ISDA-Online

Friday, May 12, 2023, 15-17h UTC

"Satellite Data Assimilation II"

Organizers and Conveners: Qi Tang *(l'Université de Neuchâtel)*, Prashant Kumar (ISRO, India), Zofia Stanley *(NOAA/CIRES, US)*, Javier Amezcua *(Tec. de Monterrey, Mexico; U. Reading, UK)*

Satellite observations substantially contribute to the accuracy of initial conditions and forecasts in geoscience and beyond. The high importance and variety of satellite observations, including various ongoing and future satellite missions, call for further advances in satellite data assimilation. We invite all contributions from this active and exciting research field.

Program: (UTC)

15:00 – 15:10 **Welcome**

15:10 – 15:28 (15'+3') **Use of satellite data in an operational NWP Data Assimilation System**
Indira Rani

15:28 – 15:44 (15'+3') **Towards the operational assimilation of all-sky water vapour SEVIRI channels in our regional ensemble Kalman filter assimilation system**
Annika Schomburg, Christoph Schraff, Liselotte Bach, Robin Faulwetter, Christina Köpken-Watts

15:44 – 16:02 (15'+3') **Several Measures for Improving the CrIS All-sky Infrared Radiance Assimilation**
Xin Li, Xiaolei Zou

16:02 – 16:20 (15'+3') **Cancelled** **Impact of SWOT observations in a global high-resolution analysis and forecasting system**
Mounir Benkiran, Pierre-Yves Le Traon, Elisabeth Rémy

16:20 – 16:38 (15'+3') **Assimilation of GOES-16 ABI all-sky radiance observations in RRFS using hybrid EnVar: Development and impacts for a severe convective event**
Samuel K. Degelia, Xuguang Wang

16:38 – 16:45 **Closing: Information on upcoming sessions**

Please note:

- When you login to the session before 15:00 UTC, and everything could be quiet, this is most likely because we muted the microphones.
- The times in UTC are approximate. In case of technical problems, we might have to change the order of the presentations.
- **Time Zones**: 15 – 17 UTC
  Europe: 04 – 06 pm BST (London) | 05 – 07 pm CEST (Berlin)
  Asia/Australia: 11 – 01 am CST (Shanghai) | 00 – 02 am JST (Tokyo) | 02 – 04 am AEDT (Sydney)
  Americas: 08 – 10 am PDT (San Fran.) | 09 – 11 am MDT (Denver) | 11 – 01 pm EDT (New York)

Use of satellite data in an operational NWP Data Assimilation System

Indira Rani S (NCMRWF)

Global operational centres use various satellite observations (direct and derived) from both geostationary orbits (GEOs) and low earth orbits (LEOs) in addition to the conventional surface and upper air observations. The first part of this presentation gives an overview of the reception, processing, monitoring, and assimilation of various global satellite observations in the NCMRWF NWP systems. NCMRWF puts enormous effort to assimilate Indian satellite data in its global as well as regional assimilation systems through Research (OSE, OSSE, and FSOI) to Operation (R2O). Second part of this presentation provides a glimpse of various Indian satellite data used in the past, present and future plans. The current status and future requirements of meteorological satellites for NWP DA in terms of spatiotemporal coverage gap analysis will be covered in the third part of this presentation.

Towards the operational assimilation of all-sky water vapour SEVIRI channels in our regional ensemble Kalman filter assimilation system

Annika Schomburg (DWD), Christoph Schraff (DWD), Liselotte Bach (DWD)
Robin Faulwetter (DWD), Christina Köpken-Watts (DWD)

