Consult the General Studies Request FAQ for more information and quick answers.

New permanent numbered courses must be submitted to the workflow in Kuali CM before a General Studies request is submitted here. The General Studies Council will not review requests ahead of a new course proposal being sent to the Senate.

Submission Information

College/School	Department/School
College of Global Futures (CGF)	School of Ocean Futures (CSOF)

Submission Type

New Request

Requested Effective Date

Fall 2025

ASU Request

Is this request for a permanent course or a topic?

Permanent Course

Subject Code	Course Number	Units/Credit Hours
SEA	330	3

Course Information

Enter the course catalog information, found in the web course catalog or Kuali CM.

Course Title

Digital Blue Planet

Course Catalog Description

Covers the foundation of data access, data analysis, data visualization and entry-level coding for coastal and marine science. Introduces the theory, data format, data type, analysis methods, and uses of point, vector and raster oceanic data to conduct research and applications.

Enrollment Requirements (Prerequisites, Corequisites, and/or Antirequisites)

Prerequisite(s): minimum 45 hours OR Visiting University Student

Is this a crosslisted course?

No

Is this course offered by (shared with) another academic unit?

No

If this course or topic already carries a different General Studies Gold (not Maroon) designation than the one being requested, please check this box.

General Studies Gold Designation Request

Requested Designation

Quantitative Reasoning (QTRS)

Attach a representative syllabus for the course, including course learning outcomes and descriptions of assignments and assessments.

Digital Blue Planet Syllabus_2024 (1).docx

Quantitative Reasoning (QTRS)

Quantitative and computational reasoning is essential for success in 21st-century careers, for critically evaluating information in the age of "big data," for assessing the quality of arguments conveyed through digital media, for informed participation in community and social life, and for contributing to the formulation of effective solutions for achieving a sustainable and just future. Quantitative reasoning enables students to apply relevant mathematical, statistical, computational, and visualization methods in academic, social and personal settings.

In a quantitative reasoning course, students learn about data, data management, data summaries, data visualization, and the use of computational tools with data. Data can take many forms, including numerical data, textual data, images, and others. Students also learn about how quantitative reasoning can be used to make arguments clear, precise and verifiable. Finally, they learn to build quantitative models, make predictions, and communicate their findings based on available data. This may include some combination of mathematical, statistical, computational or network models, or visualizations.

Instructions: In the fields below, state the assignment, project, or assessment that will measure each learning outcome, and provide a description. The description should provide enough detail to show how it measures the learning outcome. If needed, more than one can be identified.

The proposal does not need to include all course assessments that measure a given learning outcome. The provided assessment should include sufficient detail to allow the subcommittee to make their evaluation. When appropriate, the same assessment can be listed for more than one learning outcome (e.g., a culminating project).

You may provide links to a document (Google Drive or Dropbox) that includes the relevant details for the assessment. Do not provide links to Canvas shells.

QTRS Learning Outcome 1: Understand variables, measurement and data, including how they can be used to pose and answer questions about society and nature, and to manipulate, organize, classify and visualize quantitative data.

Assignment 1. Analysis of oceanic data from shipborne and autonomous platforms. In this assignment, you will understand basic oceanic data from the Bermuda Atlantic Time-series Study (BATS) and Argo float project. You will explore, download, and visualize time series oceanic data and analyze how the patterns and trends illustrate the changes in the ocean (e.g., salinity and temperature).

The assignment involves analyzing and understanding key oceanic variables such as salinity and temperature. By working with these variables, you will gain insights into how different environmental factors are measured and how they vary over time. You will explore and download data from the BATS and Argo projects. These datasets represent real-world measurements, giving students hands-on experience with the types of data collected in oceanography. By analyzing the patterns and trends in the data, students will learn how to use quantitative data to pose and answer scientific questions. For example, students could explore how ocean temperature trends relate to climate change or how salinity patterns vary with ocean currents in different geographic locations. Students will be tasked with organizing the downloaded data, classifying it by variables (like salinity or temperature), and possibly cleaning it to make it suitable for analysis. This process will enhance student's ability to manage and interpret ocean and coastal datasets, and to visualize the data, likely through graphs or charts. This will help students develop skills in data visualization, allowing them to communicate findings effectively and recognize patterns or trends more clearly.

Assignment 6. A.I. for oceanic data. In this assignment, you will learn how to better utilize ChatGPT in oceanic data analysis, download, and basic coding assistance. You will gain the ability to improve your research and data analysis efficacy by using the A.I. tool.

