**Geological Sciences (GEOL) 505: Imaging and GIS in Disaster Response**  
**Spring Semester 2016**  
**SDSU Schedule Number: 21646**  
**COURSE INFORMATION**

**Professors:** Eric G. Frost and Alma Beatriz Navarro Cerda  
**Class Times:** 4:00 PM-6:40 PM (lecture and general lab time)  
**Class Location:** CSL 422 for lecture for first class, UABC in Otay for remainder of classes  
**Office Hours Days:** Thurs. 2-3 PM, 7-8 PM  
Office Hours also by appointment at other times  
**Web page for the Viz Center:** [http://vizcenter.sdsu.edu](http://vizcenter.sdsu.edu)

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**Course Overview**

The purpose and scope of this class are to expose the students to a broad array of Disaster Response problems and opportunities for a range of solutions. By focusing the class on real events and particularly on real natural disasters if they occur during the semester, it is possible to demonstrate both fruitful approaches and solutions. The class is thus meant as a mentorship toward being able to actually help during a global disaster. As such, the quality of the assignments, the means of solving problems, and the relationship to others in the class all working as a team are vitally important to learn how Disaster Response is done. Hopefully a major outcome of the class will be that you have a profoundly better sensitivity to what can and should be done and an interest in actually helping with some of the tools and insights from this class.

This class is also unique in combining students and faculty from UABC ([http://www.tij.uabc.mx/campus/index.php](http://www.tij.uabc.mx/campus/index.php)) and SDSU ([http://www.sdsu.edu](http://www.sdsu.edu)) as well as informally involving students and Viz Center friends and Adjunct Faculty in several other countries. Students from SDSU will travel to UABC for the classes and hopefully some classes will also be done at SDSU as well as linking collaboratively from both campuses, from the field, and from disaster areas in other parts of the world like Nepal, Somalia, Latin America, and Indonesia. By collaborating between two universities in two countries, we will be also championing a new “Border University” vision that can reach out to other regions to take advantage of the wonderful blessing of living in the border community and understanding border concerns and opportunities. The largest single group of students in the class will be Homeland Security graduate students ([http://homelandsecurity.sdsu.edu](http://homelandsecurity.sdsu.edu)), where this class is a non-HSEC elective. However because most of the students have no background in Geology, the only prerequisite for the class is interest and motivation to learn. Most Geology students don’t have a background in Remote Sensing or Emergency Management or Disaster Response, so everyone is really learning and developing skills using their existing abilities.

- Specific topics to be addressed during the class include an overall background to remote sensing and GIS, types of imagery and processing, ways of acquiring imagery and using it, and collaboration tools and linkages to the field as generally done in global disaster responses.
- Topics will primarily be focused on what is used in real disasters, which means nearly everything must be free, be available on open-source networks, and utilize services that others pay for (Other People’s Money, OPM). Tools such as Google Earth, Google Earth Engine, Google Earth Map Maker,
OpenStreetMap, TNT Mips, ESRI ArcGIS and ArcGIS Explorer, Walking Papers, Field Papers, MapKnitter, MapBox, and a host of other software and web services will be utilized and integrated.

- Legal guidelines and protocols for use of in US disaster responses like NIMS (National Incident Management System), ICS (Incident Command System), NIPP (National Infrastructure Protection Plan), NRP (National Response Plan), and the NRF (National Response Framework). We will also summarize related documents and guidelines including Homeland Security Presidential Directives and Presidential Policy Directives applicable to disasters, as these provide the legal background for what can be done.
- Legal guidelines and protocols for International disaster response like DoD Directive 3000.05, DoD Instruction 3000.05, and DoD Instruction 8220.02.
- Legal guidelines for US-Mexico collaboration and interaction, role of Mutual Aid agreements, history of collaboration, role of Defense Support of Civil Authorities (DSCA) in both countries and role of military Humanitarian Assistance Disaster Relief (HADR) in other countries.
- Role of NORTHCOM in US and Mexico. Helping develop collaboration between two countries via NORTHCOM responsibilities and people.
- Social Media such as Twitter and related tools for near real-time information for disaster response, building patterns on which to put content (“dots on patterns”) especially with tools like Geofeedia.
- Data fusion and visualization, knowledge management, collaboration, real-time synthesis, change detection, animation, and decision support including simulations and game environments including Microsoft Hololens (https://www.microsoft.com/microsoft-hololens/en-us) and SimTable visualizations (http://www.simtable.com).
- Imaging technologies, capabilities, platforms, principles, and electromagnetic spectrum, technologies, laws, current and future uses, and commercial service providers like SeaSpace, DigitalGlobe, IKONOS, ASTER, NASA NPP, and others including past imaging data for change detection such as CORONA.
- Active imaging: Technologies, image processing, examples of use such as containers, port and borders, airports, maritime domain awareness, medical applications, sports, and land-mine detection and removal.
- Passive imaging: Technologies, data manipulation, change detection, and fusion of imaging and textual data.
- Hybrid imaging and applications such as RFID and other chip technologies focused on Location-Based Services (LBS) including for sports, entertainment, business, and previously unknown applications.
- Cybersecurity, data mining, and security management standards and trends/opportunities.
- UAV (Unmanned Aerial Vehicle) and AUV (Autonomous Underwater Vehicle) considerations, mapping, mosaic formation, GIS, linkage to Social Media such as during fires, earthquakes, and tsunamis.
- Funding architectures: DHS, DOJ, NIJ, NASA, TSA, DOT, DTRA, DoD, OSD, DOC, NOAA, USAID, and other agencies and modes of funding (UASI, block grants, state OHS and OES, and other International funding opportunities such as World Bank, Development Banks, Gates Foundation, EU, UN, other countries).
- Role of Native American 8a funding in Federal contracting such as for USAID and DoD.

