UNIVERSITY OF WASHINGTON

OFFICE OF THE PRESIDENT

Mark A. Emmert, President

October 13, 2008

Dean Ana Mari Cauce
College of Arts and Sciences
Box 353765

Dear Ana Mari:

Based on the recommendation of its Subcommittee on Admissions and Programs, the Faculty Council on Academic Standards has recommended approval of the revised requirements for the Bachelor of Science degree in Atmospheric Sciences. A copy of the changes is attached.

I am writing to inform you that the Department of Atmospheric Sciences is authorized to specify these requirements beginning winter quarter 2009.

The new requirements should be incorporated in printed statements and in individual department websites as soon as possible. The *General Catalog* website will be updated accordingly by the Registrar's Office.

Sincerely yours,

Mark A. Emmert
President

Enclosure

cc: Ms. Samantha Scherer (with enclosure)
Mr. Robert Corbett (with enclosure)
Dr. Deborah H. Wiegand (with enclosure)
Mr. Todd Mildon, J.D. (with enclosure ATMS-20080312)

301 Gerberding Hall • Box 351230 • Seattle, Washington 98195-1230 • 206-543-5010 • FAX: 206-616-1784

JUN 04 2008

UNIVERSITY OF WASHINGTON

CREATING AND CHANGING UNDERGRADUATE ACADEMIC PROGRAMS

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For information about when and how to use this form: http://depts.washington.edu/uwcr/1503instructions.pdf

College	Department or Unit	Date
Arts & Sciences	Atmospheric Sciences	3/12/08

New Programs

- ☐ Leading to a Bachelor of ______ in ______ degree.
- ☐ Leading to a Bachelor of ______ degree with a major in ______.
- ☐ Leading to a ______ Option within the existing major in ______.
- ☐ Leading to a minor in ______.

Changes to Existing Programs

- ☐ New Admission Requirements for the Major in ______ within the Bachelor of ______.
- ☐ Revised Admission Requirements for the Major in ______ within the Bachelor of ______.
- ☑ Revised Program Requirements for the Major in Atmospheric Sci within the Bachelor of Sciences.
- ☑ Revised ~~Requirements for the Option~~ in ~~All options~~ specializations ~~within the major in Atmospheric Sciences~~.
- ☐ Revised Requirements for the Minor in ______.

Other Changes

- ☐ Change name of program from ______ to ______.
- ☐ New or Revised Continuation Policy for ______.
- ☐ Eliminate program in ______.

Proposed Effective Date:

Quarter: ☐ Autumn ☑ Winter ☐ Spring ☐ Summer **Year: 20**09

Contact Person	Contact's Phone	Contact's Email
Samantha Scherer	206 – 543 – 4576	iamsams@u.washington.edu

EXPLANATION OF AND RATIONALE FOR PROPOSED CHANGE

For new programs, please include any relevant supporting documentation such as student learning outcomes, projected enrollments, letters of support and departmental handouts. *(Use additional pages if necessary).*

The department would like to change the options for the major to reflect the needs of our students. The Meteorology option is retained. The Atmosphere and the Environment option has been renamed Atmospheric Chemistry and Air Quality. The Atmosphere and Ocean option has been renamed the Climate option. The Teacher Education option will be ended since the School of Education dropped its five-year program for teacher certification for students in the Earth Sciences. The course list for each option has been reviewed and some changes have been made to reflect new offerings in the key departments. The three options will reflect the major divisions in atmospheric sciences and the department. See attached, pages 3 & 4, for more info.

We have also changed the required physical meteorology courses from ATM S 340 and ATM S 431 (5 credits each) to a replacement sequence (ATM S 340, 341, and 431; 3 credits each). The new sequence contains the same material but organizes it in a more logical and coherent way. Course change and new course applications are being submitted separately. See attached, pages 5-7, for more info.

Contact Prof. Cliff Mass (cliff@atmos.washington.edu, 206-685-0910)

CATALOG COPY

Catalogue Copy as currently written. Include only sections/paragraphs that would be changed if you request is approved. Please cross out or otherwise highlight any deletions.

90 credits as follows:

1. Core requirements (71 credits for the major, plus 5 credits for QSR): MATH 124, MATH 125, MATH 126; MATH 324; PHYS 121, PHYS 122, PHYS 123; AMATH 301, AMATH 351, AMATH 353; CSE 142; ATM S 301, ATM S 321, ATM S 340, ATM S 358, ATM S 370, ATM S 431, ATM S 441
2. Area of specialization: 19 credits of additional coursework at the 200 level or above, selected in consultation with the faculty adviser. Suggested options include meteorology, atmosphere and environment, atmosphere and ocean, and teacher education.
3. A grade of 2.0 or better in each of the required courses and an overall GPA in these courses of 2.50.

