# EARTH SYSTEM SCIENCE HONOURS (B.SC.) (66 CREDITS)

**Offered by:** Earth & Planetary Sciences (Faculty of Science)
**Degree:** Bachelor of Science
**Program credit weight:** 66

## Program Description

The Honours in Earth System Science (ESYS) is offered jointly by the following departments:

- Atmospheric and Oceanic Sciences (ATOC)
- Earth and Planetary Sciences (EPSC)
- Geography (GEOG)

A rigorous foundation in earth system science and the flexibility to create an individualized program in preparation for careers in industry, teaching, and research. It is also intended to provide an excellent preparation for graduate work in earth system science. A CGPA of 3.20 or higher is required for registration in and graduation from this program.

"First Class Honours" is awarded to students who obtain a minimum cumulative grade point average of 3.70, a minimum program GPA of 3.20, and a minimum grade of B+ in ESYS 300 Earth Data Analysis., ESYS 301 Earth System Modelling., and ESYS 500 Collaborative Research Project..

### Degree Requirements — B.Sc.

***This program is offered as part of a Bachelor of Science (B.Sc.) degree.***

To graduate, students must satisfy both their program requirements and their degree requirements.

- The program requirements (i.e., the specific courses that make up this program) are listed under the Course Tab (above).
- The degree requirements—including the mandatory Foundation program, appropriate degree structure, and any additional components—are outlined on the Degree Requirements page.

Students are responsible for ensuring that this program fits within the overall structure of their degree and that all degree requirements are met. Consult the Degree Planning Guide on the SOUSA website for additional guidance.

**Note**: For information about Fall 2025 and Winter 2026 course offerings, please check back on May 8, 2025. Until then, the "Terms offered" field will appear blank for most courses while the class schedule is being finalized.

## Required Courses (27 credits)

Expand allContract all

| Course | Title | Credits |
|---|---|---|
| ENVR 201 | Society, Environment and Sustainability. | 3 |
| ESYS 200 | Earth-System Interactions. | 3 |
| ESYS 300 | Earth Data Analysis. | 3 |
| ESYS 301 | Earth System Modelling. | 3 |
| ESYS 480D1 | Honours Research Project. | 3 |
| ESYS 480D2 | Honours Research Project. | 3 |
| ESYS 500 | Collaborative Research Project. | 3 |
| MATH 222 | Calculus 3. | 3 |
| MATH 315 | Ordinary Differential Equations. | 3 |

## Complementary Courses (39 credits)

3 credits from the following:

Expand allContract all

| Course | Title | Credits |
|---|---|---|
| EPSC 340 | Earth and Planetary Inference. | 3 |
| MATH 203 | Principles of Statistics 1. | 3 |

3 credits from the following:

Expand allContract all

| Course | Title | Credits |
|---|---|---|
| COMP 202 | Foundations of Programming. | 3 |
| COMP 208 | Computer Programming for Physical Sciences and Engineering . | 3 |

3 credits from the following:

Expand allContract all

| Course | Title | Credits |
|---|---|---|
| ATOC 214 | Introduction: Physics of the Atmosphere. | 3 |
| ATOC 219 | Introduction to Atmospheric Chemistry. | 3 |

3 credits from the following:

Expand allContract all

| Course | Title | Credits |
|---|---|---|
| EPSC 210 | Introductory Mineralogy. | 3 |
| EPSC 220 | Principles of Geochemistry. | 3 |

3 credits from the following:

Expand allContract all

| Course | Title | Credits |
|---|---|---|
| GEOG 308 | Remote Sensing for Earth Observation. | 3 |
| GEOG 314 | Geospatial Analysis. | 3 |
| GEOG 428 | Earth System Geographic Information Science. | 3 |

3 credits from the following:

Expand allContract all

| Course | Title | Credits |
|---|---|---|
| ENVR 200 | The Global Environment. | 3 |
| GEOG 203 | Environmental Systems. | 3 |

3 credits from the following:

Expand allContract all

| Course | Title | Credits |
|---|---|---|
| BIOL 215 | Introduction to Ecology and Evolution. | 3 |
| ENVR 202 | The Evolving Earth. | 3 |

3 credits from the following:

Expand allContract all

| Course | Title | Credits |
|---|---|---|
| ANTH 339 | Ecological Anthropology. | 3 |
| GEOG 217 | Cities in the Modern World. | 3 |
| GEOG 221 | Environment and Health. | 3 |
| GEOG 300 | Human Ecology in Geography. | 3 |
| GEOG 310 | Development and Livelihoods. | 3 |

15 credits from the following course list, with at least 3 credits from each of subject codes ATOC, EPSC, and GEOG. At least 9 of the 15 credits must be at the 400 level or higher.

Note: Courses at the 300 level or higher in other departments in the Faculties of Science and Engineering may also be used as complementary credits, with the permission of an academic adviser.