The assignment involves analyzing oceanic variables again like salinity and temperature using AI techniques. The use of AI tools will allow students to process and analyze this data more efficiently, providing insights into the methods and tools used to measure and interpret oceanic variables. The assignment also requires students to analyze patterns and trends in oceanic data, using AI to pose and answer questions about the ocean's changing conditions. This aligns with the requirement to use quantitative data to explore and answer questions related to both nature (the ocean) and potentially society (e.g., climate change impacts). AI tools are particularly effective at handling large datasets (i.e., BATS and Argo). Students will learn to use these tools to understand and classify the data, making complex analyses more accessible and efficient.

QTRS Learning Outcome 2: Evaluate arguments from everyday life or academic fields of study that are represented mathematically, statistically, computationally, or in visualizations.

Assignment 2. Coastal spatial data analysis. In this assignment, you will apply coastal spatial data analysis skills to plan a marine protection area. You will understand how to use statistical analysis and spatial data visualization to make decisions.

The assignment includes planning a marine protection area, students will need to evaluate various spatial data, such as the distribution of marine species, human activities, and environmental factors. This requires the application of statistical methods to identify significant patterns, trends, and correlations within the data. These analyses allow students to make informed decisions and construct well-supported arguments regarding the best locations for protection. The assignment involves using QGIS tools to process and analyze coastal spatial data. These tools enable complex analyses that would be difficult to perform manually, such as modeling the impact of different protection scenarios or predicting future changes in the coastal environment. By using these tools, students learn to evaluate computationally derived arguments and understand the underlying assumptions and limitations. Visualization is a critical component of marine protection area designs. Students will create maps and other visual representations to communicate the findings effectively. These visualizations not only help in understanding the data but also play a key role in evaluating and presenting arguments about where and why certain areas should be protected. They allow for the clear presentation of complex data in a way that is accessible and persuasive to decision-makers.

Assignment 4. Google Earth Engine APP design. In this assignment, you will learn how to build a publicly available web-based sharing tool, the Google Earth Engine App to analyze sea surface temperature impacts on the coral reefs. You will understand cloud computing, cloud storage, and cloud data publication in a very broad community.

The assignment analyzing the impact of sea surface temperature on coral reefs requires the use of statistical methods to identify trends, correlations, and potential causal relationships. Students will need to evaluate how these statistical analyses are represented within the GEE App, ensuring they accurately reflect the underlying data and provide meaningful insights into the health of coral reefs. The GEE App will use cloud computing to process large datasets related to sea surface temperature and coral reef locations. Evaluating the computational workflows and algorithms used to process and analyze this data is crucial to ensure that the results are reliable and that the app performs efficiently. Visualizing the impact of sea surface temperature on coral reefs is a key part of this assignment. Students will need to evaluate how effectively the GEE App communicates complex data through visualizations such as heat maps, time-series graphs, or interactive charts. These visualizations should make it easy for users to understand the relationship between temperature changes and coral reef health.

QTRS Learning Outcome 3: Formulate hypotheses, mathematical models or narratives that are consistent with quantitative data.

Assignment 3. Open ocean satellite monitoring. In this assignment, you will explore, download, and analyze ocean satellite monitoring chlorophyll levels and ocean turbidity maps from NOAA. You will understand how physical modeling could be applied to generate major ocean health indexes, including chlorophyll values and ocean turbidity.

In this assignment, students will explore and analyze ocean satellite monitoring data from NOAA, students need to formulate hypotheses about ocean health indicators, such as how chlorophyll levels and ocean turbidity are influenced by various environmental factors (e.g., sea surface temperature, salinity, oxygen). These hypotheses will guide students' analysis and help students make predictions about ocean conditions. Understanding how physical modeling is applied to generate ocean health indexes like chlorophyll values and turbidity involves working with mathematical models that observe ocean conditions. Students will need to understand these models, evaluate their assumptions, and apply them to the satellite data to get the results. In addition to mathematical models, students need to develop narratives that explain the relationships between different ocean health indexes and environmental factors. These narratives should be grounded in quantitative data analysis, helping to make complex oceanographic concepts understandable to a broader audience. Students need to ensure that your models and hypotheses are consistent with this data, meaning that they accurately reflect the observed patterns and trends in ocean health indicators.

Mid-Term Exam: The mid-term exam will consist of short answer and/or essay questions, but will not contain multiple-choice questions. The mid-term exam will consist of material covered in class including class lectures, and labs. This exam has a focus on oceanic data, models, and platforms.

Sample questions for the Mid-term exam:

S1: Could you list one NOAA ocean monitoring product and explain the basic mathematical model formulation?

When explaining the NOAA ocean monitoring product, such as ocean salinity, students are essentially describing the mathematical model that underpins the physical algorithm to detect it. This model is derived from quantitative data, which aligns directly with the requirement to formulate mathematical models consistent with quantitative data. Explaining the algorithm and its mathematical model allows students to construct a narrative about how NOAA uses quantitative data to monitor ocean health.

S2: Could you please describe how sea surface temperatures affect the coral reef health in shallow coastal regions?

To describe the relationship between sea surface temperatures (SST) and coral reef health, students would likely need to propose hypotheses based on quantitative data. For example, students might hypothesize that increased SST leads to coral bleaching, which negatively impacts coral health. This hypothesis is rooted in quantitative data, such as temperature records and observations of coral health over time.

S3: Could you please list one common ocean satellite derivable data in monitoring ocean health?

Satellite-derived data like chlorophyll concentration are often inputs for mathematical models that monitor and predict ocean health. By discussing one of these products, students are inherently linking it to the mathematical models that use these data to generate insights into oceanic conditions, such as predicting the likelihood of harmful algal blooms or assessing primary productivity. Satellite-derived products are based on quantitative data collected via remote sensing technologies. By discussing one of these products, students ensure that the hypotheses, models, or narratives they formulate are directly tied to consistent, large-scale, and reliable quantitative data, fulfilling the requirement effectively.

QTRS Learning Outcome 4: Communicate how quantitative data, interpretations, or models are connected to outcomes, predictions, decisions, explanations, or future states.

Assignment 5. Regional scale marine analysis. In this assignment, you will learn how to use modern web-based platforms to search, download, and analyze coral reefs and fishing data at a regional scale. You will understand how web-based quantitative data could be utilized to formulate hypotheses to lead marine conservation plans.

In this assignment, students will analyze coral reefs and fishing data at a regional scale using web-based platforms. The insights you derive from this data will be directly connected to outcomes, such as identifying areas where marine conservation efforts are most needed or where fishing practices may be unsustainable. By analyzing regional-scale data, students make predictions about the future health of coral reefs and the sustainability of fishing practices. These predictions will be grounded in the quantitative data you analyze, demonstrating how data-driven interpretations lead to predicting future marine conditions. The assignment emphasizes the formulation of hypotheses that can lead to marine conservation plans. This involves using quantitative data to inform decisions about where and how conservation efforts should be implemented. Students will need to communicate how their data analysis supports these decisions, linking their interpretations to actionable conservation strategies. As students work with global marine data, they will develop explanations that connect their quantitative findings to broader environmental or ecological outcomes. For example, students could explain how declining coral reef health, as indicated by data, could lead to reduced biodiversity or negatively impact local fishing communities. The analysis involves predicting future states of marine environments based on current trends in coral reef health and fishing practices. Communicating how the models are connected to potential future outcomes is essential for making the case for proactive conservation measures.

Final Project: The final project can be done in a group (2-4 people). You need to finish a final project using public coastal and marine datasets. Students need to use the coastal and marine data analysis skills learned from this class to address how the data from oceanic observations and modeling could 1) guide marine conservation plans, or 2) predict future coastal and marine environmental changes, or 3) explain the past coastal and marine environmental patterns, as a case study.

Students need to present their projects as a three-page technical-style report. The reports should be no longer than three single-spaced pages, 12-point font type, and normal margins, including all figures and tables. You must at least cite 5 peer-reviewed scientific articles in your introduction section. You can also cite websites, books, and other types of articles.

This final project is the summary to let student leverage skills and knowledge to develop their project ideas, using publicly available coastal and marine datasets to form hypotheses, design data, and analysis methods, conduct analysis using digital tools, explain and visualize results, then form a report to communicate with broad audiences.

QTRS Learning Outcome 5: Effectively employ one or more digital tools to demonstrate quantitative reasoning, interpretations of calculations, or the creation and evaluation of visualizations.

Throughout the assignments and labs, multiple digital tools will be introduced including,

Excel: Assignment 1

QGIS: Assignment 2

Google Earth Engine: Assignments 3 and 4

Web-based digital platforms: Assignment 5

ChatGPT: Assignment 6

List all course-specific learning outcomes. Where appropriate, identify the associated QTRS learning outcome(s) in brackets (see below for example). Note: It is expected that a majority of course-specific learning outcomes will be associated with a QTRS learning outcome.

