UNIVERSITY OF VERMONT
Department of Geography
SPRING 2022

GEOGRAPHY 281 **Satellite climatology and land-surface processes: A service-learning enhanced course** 3 credits

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Professor:	Dr. Lesley-Ann Dupigny-Giroux	
Course time (L309):	Tuesday & Thursday	1625 - 1740
Office hours:	Monday	1630 - 1730 (MS Teams)
	Wednesday	1000 - 1200 (MS Teams or in person pending COVID conditions) *or by appointment*
Contact information:	656-2146 (direct telephone) ldupigny@uvm.edu	656-3060 (Geography department)

Requirements Satisfied: This course meets the non-laboratory science requirement in the College of Arts & Sciences.

TERM PAPER DUE: **Tuesday 26 April 2022** **(by 1315 on Blackboard)**

SECTION 1: ABOUT THIS COURSE

1.1 COURSE DESCRIPTION

Forest fires in the Brazilian Amazon, southern Canada and Alaska. Climate change impacts on water resources. Multi-view angles for quantifying wetland stress. It is 50+ years since the first satellites were launched to study the weather in the late 1960s. Since then, such platforms have opened up new dimensions in our understanding of the Earth's atmosphere and its interaction with the land, vegetation and ocean below (i.e. land-surface interactions). In this applied, capstone course remote sensing techniques will be applied to atmospheric issues at varying temporal and spatial scales, as well as to quantifying the influence of topography, vegetation and land-water boundaries.

The course is divided into three parts. In the first section, you will acquire the advanced techniques with which to interpret the land-surface. This will be followed by analysis of vegetation and surface moisture characteristics. The course will end with a variety of atmospheric issues including precipitation estimation and aerosol transport.

1.2 LOGISTICS (platforms, software, rooms)

Mixed: In person & synchronous ((*log in to MS Teams regardless of your physical location*).

Class time will be divided into lecture-laboratory combinations with in-class tutorials and exercises. These will be complemented by short videos and 'visits' from subject matter experts as appropriate. Internet-based climate sources will be incorporated accordingly. Class time will be used for conceptual refinement and skill acquisition and you are therefore required to prepare all the assigned materials before class. The Blackboard platform (available through myUVM) will be used for all class reading and lab materials, as well as to access and submit all graded work. To the extent possible, we shall be learning to use the ENVI remote sensing software for the lab component of our class. Due to ongoing COVID-19 protocols, we shall be using the VIRTUAL MACHINE (VM) platform remotely to learn and use the program.

Pre-requisites: GEOG 040; Preferred: GEOG 143 or GEOG 185 or NR 146 or ENSC130. You are strongly encouraged to develop an extended, in-depth reading base on climatology and remote sensing to aid in our discussions, as well as your assignments.

Class expectations

‣**This is an advanced level remote sensing and climatology class and as such I expect you to have the necessary background** from having taken the introductory (GEOG 040) and/or intermediate courses listed above. If you are missing this preparation please see me for recommendations about pertinent texts or articles.

‣***This course is a Service-Learning enhanced course***. Service-Learning is a reciprocal relationship among students, faculty and an external community collaborator(s), that is responsive to the needs of the collaborator(s), while enhancing student learning. The relationship is symbiotic such that all parties benefit by learning from each other. Service-Learning differs from volunteerism and co-curricular activities. Service-learning activities are directly related to curricular goals, with course assignments tied to the service experiences" (http://www.uvm.edu/~partnerships). During this semester, we shall be collaborating with Secretary Julie Moore of the Vermont Agency of Natural Resources and the co-Chair of the Vermont Climate Council (VCC). On 1 December 2021, the Council adopted the first-ever Vermont Climate Action Plan, available at <https://climatechange.vermont.gov/sites/climatecouncilsandbox/files/2021-12/Initial%20Climate%20Action%20Plan%20-%20Final%20-%2012-1-21.pdf>. As the Plan enters its implementation phase and the Vermont State Legislature deliberates on how to fund the proposed recommendations, we shall be assisting Secretary Moore in 'putting a finer point' to some of the elements of the Plan which need further refinement. Specifically, GEOG 281 has been asked to:

- Review of emissions inventory tools for the Agriculture, Forestry and Other Land Use (AFOLU) sector being used in other states and jurisdictions and identify methodological gaps; identify potential remedies and opportunities for better alignment with the Intergovernmental Panel on Climate Change (IPCC), Environmental Protection Agency (EPA), and peer state methodologies and approaches.
- Develop and apply criteria for establishing/identifying climate resilience zones – both the safest, most appropriate places for development and the highest priority for necessary/strategic conservation.
- Evaluate strategies for quantitatively and qualitatively assessing the relative vulnerability of Vermont municipalities to the effects of all climate change hazards, considering exposure, sensitivity, adaptive capacity and other critical factors.

Service-Learning courses tend to be more fluid than others, with content being 'front-loaded' in order to address the questions/requests made by our community partner in the timeframe that

matches their timeline.

▸ We all learn best in a positive, upbeat environment and I invite you to enrich our classroom experience with your participation and high level of preparedness for class. All assigned readings are to be completed prior to class time. Materials assigned as lab/discussion work will be distributed in class and must be completed prior to the next class time.
▸ Mutual respect is expected, as is a level of professionalism that is conducive to learning in the classroom. Disruptive students will be asked to leave the class.
▸ *Class attendance is mandatory*. Should you be absent, please inform me of the circumstances and it is up to you to take whatever steps necessary to acquire the material you have missed.
▸ Students are encouraged to attend instructor and/or TA office hours (or make appointments to meet) regularly if you have questions on course content, assignments or exams.

▸ Due to the COVID pandemic, please feel free to bring your own device to class for notetaking and in-class exercises, since we shall be making use of a plethora of web-based tools during regular lecture times. Please refrain from texting, email checking, Internet surfing and/or other homework during class lectures, since these will detract from your learning. Cell phone use during class time is permitted for taking pictures of explanations drawn on the whiteboard.

If you are working with an ACCESS professional and require certain accommodations in order to excel in this class, please provide me with your ACCESS letter by the end of the second week of the semester so that I could plan accordingly.

The UVM Code of Students Rights and Responsibilities can be found at:
http://www.uvm.edu/policies/student/studentcode.pdf

while the UVM Code of Academic Integrity is located at:
http://www.uvm.edu/policies/student/acadintegrity.pdf

Students' rights on access to, and privacy of their student educational records as provided for in the Family Educational Rights and Privacy Act (FERPA) of 1974:
http://catalogue.uvm.edu/undergraduate/academicinfo/ferparightsdisclosure/

UVM Health and Safety information can be found at: the Center for Health and Wellbeing:
https://www.uvm.edu/health

Counseling & Psychiatry Services (CAPS)
Phone: (802) 656-3340

Information on the observance of religious holidays can be found at the following site. Students must inform me of the dates of the your planned absences by the end the first full of classes, so that we can mutually arrange on the completion of missed work.
https://www.uvm.edu/registrar/religious-holidays

Finally,'teaching and curriculum materials (including classroom lectures, seminars and

presentations' are considered "Scholarly and Artistic Works" which 'shall be and remain the property of their Creators' according the UVM policy on Intellectual Property. Please refrain from posting them outside of class, including to sites such as Quizlet.
https://www.uvm.edu/sites/default/files/UVM-Policies/policies/intellectualproperty.pdf?t=qnppbb

Recording of class sessions
"Our class sessions may/will be audiovisually recorded for students in the class to refer back to, and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live."

Communication
Please feel free to email me with questions and concerns. Use 'GEOG 281 - ***' in your subject line where *** is the topic of your email. ***Start each message with 'Dear Prof. Dupigny-Giroux' and end your name*** (this is really important because there are often multiple students with the same name)

1.3 LEARNING OBJECTIVES

The overarching goal of this course is to enable students to analyse, interpret and draw conclusions about atmospheric, vegetative and surface moisture characteristics from a variety of sensors, viewing angles and processing techniques.

