



Visualization of Karst Field Data

June 11-16, 2018

GEOG 475, GEOL 475, and GEOS 510

Course Instructors: Dr. Pat Kambesis and
Mr. Howard Kalnitz

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Course Description and Objectives: Data collected from cave survey are typically used to generate line plots and digitally rendered maps of caves, with GPS entrance locations used to georeference lines plots and maps. However, there is so much more that can be done with existing cave data and maps and with some additionally collected data during cave survey and entrance field work. This course will explore various methods to derive more understanding and visualization of cave and karst field data. The course will review current data reduction programs, geophysical methods, use of cave radio-location techniques and various methods, formats and software used to georeferenced cave data and render cave plots and maps. Students will be instructed in the basic understanding and use of geographical information systems (including the ArcGIS software suite). Instruction will also cover efficient development and use of data management systems, cave inventories and databases, and 3-dimensional analysis and rendering of cave/karst data. The course format will include a combination of in-class instruction, field demonstrations, and instruction in cave/karst data collection. Students should be prepared to spend 2-4 hours a day underground though no special skills are required. A general understanding of cave or field data collection techniques is helpful but not required. Students will be expected to have their own laptops, but software used for this course will be provided for each student. The course is available as a workshop, or for academic credit (either undergraduate or graduate). For those taking the course for academic credit, a database or cave/karst rendering project will be required with final project submission required by August 1 following the course.

Required Text:

- Manual of course material, reports, and articles covered in class to be provided by WKU at the start of the course.
- **Students are expected to have their own laptops.** Software and other resources will be provided by the program.

Equipment and Supply List:

Note, to avoid potential transmission of white-nose syndrome to bats in the cave, the Park Service requires that clothes and equipment used in one part of Mammoth Cave be thoroughly cleaned before being used in another part. A disinfectant will be available to treat helmets and equipment, but for cave clothes it is easier to change to fresh items kept in a separate sealed plastic bag. White-nose syndrome has been identified in Mammoth Cave National Park, but it is still necessary to follow these precautions. WNS, caused by a fungus, is fatal to hibernating bats but does not affect humans. For details, visit www.caves.org and click on WNS.

1. **Laptop**
2. **Helmet** (for caving trips) with non-elastic chin strap, quick-release buckle, and three- or four-point suspension. The helmet should stay on during a fall but be easily released if it should become wedged. The helmet will also be the mounting point for your primary light source, so any accommodation for attaching a headlamp is a plus.
3. **Two (2) lights that can be helmet mounted.** REI or other outdoor outfitters carry suitable lights for caving. Bring extra batteries.
4. **Flashlight** with extra batteries and extra bulb (ex. Mini-Maglite)
5. **Sturdy boots with non-skid soles** (comfortable, hiking, water resistant is good).
6. **Caving coveralls are ideal, but a suitable alternative is rugged clothing** that can withstand outdoor activity. These include comfortable pants or jeans that you can afford to get dirty. To keep you warm in the 56° F, almost 100% humidity, underground environment you'll need to dress in layers. It is strongly advised that you have a thermal layer top (polypro or equivalent) and a bottom. If you are not using coveralls, then a long-sleeve shirt is strongly recommended. You will be underground most days, so be prepared with some clean changes of clothes. There will not be enough time to do laundry each day.
7. **Gloves** (garden type is ok, to protect hands and for gripping)
8. **Knee pads** (These are very helpful in protecting your knees). Basketball or other athletic-type knee pads are good.
9. **Small to moderate size day-pack** to hold batteries, jacket, clothing, supplies. A large backpack will be too bulky for narrow cave passages.
10. **Water Bottle** (fill before going on trips, to keep hydrated)
11. **Snack foods suitable for long underground hiking trips**— such as granola-type bars, small cans of fruit, dried fruit, trail mixes, beef or other jerky – similar to what you would take on a long day hike on the surface.
12. **Rain Gear** (layers of clothing for severe weather, umbrella, rain jacket, etc.)
13. Food if you are staying at Hamilton Valley Facility, which has a fully equipped kitchen, showers and restrooms.
14. Bedding (If staying at Hamilton Valley -sleeping bag or sheet or blanket, pillow). Hamilton Valley has 10 rooms with 4 bunks each.
15. Toiletries and Towels (If staying at HV—Towels, toothbrush, toothpaste, shampoo, etc).

