

Coordinated Mesoscale Measurements in Mississippi (CM³) with CSWR DOW 2011

Final Report (PI: Loren White)

Submitted: October 20, 2011

1. Overview and Planning

The Doppler-on-Wheels (DOW) was on-site at Jackson State University (JSU) during February 20-March 9. The plan was for the DOW to complement surface observations during an intensive 3-week measurement campaign known as Coordinated Mesoscale Measurements in Mississippi (CM³), which would be centered around the Ross Barnett Reservoir near JSU. Unfortunately the flux station operated by JSU in the middle of the reservoir stopped reporting on 22 February and it was not possible to make repairs during the period of CM³. However, stored flux station data for the period were later retrieved when the station was repaired. Additional portable mesonet stations were planned for deployment at shoreline sites, but were not implemented due to logistical/scheduling challenges. The DOW was deployed at four sites around the reservoir under various boundary layer wind and stability regimes. There was an unexpected opportunity on 24 February to observe a severe squall line environment in coordination with CSWR staff in the vicinity of Marks, MS. Funding of the NOAA Center for Atmospheric Studies (NCAS) by the NOAA Educational Partnership Program (EPP) made possible the non-DOW components of CM³, as well as release time for the PI and other JSU faculty participants.

Project goals for using the DOW in CM³ addressed unique opportunities for training, outreach, and research at JSU. As an undergraduate program, the JSU Meteorology Program would not otherwise have the opportunity to provide students with hands-on training in operating a weather radar and processing the data. The DOW also complemented efforts to expose students to the planning and logistics of scientific field research. The DOW also provided a good attraction for community outreach and helping to promote the JSU Meteorology Program. Although all components did not work as planned, the ability to obtain high-resolution Doppler wind profiles in the vicinity of Ross Barnett Reservoir will complement research relating to turbulent fluxes under heterogeneous and non-steady conditions.

2. Training and University Outreach

A new mesoscale meteorology course (MET 435) was taught for juniors and seniors during the Spring 2011 semester. The course was designed to incorporate the DOW deployment. The course was taught by the PI and was taken by three students. Shortly after arrival of the DOW, CSWR staff spoke during one formal session of the class as

well as to a dynamic meteorology class (MET 341). Students in both MET 435 and the Research Methods (MET 472) course discussed field operations planning for different potential applications of the DOW and logistical concerns for the CM³ intensive observing campaigns.

On February 22-23, training was conducted by CSWR staff for operation of the DOW, using a site in a large parking lot on the JSU campus. About 10 undergraduate students were trained, one or two at a time, staggered in two-hour time slots. The PI, three other faculty/staff, and an advanced high school student were also trained. On March 4, a short training session was also conducted by Dr. Kosiba on postprocessing of the DOW data using the “solo ii” software. Three undergraduate students, the PI, and one research associate participated.



[JSU undergraduate meteorology students John Moore and Gabriel Houston next to the DOW, with CSWR staff Justin Walker and Andrew Arnold.]



[JSU undergraduate meteorology student Jarrett Claiborne being trained inside DOW.]



[CSWR Doppler-on-Wheels at Jackson State University]

3. Community Outreach

Although we were unable to coordinate outreach activities with some envisioned partners, there were public events organized at three different venues. The largest of these was at Brandon High School (Brandon, MS). Dr. Kosiba worked with Brandon High

School senior Vincent Webb to discuss and show the DOW to almost all of the science classes in the school on March 4. It is estimated that over 1000 students were impacted. Vincent Webb has participated previously in the NCAS High School Weather Camp, is a trained storm chaser, and participated in the DOW operations and training.

