THE INCLUSION OF INTEGRATED WATER VAPOR ESTIMATES FROM AIRS/AMSU AND SSM/I SENSORS INTO THE CPTEC'S DATA ASSIMILATION SYSTEM

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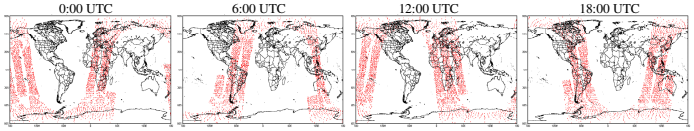
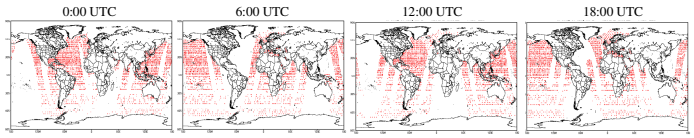
The atmospheric water vapor plays a crucial role in the atmospheric processes and its distribution is associated with cloud concentration and rainfall. The inclusion of Integrated Water Vapor (IWV) estimates into Numeric Weather Prediction (NWP) improves the vertical structure of the humidity and consequently contributes to obtain a more realistic atmospheric state. Nowadays, remote sensing data is the most important source of humidity, which provides information with good horizontal resolution and global coverage. However, the assimilation of the IWV values from humidity sounding satellites not has been explored in the CPTEC NWP model. This study investigates the impact of IWV retrieved from Atmospheric InfraRed Sounder/Advanced Microwave Sounding Unit (AIRS/AMSU) and Special Sensor Microwave/Imager (SSM/I) as additional sources of moisture information in the CPTEC data assimilation system (PSAS: Physical-space Statistical Analysis System). In order to characterize this impact were carried out different cyclic processes using the Atmospheric Global Circulation Model CPTEC/COLA (T126L28, with horizontal resolution of 100 km and 28 levels in the vertical sigma coordinate) with and without the inclusion of these data. The period this experiment is March of 2004. In the analysis of results is considerated the improvement in the forecast of the specific humidity, geopotencial height and wind field in different global areas, with special attention in the South America region. The impact of the IWV assimilation is certificated applying an O-F analysis, considering only observations from operational radiosondes, and A-F analysis. The analysis of the results shown that the impact of inclusion IWV from AIRS/AMSU and SSM/I is significant to regions where the density of conventional information is lower, as South America region. In these areas, the inclusion the IWV values improved the prediction of specific humidity in 850 and 700 hPa, the geopotencial height and wind components in 250 hPa. This result indicates that IWV assimilation minimize the model errors to characterize the humidity vertical structure, consequently produce a better adjust in the mass budget in the troposphere, generating an indirect impact in the prediction of prognostic variable, principally geopotencial height in 250 hPa.

Data used in the assimilation experiment

IWV spatial distribution from AIRS/AMSU sensor (2nd March, 2006)

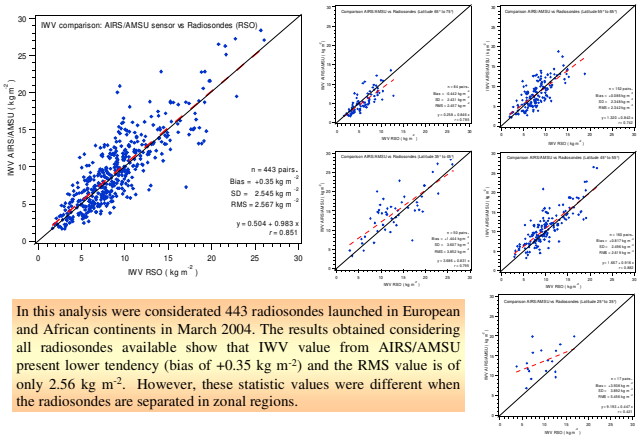


IWV spatial distribution from SSM/I sensor (2nd March, 2006)



Additional data source considered:
•ATOVS [Advanced TIROS Operational Vertical Sounder]: height geopotencial;
•Titan II Satellite, QuikScat (Nasa's Quik Scatterometer) mission: components of wind over the ocean surface;
•Global Telecommunication System: conventional data.