Attendance: Students are expected to participate in all classes and field trips, except under special conditions (e.g., health). Field trips involve easy to moderately challenging caving. In the

rare circumstance that students are unable to fulfill the field requirements they will be invited to drop the course. In general the rigor of the trips are adjusted to the abilities of the class. **All participants will receive a Certificate of Participation on the last day of the class for their full participation in the class. This does not constitute the final grade for those taking the course for academic credit.**

Grading: Courses can be taken as non-credit workshops, Undergraduate and Graduate credit, or for Continuing Education Units. For those taking the course for academic credit, a report on an independent project is required. Students will need to remain in contact with the instructor for guidance. Deadline for written reports is August 1 of year of course. Project grading is based on the insight and quality of work demonstrated, with some accommodation for those with limited background.

Grade Scale (based mainly on project, but weighted according to participation in class):

A = equivalent to the finest work that is expected of a student at this level

B = good work, but with a few flaws in procedure and interpretation

C = average work

D = poor work, sloppy presentation

F = no redeeming features, or failure to turn in project by deadline

General Class Conduct and Policies: During class periods, cell phones should be turned off and smoking is not allowed. While in cave, safety and conservation are primary concerns. We will move slowly and carefully to minimize danger and impact on the cave. On the surface, especially in the National Park, it is essential to drive carefully and to obey the speed limit. Beware of snakes, ticks, chiggers, and poison ivy. ** Cell phones should be turned off during class! ** Please treat your colleagues and their desire to learn with appropriate respect.

ADA Statement: Students with disabilities who require accommodations (academic adjustments and/or auxiliary aids or services) for this course must contact the Director of the Karst Field Studies Program, Dr. Leslie North at leslie.north@wku.edu or (270) 745-5982 so proper accommodations can be considered and made as necessary.

Schedule Change Policy: The Department of Geography and Geology strictly adheres to University policies regarding schedule changes. It is the responsibility of the student to meet all admissions deadlines. Only in exceptional cases will a deadline be waived (you will be required to fill out an appeal form). The form requires a written description of the extenuating circumstances involved and the attachment of appropriate documentation. Poor academic performance, general malaise, or undocumented general stress factors are not considered as legitimate circumstances.

Tentative Class Schedule/Agenda

Subject to Change

Sunday: June 10, 2018

7:30pm Sign in and class orientation

Monday: June 11, 2018

8:30am-Noon

Types of karst field data and what to do with it
Compass/DistoX calibrations – importance and procedures
Field exercise in compass/distoX calibrations

12:00-1:00pm

Lunch Break

1:00-5:00pm

Data reduction software (Compass, Walls, Survex, Cavewhere, Breakout)
Data structures, data archiving

5:00-6:30pm

Dinner Break

6:30-8:30pm

Quality control: Blunder detection and loop closures
In-class exercise on blunder detection

Tuesday: June 12, 2018

8:30am-Noon

Portraying Cave survey data and other resource data onto various map resources

- Arial photos (including Google earth)
- Topomaps
- Geotopo Maps
- Dyetrace maps

Noon-1:00pm

Lunch Break

1:00-5:00pm

Field exercise: Collecting field data for overlays
Introduction to Cave Radio location

5:00-6:30pm

Dinner Break

6:30-8:30pm

Plotting data from field exercise

Wednesday, June 13, 2018

8:30am-Noon

Georeferencing caves with cave radios
Understanding coordinate systems
Determining and using magnetic declination
Field exercise- using cave radio

Noon-1:00pm

Lunch Break

1:00-5:00pm

Processing and plotting of cave radio-location data
Introduction to GIS for karst/cave data (ArcGIS products, GoogleEarth, other resources from
Compass, Walls, Survex, Cavewhere, Breakout

5:00-6:30

Dinner Break

6:30-8:30pm

Generating shapefiles for GIS
Cave entrance and passage plotting exercises

Thursday, June 14, 2018

8:30am-Noon

Cave inventories and databases
Use of CaveBase (a Compass extension)
Attribute tables in Arcview, Arcmap, ArcPro?
Geodatabases in GIS

Noon-1:00-pm

Lunch Break

1:00-5:00pm

Field exercise – collecting cave inventory data

5:00-6:30pm

Dinner Break

6:30-8:30pm

Data entry for inventory data collected in field exercise
Plotting of inventory data using COMPASS, ArcGIS

Friday, June 15, 2018

8:30am-Noon

Introduction to Three -dimensional rendering and analysis cave/karst data
Field exercise for collecting 3-D data, Geophysical data collection demonstration

Noon-1:00pm

Lunch Break

1:00-5:00pm

Generating cave passage models
Introduction to ArcScene

Saturday: June 16, 2018

8:30am-Noon

Methods for cave/karst feature morphometric analysis
Cave XO 3D passage viewer (Compass)
Two and 3D Rose diagrams

Noon-until completed

Instructor meeting with students taking class for credit and instructors