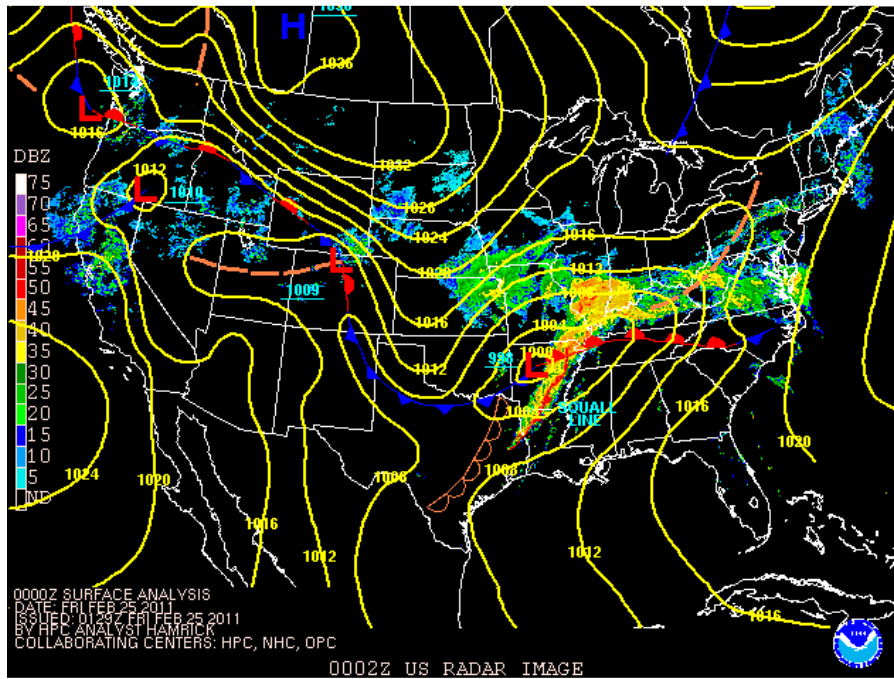
On the JSU campus, Dr. Kosiba spoke to a public seminar in Just Science Hall. There were about 30 faculty, staff, and students in attendance, including the interim provost of the university. Light refreshments and an opportunity to view the DOW followed the seminar. In the evening, the DOW was exhibited for the public and local media at the Madison Landing boat ramp on Ross Barnett Reservoir (Ridgeland, MS). At least three television stations filmed footage and interviews with Dr. Kosiba. This was then followed by a dinner meeting of the local AMS/NWA chapter at the Cock of the Walk restaurant, immediately adjacent to the boat ramp. Dr. Kosiba presented a very well-received talk about tornado and hurricane research with the DOW to an overflowing room of about 30 people, representing the NWS WFO, JSU, and local television stations.

4. Field Implementation

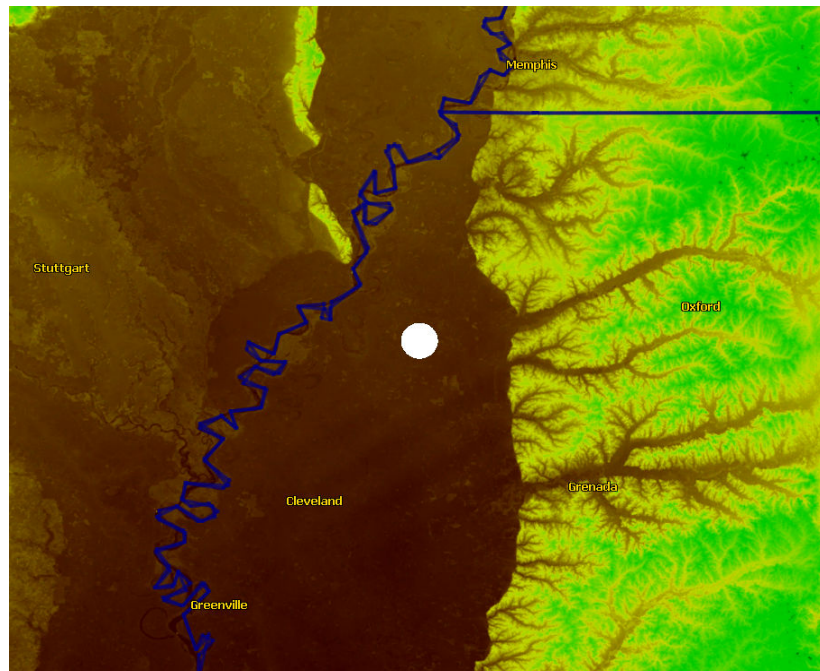
On February 24, the Storm Prediction Center forecasted a moderate risk for tornadoes, in association with a warm front and prefrontal squall line. Around 1700 UTC after consultation with CSWR staff, the decision was made to take the DOW to Quitman County (near Marks; 230 km north of JSU), in the northern Mississippi Delta. There was strong southerly flow (greater than 20 kt at the surface) in the low levels and plentiful moisture, although the more favorable conditions for tornadogenesis were farther to the north. Upon arrival at an open site near Marks, MS, a tornado was reported near Jackson, TN (200 km farther north). Other unverified tornado warnings were issued for locations in MS, TN, AR, and LA.



