A. COVER PAGE

UNIDATA COMMUNITY EQUIPMENT REQUEST

TITLE: BRINGING BACK WEATHER.NIU.EDU: A MULTIFACETED SERVER AT NORTHERN ILLINOIS UNIVERSITY

by

Dr. Vittorio (Victor) A. Gensini
Assistant Professor
Department of Geographic and Atmospheric Sciences
118 Davis Hall
Northern Illinois University
DeKalb, IL 61135
Email: vgensini@niu.edu
Phone: (815)-753-0621



Kellie M Dyslin
Associate Director
Sponsored Programs Administration
Email: asosp@niu.edu
Phone: (815)-753-1581



B. PROJECT SUMMARY

This proposal seeks to **re-establish the online presence of http://weather.niu.edu** as a cornerstone of community weather/climate data dissemination at Northern Illinois University (NIU). This will be accomplished by creating http://weather.niu.edu as an LDM relay and a web-accessible apache front-end server that facilitates users to view, manipulate, and download Unidata derived products (e.g., GOES 16/17 imagery, model data/images, analysis data, textual products). In addition, this web-accessible server will allow all community members public **access to a THREDDS North American Regional Reanalysis (NARR) archive** that the PI has created. Creation and hosting of this new front-end server would free up the PI's current operational, research, and teaching server (http://atlas.niu.edu; currently running LDM and relaying data to the community) to focus on **teaching** and **research** by allowing students access to a **Jupyter Notebook server** for coursework and individual research projects. To date, this access has been on a limited, on demand, basis due to computing resources. Allowing all NIU meteorology students access to a Jupyter Notebook server (as a result of this proposal) would aid in **data-proximate analysis** that students will need in the future as geoscience datasets continue to grow in size and number. In addition, the PI is teaching a new required course at NIU titled, "**GEOG 493: Computer Programming for the Geospatial and Atmospheric Sciences**." The focus of this course will be the use of the Python programming language for scientific analysis and plans are to facilitate resources to students through use of a Jupyter notebook server that will serve as a gateway to other Unidata tools (e.g., MetPy, netCDF4).

C. PROJECT DESCRIPTION

i. The Northern Illinois University Meteorology Program

NIU is a public Carnegie R2 institution located in DeKalb, Illinois, on the doorstep of the Chicago metropolitan area. NIU serves roughly 17,000 students and was established in 1895. The NIU Meteorology Program began in the 1970s and is the longest tenured meteorology program in the state of Illinois. In fact, NIU is the only meteorology degree granting institution in Illinois north of Interstate-80. The program attracts students from various backgrounds wishing to study meteorology, with the personal attention only available in class sizes of less than 20. The department has four full-time meteorology faculty that all teach and perform research as a part of NIU's mission. In addition, many faculty members in the department involve undergraduates in their respective research projects.

NIU Meteorology has been a **leader in the dissemination of meteorological data since the late 1990s** due to the extraordinary efforts of the 2010 Russell L DeSouza Award winner, Mr. Gilbert Sebenste. As a result of Mr. Sebenste's efforts to create 'NIU Weather' (http://weather.niu.edu), several students have gone on to successful careers in atmospheric and related sciences due to his guidance, instruction, and knowledge of Unidata tools/software. In fact, the PI first learned

GEMPAK from Mr. Sebenste in the early 2000s and still heavily uses the software to this day. With Mr. Sebenste leaving the University in 2017, NIU Weather (weather.niu.edu) was taken offline. His departure was an undoubtably sad day for the NIU and Unidata communities. While we consider this a major loss for our program, it also opens the possibilities for new ideas about how the NIU Meteorology program can serve its students through teaching and research, in addition to serving the geoscience community at large.

ii. Serving students and the community

The proposed server will be **available to all courses and student research projects** in the department in order to maximize the potential benefit. For example, recent research projects in the department have focused on machine learning as a methodology for applied climatological studies. Had students not have had access to the PI's current research server (purchased through the PI's start-up funds), these projects would likely not have been possible. NIU meteorology has had a long history of applied climatological research and this Unidata equipment grant and purchase of a new server would allow this type of research to continue on the ever-growing number and size of geoscience datasets.

The NIU meteorology curriculum uses various Unidata software packages (GEMPAK, LDM, IDV, MetPy, netCDF, THREDDS) that help students obtain a greater **understanding of meteorological processes through data visualization**. These Unidata software packages have been the cornerstone of the PI's current research and teaching server (http://atlas.niu.edu) through shell scripting and web-facing map portals. However, this server is now nearly saturated with processing and we will soon be unable to support any more load from additional students or class projects due to the constant real-time processing of geoscience data (including real-time data from GOES-16 and 17). This proposal would shift all the real-time data processing and LDM relay processes to a new server (http://weather.niu.edu) to serve as the online face of our geoscience data display and acquisition.

