

**New Graduate Minor
Risk and Uncertainty Quantification in Earth Systems**

Status: Pending Review - Graduate Council Chair ([Previous Version](#))

1. Review - College Approver - Earth, Ocean & Atmospheric Sciences

Approved by [Anita Grunder](#) Assoc Dean-Academic Programs / Earth, Ocean & Atmo Sci, March 29, 2016 3:33pm

2. Review - Curriculum Coordinator

Sent Back by [Cheryl Hagey](#) Administrative Program Assist / Acad Prgms/Assess/Accred, April 11, 2016 8:21am

Comments

Cheryl Hagey (Curriculum Coordinator) April 11, 2016 8:21am
SUMMARY: Sent back at the request of the Originator.

3. Originator Response

[Katherine Hoffman](#) Coord-Research IGERT / Earth, Ocean & Atmo Sci, April 12, 2016 11:32am

4. Review - Curriculum Coordinator

Approved by [Cheryl Hagey](#) Administrative Program Assist / Acad Prgms/Assess/Accred, April 13, 2016 11:44am

Comments

Cheryl Hagey (Curriculum Coordinator) April 13, 2016 11:44am
SUMMARY: This NEW Graduate Minor seeks to add a new opportunity for students.

CIP number 400699 has been added to the proposal.

MTH 528 has been pulled from the Requirements Block with Originator's approval. This course is still in Draft format and must be submit in the CPS to be used in the Program.

All Components are met per the Faculty Senate Curriculum Council guidelines

5. Review - Graduate Council Chair

Pending Review

More Queued Reviews (5)

Graduate School; CC Rep - Earth, Ocean & Atmospheric Sciences; Curriculum Council Chair; Academic Programs; Catalog Coordinator

Proposal

Proposal ID: 96015
Type: New Option/Minor
Submission Date: April 12, 2016 11:32am
Effective Term: Fall 2016

Justification: Current models for educating doctoral- and master-level earth system scientists and managers do not address the new workplace requirements of science professionals. Scientific and applied issues in Earth Systems are technically and socially complex, involving many forms of science, interests, perspectives, and stakeholders. New observatory platforms and analytic models provide technical challenges for analyzing and interpreting large data. Complex resource management issues need solutions that bridge the natural, technological, and social sciences. Thus, scientists and managers need to work in integrated teams to generate new scientific knowledge and to develop new policies for natural resource governance.

The graduate minor in Risk and Uncertainty Quantification in Earth Systems will provide graduate students with knowledge and skills to quantify and communicate risk and uncertainty derived from the analyses of large data in Earth System Science. The minor has an application focus on marine science and resource management, yet will be relevant to students from other fields of earth system science, as well as statistics, computer science, and mathematics. Students will extend their ability to perceive and solve problems in a transdisciplinary context related to statistical inference, uncertainty quantification, risk analyses, earth, and social systems. Students will also acquire professional skills in communication and collaboration.

Comments: All instructors have approved of their courses being used as part of the minor.

The CEOAS Graduate Proposal Committee (GPC) has approved minor per Anita Grunder, Associate Dean for Academic Programs 3/16/16 (attached)

Addition of OC 523 has been accepted 3/22/16 (attached)

History

Active Version - Submitted April 12, 2016 11:32am

[Version 1](#) - Submitted March 25, 2016 12:42pm

Originators

NAME	TITLE	DEPARTMENT/SCHOOL
Katherine Hoffman	Coord-Research IGERT	Earth, Ocean & Atmo Sci
Melinda Jensen	Office Mgr-Student Services	Earth, Ocean & Atmo Sci
Julia Jones	Professor	Geosciences
Lorenzo Ciannelli	Associate Professor	Earth, Ocean & Atmo Sci

Contacts

No contacts

Liaisons

LIAISON	STATUS	REQUIRED
Flaxen Conway - Professor / Sea Grant	Expired	No
Thomas Dieterich - Dir-Intelligent Sys Rsrch / Sch Elect Engr/Comp Sci	Expired	No
Anita Grunder - Assoc Dean-Academic Programs / Earth, Ocean & Atmo Sci This proposal has not yet been vetted by the college. Please stand by while I get this cleared up in house. (Responded on Feb 23, 2016)	Responded	Yes
Sastry Pantula - Dean-COS / College of Science Admin	Expired	No
Brett Tyler - Director-CGRB / VP for Research	Expired	No
Eugene Zhang - Associate Professor / Sch Elect Engr/Comp Sci	Expired	No

Program Information

Program Title: Risk and Uncertainty Quantification in Earth Systems

CIP Code: 400699

College/Department or College/School: College of Earth, Ocean and Atmospheric Sciences / No Department

Program Type: Graduate Minor

Description:

Marine and coastal scientific and management issues are technically and socially complex, involving many forms of science, interests, perspectives, and stakeholders. There is much uncertainty in modeling forecast and policy outcome associated with climate change and global markets. This interdisciplinary minor will provide graduate students with knowledge and skills to quantify and communicate risk and uncertainty derived from the analyses of large data in earth system science. The minor is focused on marine science and resource management, yet will be relevant to students from a variety of fields. Students will extend their ability to perceive and solve problems in a transdisciplinary context related to statistical inference, uncertainty quantification, risk analyses, earth system science, and social systems. Students will also acquire professional skills in communication and collaboration. The world is changing. Join us in becoming more resilient. The minor is open to all OSU graduate students.