In 2023 we aim to operationalize the assimilation of several SEVIRI channels in the ensemble Kalman filter assimilation system for our regional model ICON-D2 at the convective scale. They will be replaced in near future by the same channels of the next-generation imager FCI onboard Meteosat Third Generation which has been launched in December 2022. After extensive experimental testing, the visible channel at 0.6 micron is already actively used in our so-called “parallel routine”, which runs in real time in a routine-like setting. Thus, this channel will become fully operational in spring this year.
In addition, we aim to add the all-sky assimilation of the two water vapour channels at 6.2 and 7.3 micron later this year. While the visible channel can detect clouds at all levels, these channels are sensitive to upper and mid-level troposphere only, however they provide information on cloud top height and on the water vapour distribution at these heights and thus are a valuable complement to the visible range.
In this talk I will present the results of a number of experiments including these two channels. The setup that has been proven to give the best results will be presented, including the chosen observation error model, vertical height assignment approach and horizontal and vertical localization.

Several Measures for Improving the CrIS All-sky Infrared Radiance Assimilation

Xin Li (NUIST), Xiaolei Zou (NUIST),

Assimilation of all-sky infrared radiance remains challenging, due to the uncertainties of NWP model parameterizations, uncertainties of RTMs, inconsistent of clouds between observations and model forecasts, and non-Gaussian distributions of brightness temperature (TB) O-B.

Firstly, influences of cloud liquid water, cloud ice, rain, snow and graupel on all-sky simulations of the CrIS TB are assessed for the 399 data assimilation (DA) channels. The WRF 6-h forecasts with three different microphysics schemes (WSM6, Thompson and the Morrison) are used as input to the CRTM. Biases differences among three microphysics schemes are small in stratus, altocumulus and cumulus clouds, but large in cirrus and cirrocumulus clouds. The TB simulations in stratus, altocumulus and cumulus clouds are mostly influenced by the cloud top pressure, while that in cirrus and cirrocumulus clouds depends strongly on cloud optical depth. Considering distinct O-B characteristics among cloud types, we propose to combine a cloud-effect parameter with cloud types for modeling observation error characteristics in all-sky DA.

Secondly, proper bias correction and observation error assignments for all-sky radiance are on the basis of reliable TB simulation. We propose a method to improve CrIS all-sky radiance simulations, using the background constrained by microwave cloud retrieved information. The GSI En-Var DA is updated by incorporating ensemble covariances of hydrometeor variables and observation operators of LWP, IWP, and RWP for the ATMS onboard the same satellite. In the new scheme, improvements in the analyses of hydrometeor variables are found to benefit CrIS radiance simulations. A long period of statistics reveals that the biases and standard deviations of all-sky O-B are notably reduced. This pilot study suggests the potential benefit of combining the use of microwave cloud retrieval products for all-sky infrared DA.

Assimilation of GOES-16 ABI all-sky radiance observations in RRFS using hybrid EnVar: Development and impacts for a severe convective event

Samuel K. Degelia (University of Oklahoma), Xuguang Wang (University of Oklahoma)

The Rapid Refresh Forecast System (RRFS) aims to unify convective-scale data assimilation (DA) and modeling techniques around the Finite Volume Cubed-Sphere Dynamic Core (FV3). To advance the convective-scale forecast skill of RRFS, we develop capabilities to assimilate all-sky radiance observations collected by the GOES-16 Advanced Baseline Imager (ABI). These observations provide high-resolution information about water vapor and cloud hydrometeors and are complementary to radar reflectivity observations. While assimilating these observations are hypothesized to improve the structure of various convective features, many questions remain about how to best assimilate this novel dataset. This project develops methods for assimilating GOES-16 ABI all-sky radiances for RRFS using the limited area model configuration of FV3 (FV3-LAM). We will overview new developments that have been made to enable effective, direct assimilation of these observations in a hybrid EnVar system. Additionally, we will present analysis and forecast impacts when assimilating ABI all-sky radiances in FV3-LAM for a case that includes a tornadic supercell and its upscale growth into a severe, nocturnal MCS. These impacts include better analysis of various cloud features, faster spin-up of a supercell, and better suppression of spurious convection through the removal of spurious anvil clouds.