Upon completion of this course, you will be able to:
- demonstrate a theoretical and practical understanding involved in using data from land sensing satellites
    - identify and interpret landscape features at various wavelengths
    - display an understanding of mixels (mixed pixels) or the loss of information in going from a finer resolution to a coarser one
    - ability to quantify the inaccuracies associated with mixels with reference to actual land use patterns observed in the field
- demonstrate a theoretical and practical understanding involved in using meteorological satellites and radar imagery
    - identify and interpret weather features at various wavelengths
    - display an understanding of the complementarity of different regions of the EMR in sensing the same phenomenon
- demonstrate mastery of the skills needed to monitor surface moisture and vegetation
    - correctly vegetation and soil ratios
    - ability to quantify stress in vegetation using appropriate wavelengths
- demonstrate mastery of systems thinking as applied to understanding climate change
    - display an understanding of both anthropogenic (human-induced) and naturally occurring

sources of variability related to environmental and global climate change.

1.4 ASSESSMENTS/ASSIGNMENTS

Your overall grade will be assigned on the basis of the following tasks, your participation during the semester and your articulated learning. This course is holistic in nature and writing assignments should demonstrate both your own creativity, as well as being free from spelling and grammatical errors (see Attachment A). You will be given two chances to learn from any spelling and/or grammatical errors that I shall correct. After this, repeated errors will be penalized.

Interpretive exercises & theoretical questions	25 %
Intra-term examinations (2)	25 %
Reflections	20 %
Paper & oral presentation	30 %

By the semester's end, you will be required to complete a research project on a topic of your choice using the ENVI or IDRISI software. Project ideas and tentative methodologies must be submitted at a date to be announced. Complete details on the format of the project as well as guidelines in choosing a topic will be distributed shortly.

Graded assignments (in WORD or PDF format) will be due in the appropriate column on BlackBoard at the **beginning** of class on which they are due. Do not wait until one minute before class to avoid any potential glitches with your file upload. Dates and times assigned for each exercise will be announced in class and appear at the top of each assignment. Details on the format of the group project as well as guidelines for choosing a topic will be distributed by mid-March.

- Assignments should be started as soon as they are given when the material/technique is still fresh in your mind.
- Remote sensing exercises and projects are time intensive. They usually require more than 30 minutes and should not be left for the day on which they are due.
- ***Late assignments will not be accepted except under extenuating and fully documented circumstances.***

‣ Ungraded laboratory/in-class assignments and worksheets will be used to enhance your mapping, graphing, and other interpretive skills.
- I shall be looking for a) how well you have grasped the material and can ***apply*** it to a new situation or problem and b) your ability to ***make connections*** across various topics that we encounter during the semester.

The *following format is to be followed for all submitted work*.
- all submissions should be typewritten. Unless otherwise requested, handwritten material will be returned.
- use complete sentences as well as accurate grammar and spelling. (See Attachment A). You will be given two chances to learn from any spelling and/or grammatical errors that I shall correct. After this, repeated errors will be penalized.

- A paragraph is usually about 8-10 lines long. It should contain only major theme. NP on your corrected work means NEW PARAGRAPH
- include your name and course ID on all submissions.
- should we use calculations, show all of your work so that I can trace your steps. Present any formulae or relationships used and state any assumptions. [Please follow my in-class examples.]
- your final numeric answer should contain the appropriate number of significant digits based on the accuracy of the data used.

Other materials will be graded as stated on separate handouts.

1.4.1 EXAMINATIONS GUIDELINES

‣ The first examination will cover material from the beginning of the semester, while the second will test material from the first onward.
‣ Both exams will cover material presented in lectures, laboratories, exercises and videos as well as that contained in the textbook and course package.
‣ I shall be looking for a) how well you have grasped the material and can ***apply*** it to a new situation or problem and b) your ability to ***make connections*** across various topics that we encounter during the semester.
‣ Make-up examinations will not be given except in extenuating, documented circumstances.