Requirements:

Graduate Ph.D students are required to complete at least 18 credit hours, M.S. students complete 15 credits.

All students complete the professional development requirement (6 credits).

Additional credits are taken from 4 following specializations:

- Big Data and Uncertainty Quantification
- Risk Analyses
- Earth Systems
- Social Systems

Mentoring requirements

There must be a minor professor in the student committee. The minor professor is in any of the fields where course designators fall

Documents

FILE NAME	FILE SIZE	COMMENT	DATE ADDED
CEOAS_GPS_Mtg.pdf	89.06 Kb		Apr 11, 2016 8:21 am
Addition of OC_523.pdf	60.10 Kb		Apr 11, 2016 8:21 am

Requirements

Graduate Ph.D students are required to complete at least 18 credit hours, M.S. students complete 15 credits.

All students complete the professional development requirement (6 credits).

Additional credits are taken from 4 following specializations:

- Big Data and Uncertainty Quantification
- Risk Analyses
- Earth Systems
- Social Systems

Mentoring requirements

There must be a minor professor in the student committee. The minor professor is in any of the fields where course designators fall but must not be from student's major.

Classes for Minor Graduate Ph.D students are required to complete at least 18 credit hours, M.S. students are required to complete at least 15 credit hours for the minor.

Ph.D students take 1 course from each of the 4 remaining areas (Big data and Uncertainty Quantification, Risk Analyses, Earth Systems, and Social Systems).

M.S. students take 1 course in Social Systems and 1 in Earth Systems and choose 1 course from either Big Data and Uncertainty Quantification or Risk Analysis.

Professional Development:

Special Topics in Marine Resource Management (6) (2 credit hours each fall, winter, and spring term in sequence):

- a.) MRM 525. Special Topics (part 1) [Marine and Earth Systems Science: Foundations in Risk and Uncertainty] (2)
- b.) MRM 525. Special Topics (part 2) [Marine and Earth Systems Science: Collaborative Working Structures in Risk and Uncertainty] (2)
- c.) MRM 525. Special Topics (part 3) [Marine and Earth Systems Science: Communication of Risk and Uncertainty] (2)

Big Data and Uncertainty Quantification options:

CS 534. Machine Learning (4)#

CS 515. Algorithms and Data Structure (4)#

GEOG 565. Spatio-Temporal Variation in Ecology and Earth Science (4)

GEOG 566. Advanced Spatial Statistics and Gis-Science (4) **(Pending Approval)**

ST 538. Modern Analytical Methods for Large and Complex Datasets (3)- **(Pending Approval)**

ST 599. Special Topics [Big Data and Uncertainty Quantification] (3)

Risk Analysis options:

- FW 544. Quantitative Decision Analysis for Fish and Wildlife Management (4)
- ME 515. Risk and Reliability Analysis in Engineering Design (4)
- MTH 527. Introduction to Mathematical Biology (3)
- MTH 567. Actuarial Mathematics (3)
- MTH 563. Probability I (3)
- MTH 599. Special Topics [Risk Analysis] (3)

At least one class from Earth Systems options:

- ATS 520. Principles of Climate: Physics of Climate and Climate Change (4)
- OC 523. Ocean Ecological Dynamics (4)
- OC 533. Coast and Estuarine Oceanography (3)
- GEO 550. Coastal Hazards: Processes, Response, and Adaptation (3)
- GEO/SOIL 684. Global Biogeochemical Cycles (4)
- OC/FW. 534 Estuarine Ecology (4)
- OC 599. Special Topics [Earth Systems Science] (3)
- OEAS. 520 The Solid Earth (4)#
- OEAS. 530 The Fluid Earth (4)#
- OEAS. 540 Bio-Geochemical Earth (4)#

At least one class from Social Systems options:

- AEC 552. Marine Economics (3)
- ANTH 581. Natural Resources and Community Values (4)
- COMM 599. Special Topics [Policy Conflict and Public Participation] (3)
- MRM 530. Principles & Practices of Marine Resource Management (3)
- PPOL 545. International Marine Policy (4)
- PPOL 546. The Policy and Law of United States Coastal Governance (4)
- PPOL 548. Marine Policy in the United States (4)
- SOC 581. Society and Natural Resources (4)

Classes where a more advanced listing can be substituted.

