Department of Earth, Ocean and Atmospheric Sciences - EOAS

Re-invigorating Quantitative Curriculum for Earth, Ocean & Atmospheric Science Specializations

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~ ~ *Project mid-point update* ~ ~

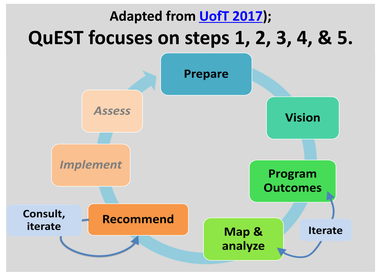
Motivating Question: *How best to adapt degrees, courses & practices to meet changing needs for Quantitative Earth Science (**QES**) disciplines?*

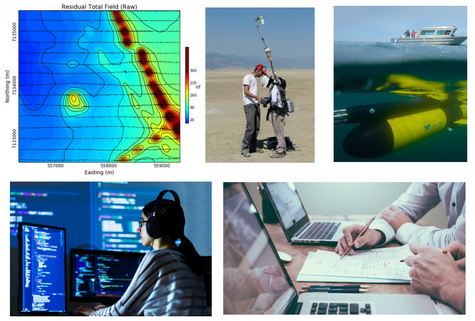
Project goals

- **Characterize current quantitative curricula** in EOAS specializations;
- **Recommend adjustments** to meet the needs of future students and society in emerging Quantitative Earth science (QES) occupations;
- **Attract & inspire** appropriate students to pursue QES degrees or take QES courses.

QES disciplines include primarily Atmospheric Sciences, Oceanography, Geophysics.

Curriculum renewal process





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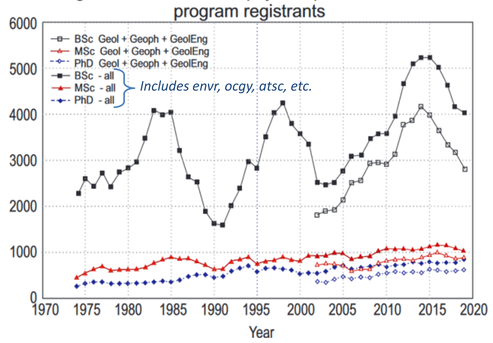
Progress Icons:
- Almost done
- In progress
- Planned

Prepare

Why now? Context & Contributors

- **Geoscience is becoming more quantitative and is growing in importance.**
  > E.g. AGI's "Vision and Change in the Geosciences", March 2021.
- **Meanwhile - declining undergrad enrollments across the geosciences**
  > From https://cccesd.acadiau.ca/2019summary.pdf:

Fig. 1. Number of BSc (> year 1), MSc and PhD program registrants



- **Therefore:** we will revisit quantitative geoscience specializations & courses to ...
  - enhance relevance of courses and curriculum;
  - increase enrollments of appropriate students;
  - showcase the diverse opportunities & potential of corresponding careers;
  - ensure learning aligns with students' needs, expectations & future occupations.
- **Five** relevant degree programs in EOAS (current enrolments):
  1. Atmospheric sciences (~14 students / yr)
  2. Environmental sciences (~55 students / yr)
  3. Geological engineering (~45 students / yr)
  4. Geophysics (~9 students / yr)
  5. Oceanography (~30 students / yr)
- **Geoscience education specialist** attached (1/2 time).
- **22 Faculty** participants.
- **Student** contributors (worklearn, undergraduate clubs, student feedback).
- CTLT Curriculum and Course services → curriculum review.
- Centre for Student Involvement & Careers → address QES career preparation.

Vision

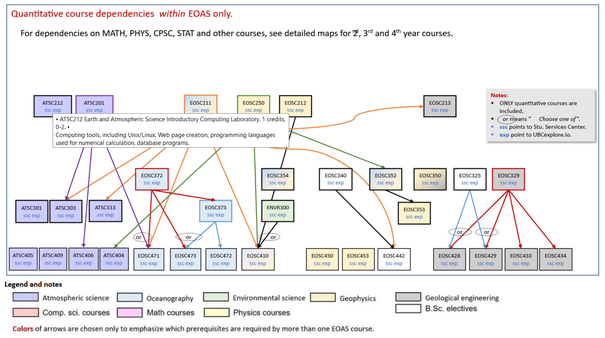
From the funded proposal …

- *"…transform and modernize quantitative Earth sciences (QES) education at UBC."*
- *"…define new, forward-looking outcomes for our QES specializations"*
- *"…maximize efficiency & build new inter-disciplinary synergies, giving students a more integrated capacity to apply quantitative thinking to Earth Sciences."*
- *"…target sustainable enrollments."*

