

A Pilot Project for Cloud-based NEXRAD Data Processing, Analysis, and Visualization for Flood Forecasting and Water Resources Management

The Iowa Flood Center (IFC) at the University of Iowa used the Unidata Equipment Awards for building a pilot infrastructure that encourages students and researchers to search and access the NEXRAD radar data archived in the cloud storage (e.g., Amazon Web Services). The name of the system is IFC-Cloud-NEXRAD, and it resembles the Hydro-NEXRAD portal that provided researchers with ready access to NEXRAD radar data. Using benefits of cloud capability (e.g., unlimited storage and instant access), IFC-Cloud-NEXRAD eliminates the common challenges of data exploration, which are massive data acquisition/ingestion and rapid filling of limited system storage. The IFC-Cloud-NEXRAD is a pilot system over the Iowa domain motivated by the need to accelerate data processing and increase computational efficiency while testing new rainfall estimation algorithms. The map-based interface allows users to select space and time domain of interest, retrieve and visualize pre-calculated rainfall metadata, and order specific radar-derived rainfall products. The system architecture and map-based interface are illustrated in Figs. 1 and 2. As the system provides generalized approaches in computing metadata and processing data for rainfall estimation, the framework presented here is readily extendable to other geographic regions and larger scale applications.

IFC-Cloud-NEXRAD is available at http://s-iihr52.iihr.uiowa.edu/Unidata_Project/. We initially built the system on AWS (e.g., EC2 instances) and fully tested network communications and relevant computations, as well as GUI functionalities on the cloud environment. Upon the completion of the project supported by the Unidata funding, we moved all developments into our local server at the University of Iowa. Currently, rainfall product request is available from 2008 in which WSR-88D sampling resolution was upgraded. We note that the maximum length of period for product request is limited to 30 days in order to protect the system from unpleasant bulk orders.

The system has been actively used for diverse hydrology and water resources classes (e.g., Hydrology, Hydrometeorology, and Remote Sensing) in the Department of Civil and Environmental Engineering at the University of Iowa, as well as for flood related research in the Iowa Flood Center. The system has helped students understand the role of precipitation and its importance in hydrology and environmental sciences. This was a great opportunity for CEE students to access radar observation data and explore the potential of using rainfall products with high space and time resolutions. In particular, the cloud system enabled students to obtain hands-on experience manipulating and interpreting radar data with their own knowledge and diagnostics. The IFC is housed at IIHR-Hydroscience & Engineering that is a research institute within the College of Engineering of the University of Iowa. Many graduate and undergraduate students currently participate in rainfall-runoff and water quality modeling. We think that this pilot system will continuously contribute to students' education and geoscience research (including the Unidata community) by integrating cloud capability to provide relevant precipitation information using the NEXRAD radar data.

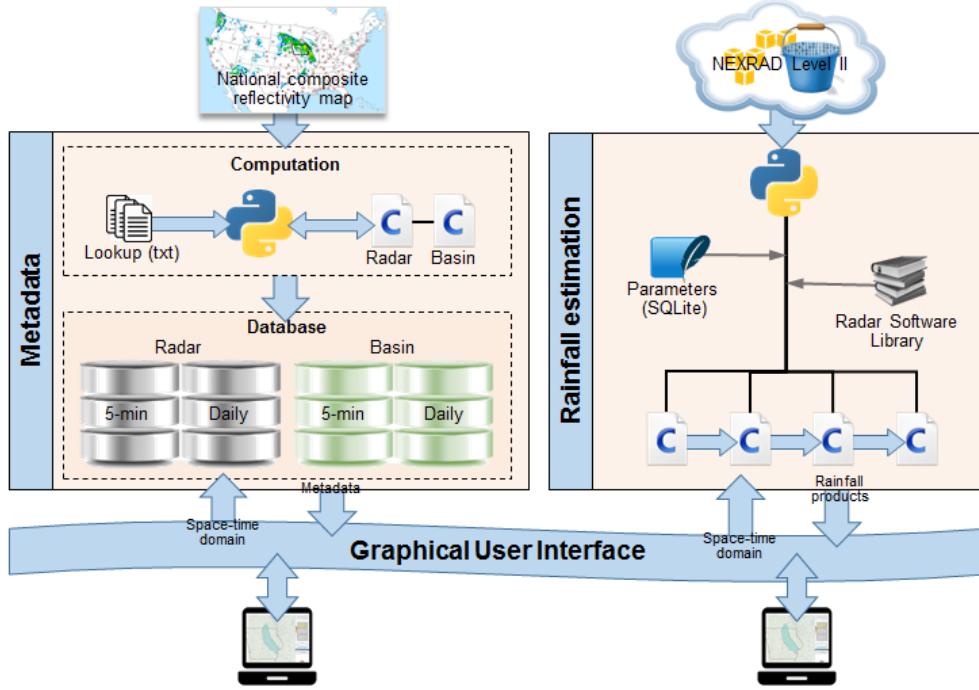


Fig. 1. IFC-Cloud-NEXRAD system architecture

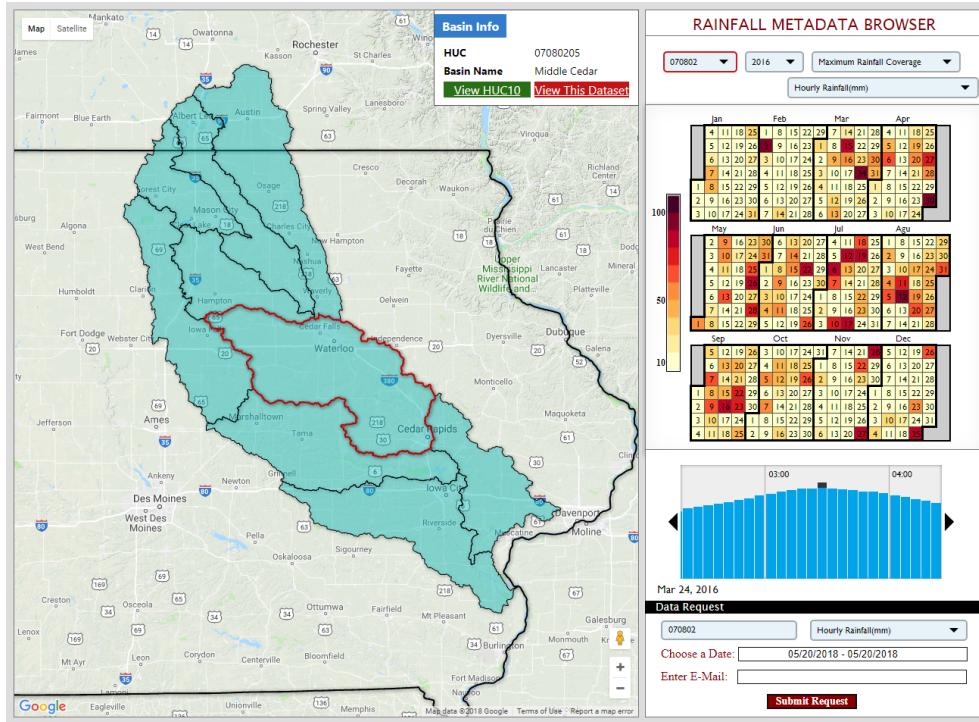


Fig. 2. A screenshot of the IFC-Cloud-NEXRAD Graphical User Interface

[Presentations]

Seo, B.-C., I. Demir, M. Keem, J. Weber, and W.F. Krajewski (2017) Rebuilding Hydro-NEXRAD on the cloud, *10th International Symposium on Weather Radar and Hydrology*, Seoul, Korea.

Seo, B.-C., I. Demir, M. Keem, R. Goska, J. Weber, and W.F. Krajewski (2016) Cloud-based NEXRAD data processing and analysis for hydrologic applications, *AGU Fall Meeting*, San Francisco, USA.

[Potential Publication]

Seo, B.-C., M. Keem, R. Hammond, I. Demir, and W.F. Krajewski (2018) A pilot infrastructure for searching rainfall metadata and generating rainfall product using the big data of NEXRAD, to be submitted to *Environmental Modelling and Software*.