Additionally, this equipment grant would allow for **the permanent hosting of the PI's archive of NARR data** via a THREDDS server (e.g., http://weather.niu.edu/narr) that several Unidata community members are beta testing. As a result of this shift, the PI's current atlas server would become the primary resource for department teaching and research as a Jupyter Notebook server. A pilot test of this project is being implemented this semester in a research course (GEOG 790; Research topics in climatology) and students have really enjoyed the portability, sharing, and workflows associated with these research notebooks. Their only complaint to date is that processes sometimes run "slow" because of all the processing from other students and projects running on the server.

iii. Importance of this project

This proposal uniquely addresses Unidata's 2019 call for proposals by highlighting the data proximate analysis of large datasets (i.e., GOES-16/17) and projects that **aid in the instruction of machine learning techniques** on weather/climate data. For example, the computing behind two recent publications to AMS journals on machine learning for purposes of classifying mesoscale convective systems was performed on the PI's atlas.niu.edu server through use of a Jupyter Notebook server. Students enjoy the fact that they do not have to worry about downloading or installing Python software or libraries. They can simply open a web-browser, enter a username/password, and be online coding and performing data analysis in seconds. This greatly reduces the **time to science**, which is an important aspect of today's research environment.

In addition to the Jupyter Notebook server, the current **Synoptic Meteorology Mapwall** is a favorite among meteorology students because of its displays of GOES-16 satellite imagery (Figure 1). Students often interact with the data by downloading the imagery and performing subjective analysis or sharing the imagery with friends/colleagues on social media. This helps spread the word about Unidata and its importance in the geoscience community.

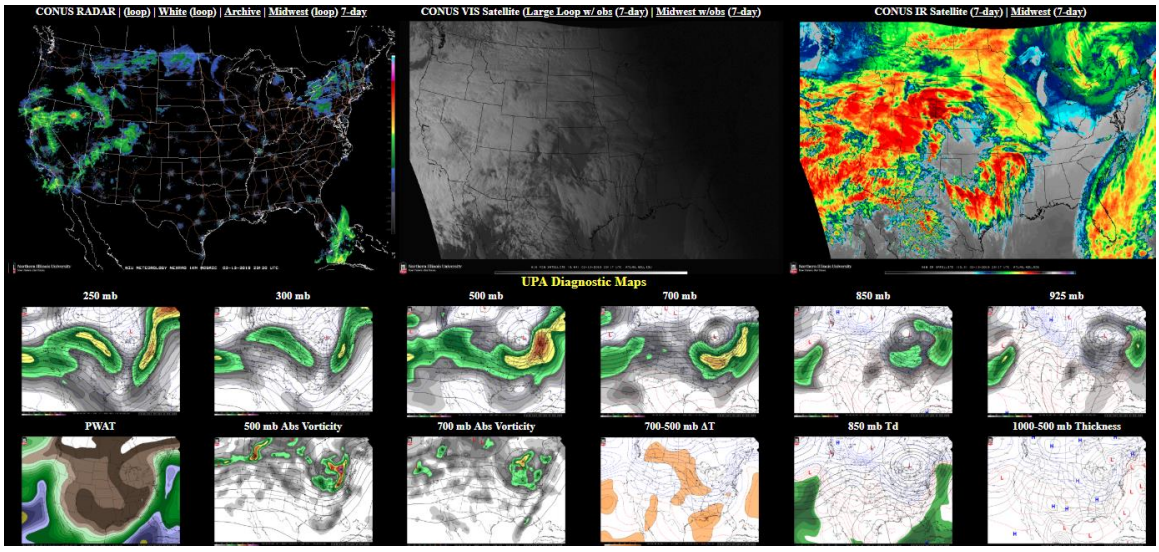


Figure 1. Example of the GEMPAK "Map Wall" portal for Synoptic Meteorology courses
http://atlas.niu.edu/mapwall

To continue serving this data to NIU students (and to the geoscience community at large), along with adding new datasets (GOES-17; GFS-FV3; NARR archive) and meteorological analysis plots, we will need a new physical server. The PI and department have examined the feasibility of a cloud-based system for the instruction/research component of our department (Jupyter Notebook activities). Through some simple testing and estimation, it was deemed that these teaching and research activities, in just three-years' time, would exceed the cost of a physical server purchase. Given the expected lifetime of today's servers, we feel it would be in the most cost-effective interest to purchase a physical server to attach to the PI's current atlas.niu.edu server. The PI has been responsible for the

setup/installation/maintenance of the atlas server (including LDM) and will also oversee the proposed http://weather.niu.edu server.