[DOW on site near Marks, MS]

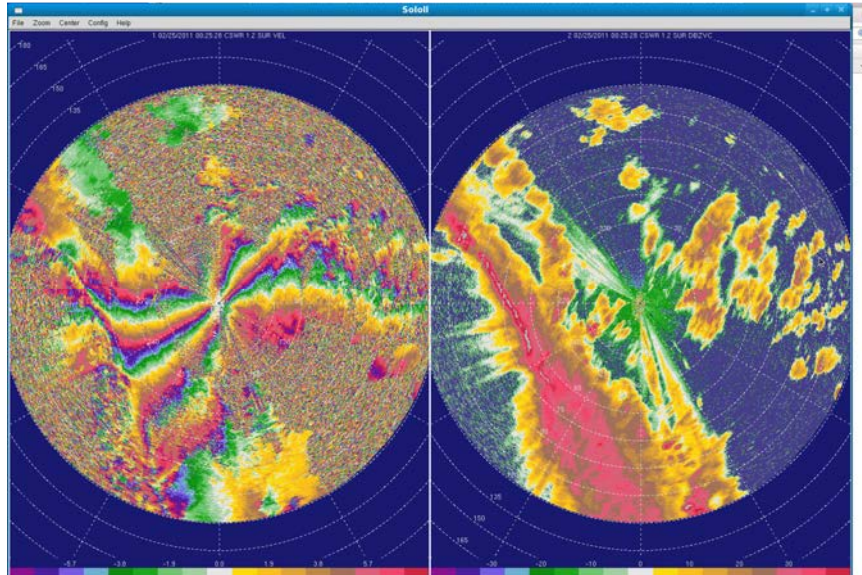


[Surface synoptic chart during severe storm event]

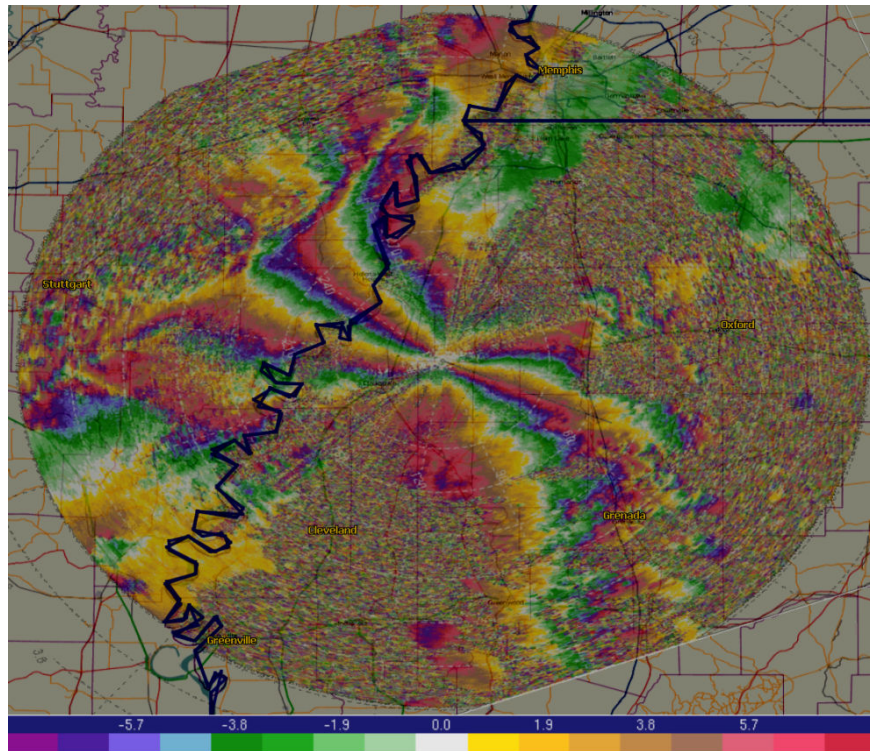


[Digital elevation map of showing site of DOW deployment at Marks, MS]

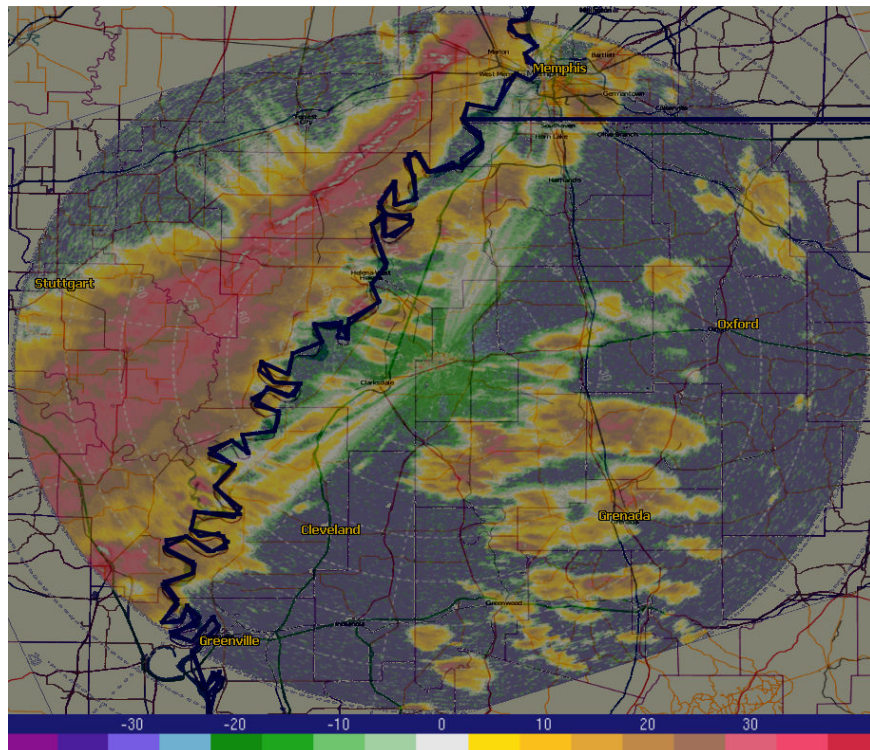
Radar data were collected from 2221 to 0125 UTC, initially in clear air mode and then in precipitation mode as the primary squall line got close to the DOW. Approximately 10 undergraduate students went along and took turns in the DOW, together with the two CSWR staff, the PI, two JSU staff, and high school student Vincent Webb (who also brought the City of Brandon storm chase vehicle).



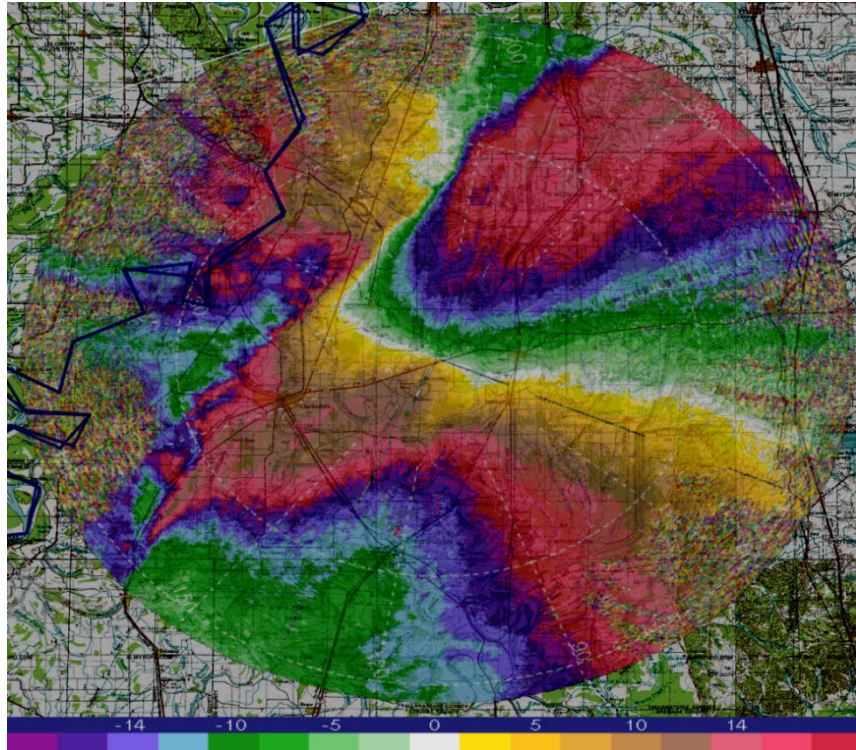
[DOW-relative velocity and reflectivity data in clear air mode at 0025 UTC from 0.5° elevation surveillance scan (8 m/s Nyquist folding)]



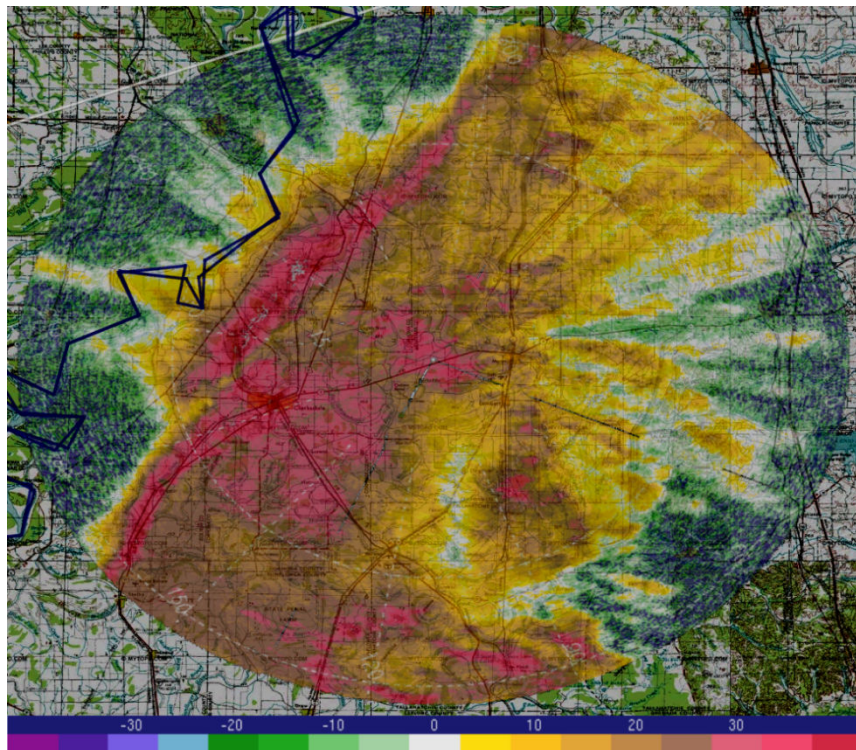
[Velocity data rotated and projected on map]



[Reflectivity data rotated and projected on map]



[Velocity display in precip mode at 0124Z (20 m/s Nyquist folding)]