Quality analysis of the IWV values from AIRS/AMSU

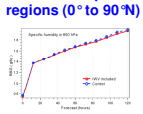


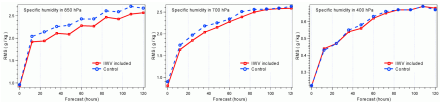
In this analysis were considerated 443 radiosondes launched in European and African continents in March 2004. The results obtained considering all radiosondes available show that IWV value from AIRS/AMSU present lower tendency (bias of +0.35 kg m^{-2}) and the RMS value is of only 2.56 kg m^{-2}. However, these statistic values were different when the radiosondes are separated in zonal regions.

Impact analysis of IWV assimilation using observations (radiosondes)

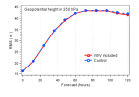
South America region (60°S to 15°N and 90°W - 30°W)

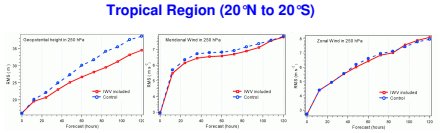
North Hemisphere regions (0° to 90°N)





Tropical Region (20°N to 20°S)

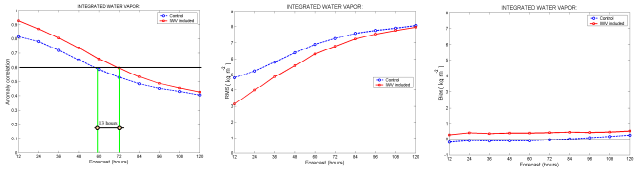




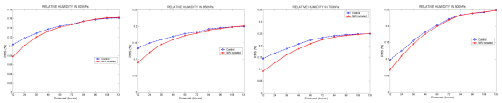
O-F analysis considering only observations from operational radiosondes available in the GTS
•The impact of the IWV assimilation is not significant in the North Hemisphere regions;
• It is significant to regions where the density of conventional information is lower:
•Improve the specific humidity prediction in the lower levels of the troposphere (850 and 700 hPa);
•Improve the Geopotential and wind components at high levels of the troposphere (250 hPa).

Impact of IWV assimilation on prognostic fields in the South America (A-F analysis)

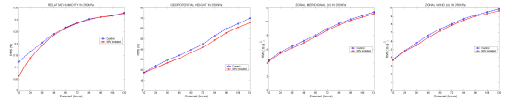
Analysis quality of predict IWV values



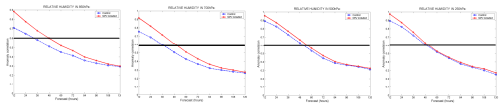
RMS analysis in low and medium levels of the troposphere



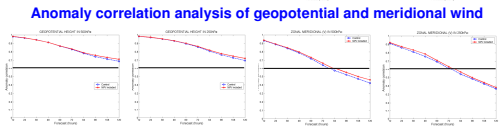
RMS analysis in high levels of the troposphere



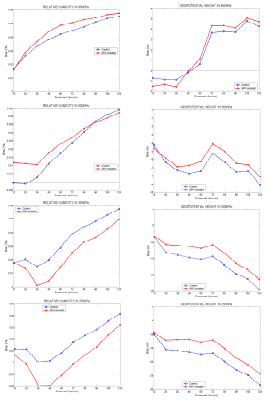
Anomaly correlation Analysis in the relative humidity



Anomaly correlation analysis of geopotential and meridional wind



Bias analysis of relative humidity and geopotential hight



The most important results obtained in the A-F analysis are :
•The impact of the IWV assimilation:
• Yielded better short-range predictions of humidity in the South America;
• Improved lightly the predictions of geopotential height and wind components in the hight level of the troposphere (250 hPa);
• Corrected the bias in the prediction of geopotential height in 250 hPa.

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Acknowledgements: