of Deep Convective Cloud Pixels

The study done by Hong et al. (2005) is adapted to detect the deep convective clouds in SAPHIR radiances and then these cloud free radiances are used to improve the initial conditions and subsequent forecasts of NGFS model. In order to verify the criteria, cloud pixels obtained from SAPHIR channels are compared with the TRMM daily accumulated rainfall.

MT SAPHIR: Simulation/Assimilation

In the absence of cloud absorption and atmospheric scattering from precipitation, an accurately parameterized community radiative transfer model (CRTM) is used to simulate/assimilate the radiances from/in the NGFS models (Prasad et al., 2011) for clear atmospheric conditions.

MT: SAPHIR Ch-5 on 20-11-2013 00 UTC

Level | FCST hour | CNT | EXP | % improvement
--- | --- | --- | --- | ---
850 hPa | day1 | 11.0 | 10.6 | 4.3
 | day2 | 15.0 | 15.0 | 0.0
 | day3 | 18.3 | 18.3 | 0.0
 | day4 | 20.7 | 20.7 | 0.0
 | day5 | 22.7 | 22.7 | 0.0
 | day6 | 13.4 | 12.8 | 4.5
 | day7 | 20.9 | 20.9 | 0.0
 | day8 | 16.3 | 16.3 | 0.0
 | day9 | 22.7 | 22.7 | 0.0
 | day10 | 25.3 | 25.2 | 0.6
 | day11 | 27.6 | 27.6 | 0.0
 | day12 | 21.9 | 21.8 | 0.2
 | day13 | 25.9 | 25.9 | 0.0
 | day14 | 29.0 | 29.1 | -0.4
 | day15 | 31.3 | 31.6 | -0.8

SAPHIR data assimilation showed improvement in relative humidity which varies from 0.1 to 4.5 % in day 1 to day 7 at 700 and 850 hPa. However, in day 5 no improvement has been seen. At 500 hPa, improvement can be seen up to day-2.

References