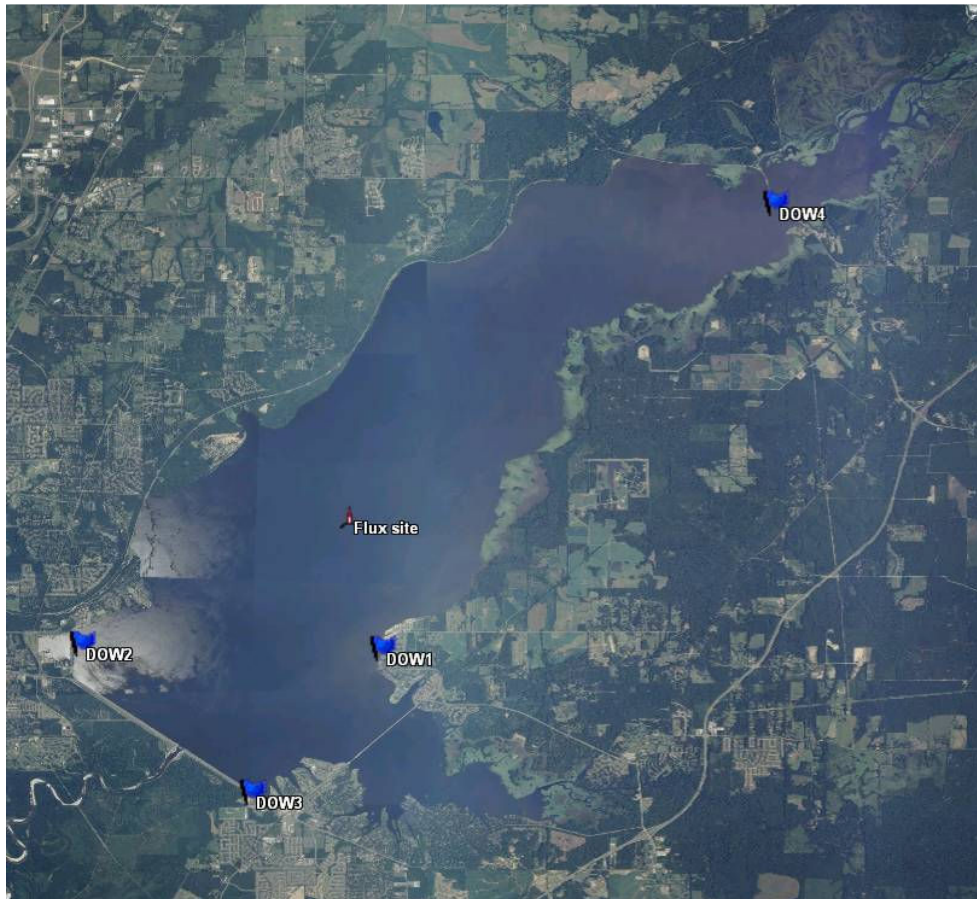


[Reflectivity display in precip mode at 0124Z]

It was decided to leave before the squall line arrival due to both the risk of damage by hail and the risk of undetected tornadoes due to attenuation in heavy rain and lack of NEXRAD coverage. During the return trip to JSU, EF1 and EF2 tornadoes hit in the southern Delta of LA and MS.

Although other responsibilities have delayed complete post-processing and analysis of the data, a few scans were taken from solo ii, rotated, and overlaid geographically using Topofusion Pro software. Data from the event were highlighted in a poster presentation given by an undergraduate JSU student at the NOAA Educational Partnership Program (EPP) Cooperative Science Centers (CSC) Spring Meeting in Silver Spring, MD.

In the focus area of CM³ around Ross Barnett Reservoir, the DOW was operated on five different days (detailed in the Timeline below). The primary goals were to document transition of boundary layer wind structure in the vicinity of the reservoir under different wind and stability regimes. One day also had numerous heavy rain showers, which produced a tornado a few hours later (after midnight) about 50 km to the southwest. Surface observations from the mid-reservoir flux site were not available in real time due to a communication problem, and the planned deployment of portable mesonet stations along the shorelines did not occur due to logistical limitations.