Expand allContract all

| Course | Title | Credits |
|---|---|---|
| ATOC 215 | Oceans, Weather and Climate. | 3 |
| ATOC 309 | Weather Radars and Satellites. | 3 |
| ATOC 312 | Rotating Fluid Dynamics. | 3 |
| ATOC 315 | Thermodynamics and Convection. | 3 |
| ATOC 404 | Climate Physics. | 3 |
| ATOC 512 | Atmospheric and Oceanic Dynamics. | 3 |
| ATOC 513 | Waves and Stability. | 3 |
| ATOC 515 | Turbulence in Atmosphere and Oceans. | 3 |
| ATOC 519 | Advances in Chemistry of Atmosphere. | 3 |
| ATOC 521 | Cloud Physics. | 3 |
| ATOC 525 | Atmospheric Radiation. | 3 |
| ATOC 531 | Dynamics of Current Climates. | 3 |
| ATOC 540 | Synoptic Meteorology 1. | 3 |
| ATOC 541 | Synoptic Meteorology 2. | 3 |
| BIOL 308 | Ecological Dynamics. | 3 |
| BIOL 309 | Mathematical Models in Biology. | 3 |
| BIOL 310 | Biodiversity and Ecosystems. | 3 |
| BIOL 432 | Limnology. | 3 |
| BIOL 434 | Theoretical Ecology. | 3 |
| BIOL 441 | Biological Oceanography. | 3 |
| BIOL 465 | Conservation Biology. | 3 |
| BIOL 540 | Ecology of Species Invasions. | 3 |
| BIOL 573 | Vertebrate Palaeontology Field Course. | 3 |
| BREE 217 | Hydrology and Water Resources. | 3 |
| BREE 319 | Engineering Mathematics. | 3 |
| BREE 509 | Hydrologic Systems and Modelling. | 3 |
| BREE 510 | Watershed Systems Management. | 3 |
| BREE 533 | Water Quality Management. | 3 |
| ECON 347 | Economics of Climate Change. | 3 |
| ECON 405 | Natural Resource Economics. | 3 |
| EPSC 212 | Introductory Petrology. | 3 |
| EPSC 320 | Elementary Earth Physics. | 3 |
| EPSC 325 | Environmental Geochemistry. | 3 |
| EPSC 331 | Field School 2. | 3 |
| EPSC 334 | Invertebrate Paleontology. | 3 |
| EPSC 340 | Earth and Planetary Inference. | 3 |
| EPSC 341 | Field School 3. | 3 |
| EPSC 350 | Tectonics. | 3 |
| EPSC 355 | Sedimentary Geology. | 3 |
| EPSC 423 | Igneous Petrology. | 3 |
| EPSC 425 | Sediments to Sequences. | 3 |
| EPSC 445 | Metamorphic Petrology. | 3 |
| EPSC 452 | Mineral Deposits. | 3 |
| EPSC 519 | Isotopes in Earth and Environmental Science. | 3 |
| EPSC 525 | Microbiology of the Earth System. | 3 |
| EPSC 530 | Volcanology. | 3 |
| EPSC 549 | Hydrogeology. | 3 |
| EPSC 561 | Ore-forming Processes. | 3 |
| EPSC 567 | Advanced Volcanology. | 3 |
| EPSC 590 | Applied Geochemistry Seminar. | 3 |
| GEOG 272 | Earth's Changing Surface. | 3 |
| GEOG 305 | Soils and Environment. | 3 |
| GEOG 321 | Climatic Environments. | 3 |
| GEOG 322 | Environmental Hydrology. | 3 |
| GEOG 351 | Quantitative Methods. | 3 |
| GEOG 372 | Running Water Environments. | 3 |
| GEOG 401 | Socio-Environmental Systems: Theory and Simulation. | 3 |
| GEOG 414 | Advanced Geospatial Analysis. | 3 |
| GEOG 470 | Wetlands. | 3 |
| GEOG 495 | Field Studies - Physical Geography. | 3 |
| GEOG 499 | Subarctic Field Studies. | 3 |
| GEOG 505 | Global Biogeochemistry. | 3 |
| GEOG 506 | Advanced Geographic Information Science. | 3 |
| GEOG 523 | Global Ecosystems and Climate. | 3 |
| GEOG 530 | Global Land and Water Resources. | 3 |
| GEOG 535 | Remote Sensing and Interpretation. | 3 |
| GEOG 536 | Geocryology. | 3 |
| GEOG 537 | Advanced Fluvial Geomorphology. | 3 |
| GEOG 550 | Historical Ecology Techniques. | 3 |
| MATH 314 | Advanced Calculus. | 3 |
| MATH 317 | Numerical Analysis. | 3 |

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|---|---|---|
| MATH 319 | Partial Differential Equations . | 3 |
| MATH 323 | Probability. | 3 |
| MATH 326 | Nonlinear Dynamics and Chaos. | 3 |
| MATH 423 | Applied Regression. | 3 |
| MATH 437 | Mathematical Methods in Biology. | 3 |
| MATH 447 | Introduction to Stochastic Processes. | 3 |
| MATH 525 | Sampling Theory and Applications. | 4 |
| PHYS 331 | Topics in Classical Mechanics. | 3 |
| PHYS 340 | Majors Electricity and Magnetism. | 3 |
| PHYS 342 | Majors Electromagnetic Waves. | 3 |
| PHYS 404 | Climate Physics. | 3 |
| PHYS 432 | Physics of Fluids. | 3 |