Focus of the class will be on learning how to use both remote sensing imagery and Geographic Information Systems linked to imagery. Much of the effort will be on trying to help understand what you could do as a leader or official or volunteer in a disaster with the understanding of using imagery and GIS through time to help make decisions. By understanding what can be done and why, it is hoped that you will be able to continually learn as the field grows and as the applications pervade smartphones, utilize cloud computing, and enable rapid decision making on a global scale. We will also use web sites such as Grants.gov (http://www.grants.gov) extensively as well as Twitter, Instagram, YouTube, Facebook, Snapchat, YikYak, and other Social Media tools. Much of this is designed to help prepare you to actually use these tools in your careers ahead and see how to get funding for your agency or jurisdiction to enable using these tools. Focus will also be on use of quadcopters, which are legal in Mexico, and how we might use for disasters like El Nino, particularly with before, during, and after imagery. Focus will also be on how to help with trade on the border and contributing to the solutions of challenges to both nations.
Enrollment Information

This class is meant as an Introduction to many of the current solutions in Disaster Response for real people, rather than what the military or major government resource can accomplish given time and millions of dollars. Rather this is meant as what can real people helping in real disasters do---what can YOU do? Because the problems and solutions transcend so many fields, the richness of the class composition will help determine the specifics of projects and approaches. So one of our goals will be to learn from each other and build special friendships.

- **Prerequisites**—Because almost no one in either Geological Sciences or Homeland Security has a significant background in Disaster Response, the only critical prerequisite is an interest in the subject and willingness to learn. We will build on the backgrounds of dozens of different fields, so nearly everyone will have expertise to contribute and expertise to learn. Because we have students from two countries, the richness of the experience should be remarkable if we can build the group together as a team.
- **For SDSU students** Adding/Dropping Procedures are the same for this class as other classes. Last day to Add or Drop or Change Grading Option (class only counts for graduation as a graded class for most people) is Feb. 3rd. The University rigidly enforces this, so Adding/Dropping is possible after two classes (Jan. 21st and Jan. 28th) so should be very obvious what the class is about and the workload that it represents. Also, with going to Baja on Jan. 28th, should be obvious how the cross-border travel works so can see that is very straightforward for most folks.
- **Spring break** is March 28th-April 1st, so no class scheduled that week.
- **According to Academic Calendar** (on school webpage), last day of classes will be Thursday, May 5th. Final exams are May 6th-12th, so for this class the scheduled final exam would be May 12th. Final will actually be group presentations, which we will start near the end of the semester, so May 12th may or may not be a time of meeting.
- **May 20th** grades due from teachers, so you will have your grade by that night.
- **Graduation at SDSU** is the weekend of May 14th and 15th.

If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact Student Disability Services at (619) 594-6473. To avoid any delay in the receipt of your accommodations, you should contact Student Disability Services as soon as possible. Please note that accommodations are not retroactive, and that I cannot provide accommodations based upon disability until I have received an accommodation letter from Student Disability Services. Your cooperation is appreciated.

Course Materials

Nearly all the materials such as reading materials will be from online sources, as we are trying to mimic real disasters, so that students should be able to access and copy the materials as PDF and other formats. This is purposefully done as most people who use Imagery and GIS in disasters are doing it from web resources, so you will also see how to teach others. Other materials such as DHS materials on the Incident Command System (ICS), National Incident Management System (NIMS), and the National Response Framework (NRF) that are integral to disaster responses in the US will be from DHS and FEMA websites. Materials on the collaboration with Mexico will be particularly highlighted including the role of US NORTHCOM (http://www.northcom.mil) and their legal and collaborative roles with Mexico and other countries. Significant materials will be sought out individually and in small groups via web and social media sources. Twitter, Google, and other tools will be widely used, as will online tools for analysis of these near real-time data inputs. Significant time and energy will also be put into teaching students how to pursue outside funding, which is one of the most common requirements for being able to work in disasters. Tools such as Grants.gov will provide significant materials for projects and directions for individuals and groups, much as for your careers.
Most of the course materials will be available online and free to you. This is both so that you can use them personally and also that you can share as you likely assist others in using imagery and GIS in disasters. Examples will be tutorials from NASA and NOAA, TNT Mips software—free version (http://www.microimages.com/products/tntmipsfree/), ESRI ArcGIS Explorer (http://www.esri.com/software/arcgis/explorer), and Open-Source software such as OpenStreetMap.org (http://www.openstreetmap.org), and Google Earth and family of products and services like Google Earth Engine and Google Earth Map Maker. Several very special groups led by Open-Source groups like Crisis Mappers (http://crisismappers.net) and commercial companies doing humanitarian assistance disaster relief like Google Crisis Map (http://google.org/crisismap) and the ESRI Disaster response group (http://www.esri.com/services/disaster-response) are leading the way with free tools, techniques, and expertise---so we will follow their lead in a major way. Using tools that you can share with others is powerful and scalable.

### Course Structure and Conduct

Course will be structured primarily as a lecture-discussion class with instructor leading the discussion around current events in Humanitarian Assistance Disaster Response (HADR) such as major international natural disasters and other global political events such as the current conflicts in Syria, Columbia, Democratic Republic of Congo, South Sudan, Mexico, and other areas.

- **Style of the Course** will be Lecture-Discussion and students will be expected to participate in the discussion, including using social media like Twitter to understand how such tools work.
- **Individual and Group Activities** will both be used as disaster response is profoundly a team effort. Many of the assignments will be done as small groups of students, but with each individual turning in separate, but related deliverables.
- **Technology utilized in the course** will hopefully be useful away from school so you are encouraged to bring and use your own laptops. School computers also fit because we are mostly using web services from the Cloud. We will also seek to work with technologies applicable to non-US and cross-border concerns including efforts inside Mexico, as with mapping, telecommunications, and imagery acquisition such as with UAVs in Mexico where they are not nearly as restricted as in the US, so much more like global disasters. Mexico is a wonderful staging area for helping in other parts of the world, where the laws are much more similar to Mexico than those of the US. US-Mexican teams thus become extremely powerful.
- **Additional opportunities to learn** will be available such as the beginning and advanced DHS Texas A&M Extension classes in Threat and Risk Assessment. These will likely be available at this semester and are free to the student though they cost DHS several hundred dollars per student. The classes will be helpful and highly useful for the professional field of Homeland Security and disaster mitigation and response, but will not count toward grade. They are in addition to the class and are strictly voluntary. Materials from the class will be provided to the students attending the class by DHS, as will a Certificate of Completion for each class. Listing these classes on your resume along with the several ICS classes from FEMA that I will ask you to complete is extremely appropriate.

During the semester, if any major natural disasters or major Homeland Security events occur, class will likely focus on the use of imaging and GIS for assisting in the response to these events, especially cross-border events or opportunities. Major disaster events will also be things we address, likely in concert with groups like CrisisMappers (http://crisismappers.net). A simple example could be a major winter storm or spring floods in US or earthquake or tsunami or typhoon or volcanic eruption in areas like Indonesia, Mexico, Columbia, Vietnam, or Somalia where we are deeply involved with other universities in trying to help.

We will focus primarily on impact of El Nino both in border community and specifically Tijuana, but also in other parts of the world. This will focus on obvious rain, landslides, crop damage, and other physical things, but we will also use imaging to address concerns with Ebola and hospitals in Liberia and Sierra Leone as well as other places in...
that region. We will also use imagery and maps as base maps for vector studies for things like Zika virus in Brazil and its spread to other countries like Mexico and US. In the same way, we will look at other diseases and linked conditions like Guillain-Barre (http://www.nytimes.com/2016/01/22/world/americas/zika-virus-may-be-linked-to-surge-in-rare-syndrome-in-brazil.html?emc=edit_nyt20161228&nl=afternoonupdate&nlid=564448111&_r=0), dengue fever, and chikungunya (http://www.latimes.com/local/lanow/la-me-ln-mosquitoes-disease-california-20151015-story.html).