UVM's policy on the expectations, timing and manner of the exam period can be found at:
https://www.uvm.edu/registrar/final-exams

1.4.2 REFLECTION

Reflection assignments are designed to connect our course goals, objectives and conceptual material with practical applications. Reflection will help you to focus on yourself as a learner and the ways in which you are synthesizing knowledge, information and experiences during the term. It will help you answer such questions as:
- What am I learning?
- How am I learning this?
- How does my field work synthesize class materials, readings, labs or tutorials?
- What skills have I acquired as a result of working on this project?
- How will these skills make me more marketable or prepared for graduate school?

By answering these questions, you are articulating your learning.

There will be 3-5 written reflection assignments for the semester. These will start on the first day of class, and be assigned in response to guest speakers/collaborators' visits, after challenging lab exercises and after selected readings. You are to address the foregoing 4 questions, as well as any other related issues such as - What skill do I need to acquire in order to address the problems mentioned in a given article? Did I have preconceived expectations of a given analysis at the beginning of an exercise and how have these been addressed? A reflection rubric is given on Attachment B to assist you.

In addition, there will be monthly, ungraded reflections on the progress of the course, where you will be able to express any concerns or make suggestions for its improvement.

1.4.3 REFERENCES

For any written assignment, you must cite any material that is not your own. All references should follow the scientific style below which is used in most geoscience, earth science and spatial analysis journals. Note the differences among an article, book and Internet citation.

Article

- Last, Peter (2000) "Monitoring snowmelt response via a three-dimensional landscape model," *Journal of Spatial Climate*, Vol. 1, No.1, pp. 2-10.

Book

Johnson, Mary (2000) Climate controls in New England and the analysis of ecotypes by spatial statistics, John Wiley & Sons, New York.

Website

Centre for Spatial Research, http://www.hcgd.gov/spatial last accessed on 1 January, 2021

When **citing material within the body of your written work**, please use the following:

> "We find that since the mid-twentieth century, greenhouse gases contributed 0.85 °C of warming (5–95% uncertainty: 0.6–1.1 °C), about half of which was offset by the cooling effects of aerosols, with a total observed change in global temperature of about 0.56 °C" (Huber and Knutti, 2012:31). [notice that this is a direct quote that is more than 3 lines long, and therefore presented in an indented paragraph.]

Then in your bibliography/references at the end of your written assignment, use the following for the full citation:

- Markus Huber & Reto Knutti (2012) "Anthropogenic and natural warming inferred from changes in Earth's energy balance", Nature Geoscience 5,31–36, doi:10.1038 /ngeo1327.

Only use page numbers in your within-text citation if it is a direct quote, e.g."Climate variability is very pronounced in the North American Northeast (Smith, 1980:23)"

1.5 GRADING POLICY

The following grading scheme will be used to assign a final grade. This final grade will be computed using the percentages for the assessments given in Assessments/Assignments section. Since we shall be using percentages (rather than adding up a total number of points), 'running' or 'grades-to-date' will not be available during the semester. Letter grades are not given on individual assignments. Instead, you will receive a score out of a total (e.g. 15/20, which is 75% or a B in this class).

NUMERICAL GRADE	LETTER GRADE
90-100	A+
85-89	A
80-84	A-
77-79	B+
73-76	B
70-72	B-

67-69	C+
63-66	C
60-62	C-
57-59	D+
53-56	D
50-52	D-
49 and below	F

Required course materials

Reading materials will be made available either on Blackboard or as in-class handouts. They will be taken from a number of sources including:

1/ Course package with lecture notes, collaborator information, exercises and other ancillary material. [abbreviated as CP in reading list]

2/ Kidder, S.Q. and von der Haar, T.H. (1995) Satellite meteorology - An introduction. Academic Press. [abbreviated KV in the reading list]

3/ Jensen, J. (2005) Introductory Digital Image Processing - a remote sensing perspective, 2nd edition, Prentice-Hall series in geographic information science. [abbreviated JJ in the reading list]

4/ Introduction to Remote Sensing, 3rd edition, Campbell, J.B, Taylor & Francis. [abbreviated as JC in the reading list]

NOTE: Contents of this syllabus may be modified by the professor in ways to best enhance your learning experience, as well as in response to changing UVM COVID protocols.