Program Outcomes / Map & analyze

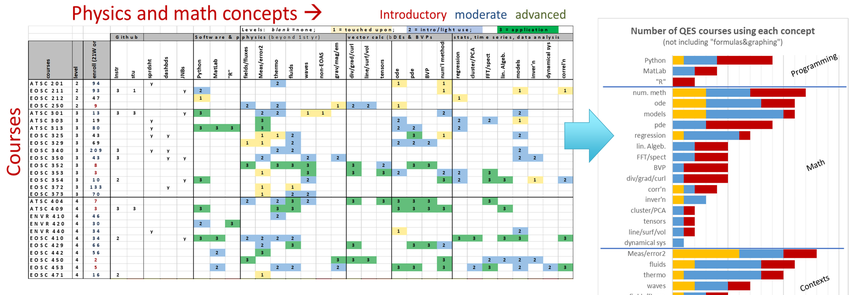
Actions and status

- **Background & context:** peers, alumni, non-academic sectors, & hiring trends.
- **Current UBC QES course dependencies:** Online visualization helps find relationships, gaps & opportunities: https://www.eoas.ubc.ca/~quest



- **QES course-content matrix based on syllabi and interviews.**
  Mapping courses against math, physics & computing concepts they include.

Physics and math concepts → Introductory moderate advanced



- **Generate consistent Course Learning Outcomes** (CLOs)
- **Propose new Program Learning Outcomes** (PLOs)
- **Student insights:** Past & present geophysics students:
  From **interviews** (2022) & EOAS specialization **surveys/focus grps** (2020)
  - ***Likes:*** *>small dep't; >faculty support & expertise; >focus on fundamentals.*
  - ***Student's recommendations:***
    > review relevancy of pre-requisites;
    > courses are too heavy on global & fundamentals;
    > courses could have more applied aspects and "career preparation";
    > improve sense of academic community for QES specializations.
- Consider creative **alternative credential** options (certificates, badges, degrees, etc.)

Recommend

Opportunities vs Risks

To formulate recommendations, **consulting** and **discussion** must focus on balancing priorities of **faculty** and future needs of **students**.

- **Some QES content balancing acts:**
  - Breadth ←→ depth (content & skills)
  - Existing ←→ new skills (eg, R or Python)
  - Top-down ←→ bottom-up learning frameworks
  - Fundamentals ←→ career preparation
  - Instructors ←→ students' & employers' priorities
- **Some QES pedagogic balancing acts:**
  - Existing ←→ new techniques
  - Math ←→ computing … paper ←→ technology
  - Lecture ←→ activity-driven learning
  - Topic list ←→ "challenge-based" or "project oriented"
  - Conventional assessment ←→ high level student products

Marketing

Showcase QES as a rewarding & impactful option

Actions to make QES more visible to prospective students & the public:

- **Renovate** geophysics degree; more versatile prereq's & electives.
- **Partner** with BC & Canadian geophysical community: careers for greening economies, scholarships, internships, showcase occupations.
- **DSCI 100**: develop an Earth science oriented, python-based section.
- **Partner** with math, physics etc. to use QES contexts for learning.
- **EOAS web** is increasing the visibility of QES options & opportunities.
- **Outreach** partnerships: Pacific Museum of Earth, GeeringUP & others.
  E.g. Podcasts, videos, spotlights on faculty, research, students & others.
- Updated **co-op work term** and **careers** info. & advice.
- **Showcase** the importance & impact on society of occupations in:
  - Atmospheric sciences
  - Oceanography
  - Geophysics
- **Leverage** efforts of others – e.g. GROW https://www.grow-geocareers.com/home.html
- Instigate / support **networking** opportunities for students.

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Details & pointers

- Summary: https://www.eoas.ubc.ca/education/current-major-initiatives/quest
- Curriculum renewal https://ctlt.ubc.ca/2021/11/25/edubytes-curriculum-renewal/
- Career preparation: https://students.ubc.ca/career/career-resources
- Contact : Francis Jones <fjones@eoas.ubc.ca>