**Course Assessment and Grading**

Course will be graded by combination of three short papers (depending on whether natural disasters occur, so we will focus on the real disaster rather than papers), small weekly assignments, and a final project:

- Three papers will be evenly spaced throughout the semester and will focus on specific uses of Imaging and GIS in disasters so that you have the vision and framework for how Imaging and GIS can actually help in disaster response and humanitarian assistance. Each will be 15% of the grade.
- Shorter weekly assignments such as working on Grants.gov, Twilert, Geofeedia, Snapchat, HootSuite, Crismappers.net, OpenStreetMap.org, Ushahidi, UN ASIGN, Sahana, Pacific Disaster Center’s DisasterAware (http://www.pdc.org/solutions/products/disasteraware/), and other tools will be assigned and will add up to a total of 25% of the grade.
- Final project and presentation of the results in front of the class will be 30% of the grade and focused on one aspect of the course chosen and presented in front of the group. Final projects will hopefully provide real-life experience in doing Imaging and GIS for Disaster Response and Humanitarian Assistance. Many of the projects will focus on specific areas such as specific areas in Mexico, Columbia, Congo, South Sudan, Syria, Kazakhstan, Indonesia, and other areas on which we may work.
- Excused Absence Make-up Policies: Most of the students are working adults with complex travel and daily lives. Generally possible to work with individuals who are not able to make class for valid reasons. Simply contacting instructor prior to class is best way to approach this and can individually arrange to make up the material.
- Because of the remarkable collaboration form of this class linking UABC and SDSU together, we may try to also work on specific projects such as mapping El Nino damage and potential damage, so some of the projects that students may work on will not be known until the severe weather hits. Similar projects can be done in parts of US and other countries, but we will primarily focus on Baja California.

**Other Course Policies**

- I ask that you not work on external projects or communication during class, like working on your Facebook page or wedding preparations or projects in other classes. This is especially true when we have guest speakers, as you represent SDSU and our special partnership with UABC.
- I would also ask that you carefully clean up your space after class so that we leave the room in better shape than we inherited it, as most of our classes will be in wonderful computer lab at UABC. Being gracious guests in cleaning and making it nicer than when we walked in would be a wonderful legacy.
- We will also likely participate in a number of online and distributed learning efforts, where students will engage in the collaboration electronically, so working to use appropriate Cybersecurity and professional presentation in an electronic format will be done. Examples will be listening to World Wide Human Geography Data (WWHGD, http://wwhgd.org) and the CrisisMappers (http://crisismappers.net) webinars on disaster response and real disasters. When we are on conference calls, making sure you know how to mute your phone so that everyone doesn’t hear your dog barking or airport announcements is really important.
- Several of the people in the Homeland Security program have security classifications---so it is extremely inappropriate to engage in activities that could endanger their clearances and therefore their careers and
ability to contribute to the nation. Please simply refrain from inappropriate activities, as most are against University and law enforcement rules anyway.

- As per University rules, drug usage is totally inappropriate---please don’t do so for your own good and also for the reputation of the school. As we seek to use Imaging and GIS to assist others in crisis, we need to be trustworthy people in regard to obeying the law. Ruining the lives of others is completely inappropriate in this field that is based on Trust Networks and Integrity. Also guns and ammunition are illegal in most ways in Mexico, so completely inappropriate unless licensed to carry arms by Mexico.

- Serving others such as in Disaster Response requires Integrity---please honor your colleagues and yourself by refraining from inappropriate behavior such as drugs, cheating, heavy drinking, bullying, discrimination, or many other things that you would be aware that they are inappropriate before you do them. Working as a multi-faceted team is wonderfully enjoyable, so let’s honor each other and lift each other up so that we can help others in need.

- As we cross over the border going south so walk through Mexican security and then walk back north through US Border Security, being respectful of others in line and those there officially is very appropriate. You represent the schools and the vision of a combined Border University way of learning---you can make a positive difference and impact, so I would respectfully ask that you do so.

- One of the ways that can make crossing into the US far easier is with a SENTRI/Global Entry pass. There is an office at the Otay Mesa crossing, just to the west of where you cross and just to the south of the walking bridge to Mexico, so very convenient. To apply, it is dramatically easier than before---nearly all online at https://goes-app.cbp.dhs.gov and really worth getting. From start to finish (originally filling out the form to having it in hand) is about a month----so very much worth doing now so can take advantage of during the semester. You can also register car for this and simply drive back and forth to class and to other areas in Baja with rapid return in the SENTRI (Secure Electronic Network for Travelers Rapid Inspection, SENTRI, http://www.cbp.gov/travel/trusted-traveler-programs/sentri) lane. For most people, Global Entry is actually most attractive (http://www.cbp.gov/travel/trusted-traveler-programs/global-entry). A simple comparison of the different programs is at: http://www.dhs.gov/comparison-chart

- We are also working with the University for people using the class as a Study Abroad requirement, so there will be further details described during the first class meeting about concerns such as health care (University Office of International Programs is putting this package together for us) so that the University and CSU System regulations can be complied with as well.

- Transportation details will be discussed in the first class, which will be held in CSL 422 on Jan. 21st at the normal class time.