INSAT- 3DR   Hydro-estimator Nowcaster

The development of an operational system for nowcasting precipitation data for the next few hours based on the current observations is a critical research area that can have a significant impact on various weather related challenges. Hydro-Estimator (HE) Nowcaster is an optical flow based algorithm developed by Space Applications Centre on the framework of a python based library 'pysteps'"(https://pysteps.github.io/) under creative common license. This algorithm provides predicted precipitation fields upto next six hours. The data source for the same is the H-E(Hydro-estimator) Data provided by INSAT-3DR satellite.

This has been operationalized on mosdac.gov.in to display the nowcasted Hydroestimator precipitation data for Indian subcontinent over the next three hours on a web-GIS platform. The following paragraphs list the different functionalities and their usage.

Using the checkbox "HEM NOWCAST Layers", the pixels indicating the predicted precipitation will be displayed on the base layer in the map showcased at the website. Then using another checkbox named "HEM NOWCAST", further two functionalities are displayed. In the "Select Event" dropdown menu, on choosing "Archive HEM" and then selecting "Data" and "Time (IST)" accordingly, the GIF files of prediction for next three hours from the choosen time instance will be displayed on the screen. The time instances of the available GIF files are separated by duration of approximately 30 minutes (The time steps varies in accordance to the acquired satellite images , and govern the lead time of nowcast, as displayed on the GIF images). In the gif files, the labels "HEM-Nowcast at {Date} for {minutes}" indicates the date and time of each predicted instance. The Y-axis and X-axis display latitude and longitude respectively. On the right side, colorbar is displayed for knowing the range of pixel's intensity and its unit is mm/hr.

Now, on selecting another function in "Select Event" dropdown menu i.e. "Prev 10days HEM", user will be able to access the predicted HEM data of the last 10 days. Here, on selecting date and time, the pixels will be showcased on the map available on the website.

In the bottom, there comes other three functionalities including "Tools", "Analysis" and "Legends". In tools, the first button with icon similar to a square shape on the left bottom end, is used to draw a polygon on the map and know the dimensions of the total region covered. Then the middle button displaying icon of a map scale, is used to know the distance between two arbitrary points on the map. And the third button in the bottom right corner is used to display latitudinal and longitudinal lines on the map. Now comes, another functionality i.e. "Analysis", which is has two sub-functions. Using the first button i.e. the thumb icon on the bottom left corner, the latitude, longitude and predicted precipitation value of any pixel on the map can be known by moving the cursor over the map. Using the bottom right button with the icon of a graph, a linear graph displaying the variation in the precipitation intensity of a particular pixel over the next three hours can be known. "Legends", which is used to display the color bar for knowing the rainfall intensity of the multi-colored precipitation pixels displayed on the map, here again the unit will be mm/hr.

References:

1. Bipasha Paul Shukla , Jinal Vyas, Shivani Shah, Sambit Kumar Panda and A. K. Varma (2023), Hydro-Estimator Nowcaster: Algorithm Development, Validation and Operational Implementation, SAC internal Report, SAC/EPSA/AOSG/ASG/SR-11/2023
2. Pulkkinen, S., Nerini, D., P\'erez Hortal, A. A., Velasco-Forero, C., Seed, A., Germann, U., & Foresti, L. (2019): Pysteps: an open-source Python library for probabilistic precipitation nowcasting (v1.0). Geoscientific Model Development, 12(10), 4185-4219. https://doi.org/10.5194/gmd-12-4185-2019

For any queries regarding the algorithm, please contact: Dr. Bipasha Paul Shukla (bipasha@sac.isro.gov.in)