1	Course Code:	CIVL1180
2	Course Title:	Monitoring Changing Climate from Space
3	Course Credits:	3
4	Class Quota:	NA
5	Duration / Offering Term:	3 hours per week, 14 weeks/Fall
6	Lecture/tutorial/lab hour per week	Lecture
7	Targeted Student Group:	First year undergraduate students
8	Prerequisite (if any):	None
9	Exclusion (if any):	None
10	Corequisite (if any)	None
11	Instructor:	Prof. Hui Su
12	Enrollment requirement (e.g., Instructor's approval is required):	None
13	Course Description: (within 150 words)	This course introduces the fundamental principles of satellite remote sensing and its role in monitoring our changing climate and environment. It covers the science underlying remote sensing, various remote sensing methods and technologies, observational evidence of climate change from space, and use of satellite data to advance science understanding and assist decision-making. The characteristics of satellite data and common methods to process and analyze satellite data will be introduced.
14	Course objectives:	This course aims to: 1. Introduce the basics of remote sensing and technologies for observing the Earth from space 2. Present space-borne observational evidence of climate change and attribution of the changes to human activities 3. Demonstrate scientific data visualization, analysis and inference methods 4. Engage students in big data analytics exercise 5. Train students to quantify knowledge in measurable terms 6. Educate students to use quantitative knowledge to formulate social policy decisions
15	Topics	The following topics are covered in this course: 1. History of remote sensing programs and climate science research 2. Basic concepts of how remote sensing works and the underlying science 3. Remote sensing methods and technologies 4. Satellite mission design 5. Characteristics of satellite data and satellite data analysis methods 6. Basics science of climate change 7. Observations of climate change: atmosphere 8. Observations of climate change: land 9. Observations of climate change: ocean 10. Observations of climate change: cryosphere 11. Climate change mitigation and adaptation 12. Use of satellite data to constrain climate models 13. Future perspectives

16	Laboratory Projects	In-class lab sessions for satellite data analysis. Sample programming code will be provided (9 hours).
17	Intended learning outcomes (ILOs) of the course:	Upon completion of this course, students are expected to be able to 1. Explain remote sensing principles, approaches, and methods 2. Describe satellite observations of climate change and associate the changes to human activities 3. Discuss and evaluate the complexity of physical science, and recognize limitation and future developments 4. Process, analyze, and interpret spatiotemporally varying data 5. Assess the soundness of climate-related policies using scientific knowledge 6. Write technical reports with creative thinking and quantitative evidence
18	Rationale for introducing the course:	Satellites provide vital views of the Earth, playing an important role in monitoring climate change due to their continuous coverage of the globe. Technology advancement has enabled rapid growth of remote sensing products from both government and private sectors. The use of satellite observations has enabled breakthroughs in improved understanding of climate change and better-informed decision-makings for environmental management. This class will teach students the basics of remote sensing and how to use satellite data for climate research and environmental management. Scientific visualization and interpretation of spatiotemporally varying remote sensing data can train students in quantitative data analysis and significantly enhance their ability to make appropriate decisions based on quantifiable knowledge. Satellite remote sensing will inspire students' passion for learning and pursuing innovative solutions for societal benefits.
19	Relationship to program objectives.	The course is aligned with the following CIVL programme objectives: 1.Provide students with professional skills in environmental management and awareness of environmental sustainability. The course will teach students to use remote sensing data to guide decision-makings in environmental management and mitigate the climate crisis. 2.Train students with good communication skills so they can work effectively in large projects involving different parties and professions. This course will train students to explain natural phenomena and present problems and solutions using quantifiable data. 3.Challenge students with research-type and open-ended design problems to stimulate self-learning and innovative problem-solving skills. The course will teach students to formulate science hypotheses and use data to test hypotheses and identify solutions. 4.Expose students to real world environmental problems to improve their understanding of the profession and technological advancements that can improve current practice.

		This course will present evidence of climate change using remote sensing data and inspire students to seek solutions to combat climate change.
20	Relationship to program outcomes	The course syllabus is aligned with the following program outcomes: PO1.Acquire fundamental knowledge in mathematics and science on which civil engineering research and practice are based PO5:Develop an ability to identify and formulate civil engineering problems, and propose feasible solutions with an appreciation of their underlying assumptions, uncertainties, constraints, and technical limitations PO7.Develop an appreciation of the breadth of civil engineering, and acquire basic knowledge in several disciplines to enable effective performance within a multidisciplinary work environment PO9.Develop an ability to communicate and present ideas effectively, including oral, written, and technical writing skills, and to function effectively within and among teams with a variety of backgrounds and interests PO11.Instill a deep sense of professional responsibilities and the importance of ethical and societal considerations, including public health, safety, environmental conservation, welfare etc. PO12.Develop an ability to stay abreast of contemporary issues, both nationally and internationally, and the awareness of the impact of engineering in these areas.
21	Assessment of Outcomes	Assessment will be conducted through homework assignments, a mid-term exam and a final project report. The lectures will cover the fundamental principles of satellite remote sensing, climate science, remote sensing methods, data visualization and interpretation, climate change mitigation and adaptation strategies. The homework assignments include hands-on exercises using online data viewers such as https://worldview.earthdata.nasa.gov/ and https://disc.gsfc.nasa.gov/. I will lead in-class discussions and ask students to discuss in groups and then present their discussions, in order to encourage critical thinking, public speaking and teamwork. The final project will involve satellite data analysis and a written report to reveal students' mastery of the course content as a top-level summary. It will demonstrate the students' concept understanding, analytical skill and critical thinking on the subject. Students are encouraged to form groups to discuss about homework and the final project to develop teamwork spirit, but individual written reports are required.
22	Textbook / Reference books:	Lecture notes will be provided. Reference books include: • Remote Sensing and Global Environmental Change, by S. J. Purkis and V. V. Klemas • https://courses.imperativemoocs.com/monitoring-climate-from-space (open source online course)
23	Grading Scheme	Homework (30%), Mid-term (30%), Final project and presentation (40%)
24	Grading Type (PP/P/F/Letter)	Letter