[Doppler-on-Wheels deployments sites in relation to reservoir flux station]

5. Evaluation and Recommendations

It was definitely helpful to begin the planning process several months ahead. The proposal process was fairly simple, although a little unclear at times. Internal to JSU, there was some uncertainty where to keep the DOW on campus. Fortunately however the campus police were quite helpful in identifying an area that we could use for the full period of the deployment, as well as a site next to Just Science Hall that we could get into for display following the public seminar. The assistance of Andrew Arnold was crucial for identifying safe travel routes for the DOW and suitable deployment sites, with trees being a common concern.

The most challenging components were involved with scheduling of outreach activities. Although the PI contacted a wide variety of K-12 schools, other universities, other academic departments, and city officials, it was frustratingly difficult to get outreach events scheduled and to get field involvement by anyone other than JSU meteorology students. Scheduling and promotion were also complicated by not knowing who would come from CSWR to speak (or when) until only a few days before.

Although the enrollment was smaller than hoped for, the mesoscale meteorology course was a significant enhancement to the JSU curriculum that had been envisioned for a long time and that clearly benefited from the DOW. Justin Walker did a very good job with the hands-on training sessions. At the high school, with media, and at the AMS/NWA chapter meeting, Dr. Kosiba also was very well received in her presentations and interactions. Unfortunately the solo ii training was somewhat rushed (partly due to the PI's schedule) and would have benefited from better written documentation. It would also have been helpful to have more information on how to program complex scan patterns. Another problem was with respect to the non-radar data from the DOW. Although we tried to stress that we wanted the data (partly to help with unfolding the Doppler velocities), they were still overwritten without being archived. There were a few technical problems with the DOW systems that presented minor challenges. All participants were also thankful not to experience the non-air conditioned cab of the DOW during the heat of summer.

It proved quite challenging to balance DOW operations with classes, student schedules, and other responsibilities. The PI in particular had unexpected time demands during the period associated with a critical stage of a faculty search process. Although not part of the plans, the opportunity presented by the February 24 severe storm event was quite fortuitous in many ways and was clearly a very positive experience for the students (at all academic levels). The plans for CM³ around Ross Barnett Reservoir were complicated by scheduling problems (especially for students), the communications problems of the flux station, and failure to deploy the portable mesonet stations, all of which of course were JSU problems. Unfortunately, scheduling prevented getting the DOW out for operations during any significant cold front passages, although there were still some interesting wind profiles associated with evening boundary layer transition and investigating anecdotal reports of wind reversals across the reservoir.

In the future, there are hopes of more fully instrumenting for CM³ with surface mesonet stations, and possibly even use of a lidar or ceilometer to assist with boundary layer profiling. We also need to make sure that the DOW data already collected all get processed. There are tentative discussions about requesting the DOW for sometime in the late fall of 2012, since Mississippi is one of the few areas to have a secondary maximum of severe and tornadic weather in November and December. It would be great if one or two JSU faculty or students who now have experience with the DOW could accompany CSWR staff during part of a future non-educational field campaign (similar to Vortex 2). At some point in the future, it would be desirable for PIs from the various educational DOW deployments to interact with each other in a conference or workshop. This might be arranged as a session at an AMS/NWA conference or specially scheduled at CSWR.

6. Timeline

- Feb. 20: DOW arrival at JSU (with Justin Walker and Andrew Arnold)
- Feb. 21: Presentations to undergraduate classes
- Feb. 22-23: Student training (2 hr slots) at JSU (32 18' N, 90 13' W)
- Feb. 24: Storm chasing with JSU faculty/staff/students in MS Delta (Marks, MS; 34 15' N, 90 23' W)
- Feb. 25: Justin Walker departure
Scouting of DOW sites at Ross Barnett Reservoir with Andrew Arnold
- Feb. 27: Andrew Arnold departure
- March 1: Fair weather daytime deployment at Fannin Landing (DOW1; 32 25' N, 90 01' W)
- March 2: Fair weather evening boundary layer transition at Red Dot Rd. (DOW2; 32 25' N, 90 05' W)
- March 3: 9:30 Public seminar on JSU campus by Dr. Karen Kosiba
11:00 Software training of JSU students by Dr. Kosiba
4:00 DOW for public/media viewing at Madison Landing (Ridgeland, MS; 32 26' N, 90 05' W)
6:00 Dr. Kosiba at Central MS AMS/NWA chapter meeting at Cock of the Walk (Ridgeland, MS; 32 26' N, 90 05' W)
- March 4: 8:30-12:00 Outreach with Dr. Kosiba at Brandon High School (Brandon, MS; 32 14' N, 89 59' W)
Solo ii training on JSU campus by Dr. Kosiba
- March 5: Post-frontal strong winds deployment at Rankin Landing (DOW3; 32 23' N, 90 03' W)
- March 7: Heavy rain evening deployment at MS 43 causeway (DOW4; 32 31' N, 89 56' W)
- March 9: Weak passive cold front passage in morning at Fannin Landing (DOW1; 32 25' N, 90 01' W)
Hand-off of DOW to CSWR driver