D. BUDGET

NIU Meteorology proposes the purchase of a Puget ASUS Sage Server and 256 GB of memory, based on current specifications of the PI's atlas server and the estimation of the need to have a server that will last well into the future. While no minimum specification was suggested, we feel that this particular model will optimize cost and efficiency, while providing a high-end performance server capable of meeting the unique needs of NIU Meteorology program. The total cost of the server system is $19,456.17 (see attached quote). Full time faculty and staff time is covered by Northern Illinois University. While NIU will not provide direct matching funds toward the purchase of the proposed equipment herein (in this instance), NIU has recently decided to renovate the meteorology laboratory in support of the mission of the Department.

i. Itemized budget request

Puget ASUS WC Sage Server

- ✓ 2 Eighteen-Core Intel Xeon 2.3 GHz processors
- ✓ 2 x Intel Optane 905P 960GB PCIe SSD
- ✓ LSI 9361-24i SAS/SATA RAID Controller
- ✓ 8 x Western Digital Ultrastar 12TB SATA3
- ✓ Crucial 256GB DDR4-2666 REG ECC (4x64GB)
- ✓ Intel Quad Port Ethernet Server Adapter I350-T4
- ✓ EVGA SuperNOVA 1200W P2 Power Supply

COST: **$19,456.17 based on recent attached quotes**

TOTAL AMOUNT REQUESTED: **$19,456.17**

E. PROJECT MILESTONES

Vendor quotes have already been obtained, which will allow for immediate placement of purchase in late May or early June 2019. This will allow for project PI Gensini and NIU IT staff to install equipment early in the summer semester while campus activity is at a minimum.

(Assuming the this proposal was funded by 1 June 2019)

Date	Task
1 Jun 2019	▪ Purchase of the new dedicated weather.niu.edu server
1 Jul 2019	▪ Delivery and installation of the new server begins
1 August 2019	▪ Providing data to students and community members for years to come

https://www.pugetsystems.com
Puget Sound Systems Inc, Tax ID #20-0056154
2707 West Valley Highway N | Auburn, WA 98001
(425) 458-0273 phone | (425) 484-6208 fax

QUOTE

Quote Date: 02/07/19
Rep: Jeff
Print Date: 02/20/19
Invoice # 000187209
P.O. #

Bill to:

Ship to:

Northern Illinois University
Victor Gensini
43W545 Scott Rd.
Sugar Grove, IL 60554
815 303 2381
Fax: 815 303 2381

unidata

Item	Category
Asus WS C422 SAGE/10G	Motherboard
Intel Xeon W-2195 2.3GHz 18 Core 24.75MB 140W	CPU
4 x Crucial DDR4-2666 64GB ECC Reg. LRDIMM	Ram
PNY Quadro P1000 PCI-E 4GB	Video Card
LSI 9361-8i SAS/SATA RAID Controller	Controllers
Intel Quad Port Ethernet Server Adapter I350-T4	Networking
2 x Intel Optane 905P 960GB PCIe SSD **Additional Information:** Primary drive. RAID 1	Hard Drive
8 x Western Digital Ultrastar 12TB SATA3 **Additional Information:** Secondary drive. RAID 5	Hard Drive
In Win R400-01N 8P 4U Rackmount Case	Case
EVGA SuperNOVA 1200W P2 Power Supply	Power Supply
Dynatron R17 CPU Cooler (2011)	CPU Cooling
CentOS 7 Installation (64-bit) [LIMITED SUPPORT]	Operating System
In Win SR1-23N Rackmount Rails (for 24-36-inch post spacing)	Accessories
LSI CacheVault for LSI 9361/9380 Series (LSICVM02)	Accessories
Intel VROC Upgrade Key (Standard)	Accessories
iStarUSA 4-Hard Drive Hot Swap Rack	Accessories
Motherboard header USB 3.0 20pin female to USB 2.0 9Pin male cable 10cm	Cables and Adapters
Warranty: Lifetime Labor and Tech Support, 3 Year Parts	Warranty

Customer Notes: Intended Use: Similar to last purchase...meteorological data server
Budget: $20,000

These commodities, technology, or software are subject to the United States Export Administration Regulations. Diversion contrary to U.S. law is prohibited.This quote is based upon the acceptance of the Terms and Conditions found at pugetsystems.com/terms

Due to the custom nature of every order, payment or an approved purchase order is required upon placement of your order. Please pay from this invoice. A receipt of your payment will be included with your delivery.

Subtotal: $19456.17
Shipping: unselected
Tax: $0.00
Total: $19456.17 + shipping
Payment Received: $0.00
Balance Due: $19456.17 + shipping

Please remit payment to: Puget Systems
2707 West Valley Highway N
Auburn, WA 98001