WEEK	DATE	TOPIC	TEXT READING	LAB WORK
1	Jan. 18, 20	Introduction to satellites	KV: Chapter 4, 5	
2	Jan. 25, 27	Interpretation	JC: Chapter 6, 5	interpretation exercise
3	February 1	*Introduction to our collaboration with Vermont Climate Action Plan* *MS Teams visit - Secretary Julie Moore, GWSA Director Jane Lazorchak & GWSA Coordinator Marian Wolz* Climate change & variability		
	February 3			
4	Feb. 8, 10	Precipitation estimation		
5	Feb. 15, 17	Hurricane monitoring		
6	Feb. 22, 24	Air quality - forest fires, dust transport		
	February 24	Take home examination 1		
7	Mar. 1 Mar. 3	Town Meeting day (no class)		
		FLOATING WEEK		
8	March 6-12	SPRING BREAK (NO CLASSES)		
9	Mar. 15-17	Quantifying soil moisture	various articles	soil ratios
10	Mar. 22, 24	Vegetation monitoring	various articles	vegetation ratios
11	Mar. 29, 31	Geobotany	various articles	
12	April 5, 7	Multi-angle imaging	various articles	MISR & AirMISR
	April 7	Take- home examination 2		
13	April 12, 14	Multivariate techniques	JJ: Chapter 8	PCA
14	April 19, 21	Advanced classification	various articles	end member classification
15	April 26, 28			

16	May 3, 5	***Oral presentations to the VCC members - all term papers are du***

ATTACHMENT A

PLEASE NOTE THE CORRECT USAGE OF THE FOLLOWING GRAMMAR & SPELLING IN YOUR WRITTEN WORK. <u>YOU WILL BE PENALISED FOR FAILURE TO DO SO AFTER THE FIRST TWO WARNINGS.</u>

1- **its** (possessive) **it's** (contraction meaning it is or it has)

2- **then** (adverb meaning at that time) **than** (conjuction or preposition used in comparison, e.g. smaller than)

3- therefore (note the "e" at the end)

4- "but" should not be used at the start of a sentence

5- tornado is the singular of tornadoes

6- develop is the third person singular form of the verb to develop (**not develope**)

7- **of** (preposition meaning belonging to) **off** (preposition meaning away from)

8- to **too** (adverb meaning also OR an adverb, e.g. too much wind)

9- Rockies (like all proper nouns, this should begin with a capital letter)
10- Tornado Alley (likewise)

11- occurrence (note double "c" and double "r")

12- **there** **their** (possessive)

13- **lose** (means to misplace) **loose** (means to slacken or untighten)

14- **affect** (verb meaning to influence) **effect** (verb meaning to bring about a change in)
affect (noun meaning mood) *effect* (noun meaning result)

15- **weather** (what we study) **whether** (conjunction expressing a choice)

16- same exact (should not be used together since they both mean the same thing)

17-**data** is a plural word, so use the third person plural -e.g., the data SHOW not the data shows

18-impact is a noun - to say that the weather impacted an activity is incorrect.

19-**less** (means not as much) **fewer** (means not as many). If you can count something, use fewer.

http://www.wsu.edu/~brians/errors/errors.html (Additional resource)

Attachment B

REFLECTION RUBRIC

	EXCELLENT	VERY GOOD	GOOD	ATTEMPT MADE	NO ATTEMPT MADE
mastery of topic content	original presentation of material	thorough presentation of material	accurate presentation of material		
activity	insights gained from activity	thorough presentation of activity	accurate presentation of activity		
synthesis of content & activity	original & insightful	thorough	accurate		
enthusiasm expressed in narrative	elegantly written, creative and original	well-written	competently written		
TOTAL	so engrossing that I could not stop reading	absorbing and holds interest	solid work	some flaws evident	needs to be rewritten

NOTE: Contents and the timing of certain events on this syllabus may be modified by the professor to enhance your learning.