Documents

FILE NAME	FILE SIZE	COMMENT	DATE ADDED
CEOAS_GPS_Mtg.pdf	89.06 Kb		Apr 11, 2016 8:21 am

Minutes GPC meeting March 16 2016
2-2:45 P.M. 203 Wilkinson Hall:

Present: Anita Grunder, Flaxen Conway, Robert Allen, Ed Brook, Joe Stoner, Andreas Schmittner, Rob Wheatcroft, Byron Crump, and Katherine Hoffman

Topic: Risk and Uncertainty Quantification in Marine Science and Policy minor proposal

- 1) Anita handed out a document with the most recent additions and went over that:
 - OEAS 520 Solid Earth (4) was added
 - ATS 520 Principles of Climate (4) was added (instead of ATS 521 as it is a prerequisite of ATS 521)
 - 18 credits for Ph.D and 15 credits for M.S. are required for the minor
 - All students complete the professional development (6 credits) area
 - Additional credits are taken from 4 following specializations:
 - --Big data and uncertainty quantification
 - --Risk analyses
 - --Earth systems
 - --Social systems
 - Ph.D. students take 1 course from each of the 4 areas above. M.S. students take 1 course in social systems and 1 in earth systems and choose 1 course from either big data and uncertainty quantification or risk analysis.
 - There must be a minor professor on the student committee. The minor professor is in any of the fields where course designators fall but must not be from student's major.
 - Any graduate student can take minor and can count minor credits to completion of major.

a. 2) After much discussion, the committee approved minor with suggestions:

- Change title from "Earth System Science" which entails interaction of energy and matter between systems to "Risk and Uncertainty Quantification in Earth Systems" OR "Risk and Uncertainty Quantification in Natural Systems"
- Fill in GEO 541 Spatio-Temporal Variation in Ecology and Earth Science with new course designator GEOG 565
- Fill in GEO 584 Advanced Spatial Statistics and GIS-Science with new course designator GEOG 566
- Put *next to classes where a more advanced class can be substituted:
 - i. Such as *CS 534 Machine Learning (4)
 - ii. Such as *CS 515 Algorithms and Data Structure (4)
 - iii. Such as *OEAS 540 Bio-Geochemical Earth (4)
 - iv. Such as *OEAS 520 The Solid Earth (4)

Decision Analysis for Fish and Wildlife Management

At least one class from Earth Systems options:

- OC 599 Special topics in Earth System Science (3)
- OC 523 Ocean Ecological Dynamics (4)
- OEAS *540 Bio-Geochemical Earth (4)
- OEAS *520 The Solid Earth (4)
- OEAS *530 The Fluid Earth (4)
- ATS 520 Principles of Climate (4)
- GEO 550 Coastal Hazards (4)
- GEO 684 Global Biogeochemical Cycles (4)
- OC/FW 434/534 Estuarine Ecology (4)

At least one class from Social Systems options:

- COMM 599 Policy Conflict and Public Participation (3)
- PPOL 546 The Policy and Law of United States Coastal (4)
- PPOL 545 International Marine Policy (4)
- PPOL 548 Marine Policy (4)
- SOC 581 Society and Natural Resources (4)
- MRM 530 Principles & Practices of MRM (3)
- ANTH 581 Natural Resources and Community Values (4)
- AEC 552 Marine Economics (3)

*classes where a more advanced class can be substituted:

Subject: Re: OC 522 and 523

From: Rob Wheatcroft <raw@coas.oregonstate.edu>

Date: 3/22/16, 1:24 PM

To: Lorenzo Ciannelli <lciannel@coas.oregonstate.edu>

CC: anita grunder <grundera@geo.oregonstate.edu>, Katherine Hoffman <Hoffmank@science.oregonstate.edu>, Flaxen Conway <fconway@coas.oregonstate.edu>

Sounds good from NH-5. Signing out. -rob

On 3/22/16 11:30 AM, Lorenzo Ciannelli wrote:

Hi Rob,

I am sorry if this comes up while you are taking students out, but moving ahead with the minor proposal is also a priority.

I am asking to keep at least OC523 in the minor proposal for the reasons listed below.

1. Without it, the Minor does not have a course that represents the ocean biological system. Without it I will then be forced to find a viable substitute either in FW or IB, which besides being less than ideal (this minor is also fulfilling the curriculum need of the NRT program, which is focused in oceanic systems), seems also counter-productive.
2. I spoke with Ricardo (currently teaching OC523) and he indicated that students taking this course do not need to be simultaneously registered for OC521 and OC522. I do know of at least one student, from nuclear engineering, who has taken this course in the past without being registered for the other two.
3. About pre-req, many more courses listed in the minor (e.g., MTH 567) also require pre-reqs. So it will be up to the students to juggle those. This is a cross-disciplinary graduate minor, and students are aware of that, and will act accordingly. Also, students from the FW and IB are most likely to select this course, and they may have the required background to go directly in OC523.

So in summary, I ask that OC523 be put back in our proposal because:

1. it fulfills an important curriculum need of the NRT program and the minor, especially for students outside of OEAS
2. the pre-req issue is an important one, but one that equally applies to nearly all courses we listed in the minor, and that students are well aware of that
3. the simultaneous core-requirement of OC521 and OC522 does not seem to have applied in the past, and certainly does not seem to apply now
4. by including OC523 in the minor we are not providing a short cut to MRM or OC students - they will still need to fulfill their core requirements for the major. However, students from IB, FW, will greatly benefit from having this option in their curriculum.

Best, Lorenzo