7. References

Moore, J., D. Canales, L. White, and D. Lu, 2011: A severe storm environment in the northern Mississippi Delta as observed by the CSWR Doppler-on-Wheels mobile radar. Poster presented at NOAA Educational Partnership Program (EPP) Cooperative Science Centers (CSC) Spring Meeting, Silver Spring, MD, March 24, 2011.

8. Appendices

From NWS WFO website:

NWS Jackson, MS

http://www.srh.noaa.gov/jan/?n=local_ams_meeting

National Weather Service Weather Forecast Office Jackson, MS

Central Mississippi Chapter of the AMS/NWA

The Central Mississippi Chapter of the American Meteorological Society(AMS) and National Weather Association(NWA) is having their next meeting this Thursday, March 3, 2011. Information for the meeting follows:

- When: Thursday March 3, 2011 at 6pm. Tours of the DOW will be from 4-6pm
- Where: Cock of the Walk Restaurant. This is located at the Reservoir. See the map below for the location

The Chapter is proud to host Dr. Karen Kosiba, a Senior Scientist from the Center for Severe Weather Research in Boulder, CO. She will be showcasing the Doppler-on-Wheels and will be presenting information related to the research being conducted with this technology. Tours and talks related to the DOW will be conducted in the parking lot of Cock of the Walk from 4-6pm. We hope to see you there!

Click for more information about the [Center for Severe Weather Research](#) and for information about the [Doppler on Wheels program](#)



[View AMS meeting in a larger map](#)

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University Communications

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March 1, 2011**

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Jackson State University Meteorology students pose with the Center for Severe Weather Research's Doppler-on-Wheels, which will be at JSU through March 11

Press Release:

Doppler-on-Wheels at Jackson State University

The Jackson State University Meteorology Program is hosting the Center for Severe Weather Research's Doppler-on-Wheels (DOW) from February 21 through March 11. The DOW is a completely mobile Doppler radar that has made headlines for its groundbreaking up-close measurements of wind circulations within tornadoes and hurricanes. It is operated by the Center for Severe Weather Research (Boulder, CO) with funding from the National Science Foundation.

Besides training JSU meteorology students, research data will be collected as part of a larger long-term observing effort known as "Coordinated Mesoscale Measurements in Mississippi" (CM3), focused around the vicinity of Ross Barnett Reservoir. During the second week of the deployment, there will be outreach opportunities for the public to see and learn about the DOW. To mark the 45th anniversary of the F5 tornado which destroyed the Candlestick Park area of South Jackson March 3, 1966, there will be talks and public viewing on the JSU campus and at the meeting of the Central Mississippi chapter of the American Meteorological Society and National Weather Association.

Depending on meteorological conditions, we hope to use the DOW for observing small-scale effects of the reservoir and local surface features on the near-surface wind field during severe thunderstorms, bore-like frontal passages, strong gradient winds, and fog dissipation.

Please contact Dr. Loren White if interested in participating in any way during this opportunity.

White is an associate professor and coordinator of the meteorology program at JSU. He also serves as president of the Central Mississippi chapter of the American Meteorological Society. He can be contacted at Loren.D.White@jsums.edu or 601-979-3635.