1. Identify, access, analyze oceanic shipborne and auto platform databases to analyze historical patterns and changes. QTRS LO1

2. Identify, access, and analyze oceanic spatial databases using open-source software QGIS. Conduct spatial analysis, spatial visualization using public datasets. QTRS LO2

3. Identify, access, and analyze oceanic satellite products and images from NOAA and NASA. Conduct analysis and visualization of raster results using QGIS. QTRS LO3

4. Access, and analysis coastal shallow ecosystem information from the Allen Coral Atlas project. Conduct analysis and mapping of shallow coral reefs environments. QTRS LO4

5. Be familiar with A.I. tools in oceanic research. Apply ChatGPT in research backgrounds survey and analysis. QTRS LO5

6. Be familiar with the Google Earth Engine, building a Google Earth Engine APP to share research outcomes. QTRS LO3

7. Understand data roles in coastal and marine research. Design and conduct data analysis research to guide real-world marine and coastal protection and management. QTRS LO4

Provost Use Only

Backmapped Maroon Approval

No Response

Form Submission - Proposer

Submitted for Approval | Proposer

Laura Zafirakis - August 22, 2024 at 1:17 PM (America/Phoenix)

Department Approval

Approved

Althea Pergakis

Susanne Neuer - August 22, 2024 at 1:29 PM (America/Phoenix)

GSC Coordinator Review

Sent Back

Alicia Alfonso - August 23, 2024 at 11:09 AM (America/Phoenix)

GS outcome statements may not be edited on the syllabus from what is in the official document:
https://docs.google.com/document/d/1JrFD2qKryUpvc0wvj4C2N8i0lqoQKY4XRmFOgkNnyF0/edit
For QTRS outcome 3 on the proposal, could you add sample questions from the mid-term that demonstrate the learning outcome.
For QTRS outcome 5 on the proposal, please name the assignments or labs where the tools are used.

April Randall

Form Submission - Proposer

Submitted for Approval | Proposer

Laura Zafirakis - August 26, 2024 at 3:23 PM (America/Phoenix)

Department Approval

Approved

Althea Pergakis

Susanne Neuer - August 26, 2024 at 3:28 PM (America/Phoenix)

GSC Coordinator Review

Sent Back

Alicia Alfonso - August 29, 2024 at 2:54 PM (America/Phoenix)

GS outcome statements may not be edited on the syllabus from what is in the official document. Please change QTRS outcome 5 on the syllabus to what is in the official document: https://docs.google.com/document/d/1JrFD2qKryUpvc0wvj4C2N8i0lqoQKY4XRmFOgkNnyF0/edit

April Randall

Form Submission - Proposer

Submitted for Approval | Proposer

Laura Zafirakis - September 3, 2024 at 12:38 PM (America/Phoenix)

Department Approval

Approved

Althea Pergakis

Susanne Neuer - September 9, 2024 at 8:36 PM (America/Phoenix)

GSC Coordinator Review

Approved

Alicia Alfonso - September 10, 2024 at 12:47 PM (America/Phoenix)

Identified issues have been addressed.

April Randall

Assistant Vice Provost Review

Approved

Tamiko Azuma - September 10, 2024 at 1:56 PM (America/Phoenix)

All required components confirmed.

Pre-GSC Meeting

Approved

Alicia Alfonso

April Randall - September 10, 2024 at 4:53 PM (America/Phoenix)

Quantitative Reasoning (QTRS) Subcommittee

Acknowledgement Requested

Abhishek Singharoy - September 19, 2024 at 10:43 AM (America/Phoenix)

Jason Nichols

Terri Kurz - October 1, 2024 at 8:35 AM (America/Phoenix)

Revise and Resubmit: The course seems like it could be a good fit for QTRS designation. The committee is requesting a few edits. First, please carefully makes sure that the language in the course learning outcomes is aligned with the QTRS learning outcomes. Minor edits to the course learning outcomes to more richly connect to quantitative reasoning are needed. Second, the assignment(s) connected to the fifth QTRS learning outcome on the General Studies Course Request form is(are) not clear. Please be more specific rather than just providing a list. Finally, the descriptions for the assignments were unclear to some committee members. Specificity in the descriptions of some of the assignments are needed, particularly in the syllabus. Students will likely be confused if the assignments are provided as written in the current syllabus.

Michelle Mancenido

Elizabeth Kizer

General Studies Council Meeting

Waiting for Approval

Alicia Alfonso

April Randall

Registrar Notification

Notification

Courses Implementation

Implementation

Approval

Rebecca Flores

Lauren Bates

Alisha Von Kampen

Proposer Notification

Notification

Laura Zafirakis

College Notification

Notification

Althea Pergakis

Sharon Hall

Lisa Murphy

ATCS Notification - ASU Course

Notification

Bryan Tinlin

Jessica Burns

Michele Devine

DARS Notification

Notification

Leticia Mayer

Peggy Boivin

EdPlus Notification

Notification

Sarah Shipp

Bronson Cudgel