PROPOSED CATALOG COPY

Reflecting requested changes (Include exact wording as you wish it to be shown in the printed catalog. Please underline or otherwise highlight any additions. If needed, attach a separate, expanded version of the changes that might appear in department publications)

89 credits as follows:

1. Core requirements (70 credits for the major, plus 5 credits for QSR): MATH 124, MATH 125, MATH 126; MATH 324; PHYS 121, PHYS 122, PHYS 123; AMATH 301, AMATH 351, AMATH 353; CSE 142; ATM S 301, ATM S 321, ATM S 340, ATM S 341, ATM S 358, ATM S 370, ATM S 431, ATM S 441
2. Area of specialization: 19 credits of additional coursework at the 200 level or above, selected in consultation with the faculty adviser. Suggested options include Meteorology, Atmospheric Chemisty and Air Quality, and Climate.
3. A grade of 2.0 or better in each of the required courses and an overall GPA in these courses of 2.50.

SIGNATURES (required)

Chair/Program Director [signature]	Date 3/14/08
Dean [signature]	Date MAY 29 2008
College Committee [signature]	Date MAY 29 2008
Faculty Council on Academic Standards John Schaufelberger	Date OCT. 10, 2008

UoW 1503 (12/05) REVERSE

RESET FORM

Revised Undergraduate Tracks

In the department undergraduate program, all students take a collection of core classes and then supplement them with additional classes selected from several pre-arranged tracks that include at least 19 credit hours at the 200 level or above. The option to create a custom track is offered, but rarely is taken. Currently, we have four tracks:

Atmosphere and the Environment: Directed towards students interested in air quality and atmospheric chemistry.

Meteorology: For students interested in a general background or forecasting.

Atmosphere and Ocean: For students wanted to combine study of both. Only a handful of students have followed this route

Teacher Education Focus: This option is not available now due to new policies in the School of Education.

Nearly all (95%) of our students have taken the meteorology option and none have followed the Teacher Education Focus. We propose to simplify the prearranged tracks to three, areas that reflect the major directions of our department and discipline:

Meteorology
Climate
Atmospheric Chemistry and Air Quality

Specific Descriptions of the Tracks

I. Meteorology

This track provides students with a strong background in dynamics, synoptic meteorology and weather forecasting, and covers the coursework required for entry into the National Weather Service, military forecasting careers and graduate school in the atmospheric sciences. The elective courses selected for this track are:

STAT 390: Basic Statistical Analysis (4)
ATM S 442: Atmospheric Motions II (5)
ATM S 451W: Instruments and Observations (5)
ATM S 452: Weather Forecasting and Advanced Synoptic Meteorology (5)

Other recommended courses for this option:

- General Studies 350 (Internship) or
- ATM S 492 (Research/Independent Study).

II. Climate

This track provides additional background in oceanography and glaciology so that a student has a widened perspective of the climate system.

- ATM S 442: Atmospheric Motions II (5)
- OCEAN 200 Introduction to Oceanography (3)
- OCEAN 210 Ocean Circulation (3)
- ESS 431 Principles of Glaciology (3)
- STAT 390 Basic Statistical Analysis (4)

Additional "recommended" classes for this option:

- ATM S 587: Climate Dynamics
- ATM S 588: Global Carbon Cycle and Greenhouse Gases
- OCEAN 420: Physical Processes in the Ocean
- ATM S 451: Instruments and Observations
- ATM S 505: Fluid Dynamics
- ATM S 492 (Research/Independent Study)

III. Atmospheric Chemistry and Air Quality Track

This track is aimed at students with interests in chemistry and/or environmental engineering who would like to apply their knowledge of atmospheric sciences to environmental issues such as evolving atmospheric composition and air quality. Students selecting this track will take all core courses EXCEPT ATMS 358 and the following:

- CHEM 142 (5)
- CHEM 152 (5)
- ATMS 458 (4)

And, at least two from the following*:

- CHEM 455** Physical Chemistry – Quantum Mechanics and Spectroscopy (3)
- CHEM 457** Physical Chemistry – Kinetics and Statistical Mechanics (3)
- CEE 480 Air Quality Modeling (3)
- CHEM E 468 Air Pollution Control Design (3)
- PHYS 341 Energy and Environment I (3)
- PHYS 342 Energy and Environment II (3)
- ESS 424 Water in the Environment (3)
- STAT 390 Basic Statistical Analysis (4)

*Other courses are available, students should discuss their plans and interests with one of the undergraduate track advisors.

**These courses have CHEM 162 as a prerequisite.

New Undergraduate Physical Meteorology Sequence

Today we have two five credit classes in physical meteorology:

ATMS 340: Thermodynamics, Hydrostatics and Cloud Processes
ATMS 431: Radiation, Turbulence and boundary layer.

These daily, five-credit courses are a burden on faculty and students and divide the material in awkward ways. Another issue has been duplication of material with other courses (e.g., thermodynamics and hydrostatics with 301, radiation with 321). Furthermore, there have often been split teaching assignments that make teaching and evaluation difficult.

It is proposed to replace these two courses with three, 3-credit classes, for a reduction of one credit hour:

ATMS 340 (W) Thermodynamics and Cloud Processes
ATMS 341 (S) Atmospheric Radiative Transfer
ATMS 431 (A) Boundary Layer Meteorology

The outlines of these new or amended courses are found below:

ATMS 340: Thermodynamics and Cloud Processes (W, 3 credits)

Text: Bohren and Albrecht or Wallace and Hobbs.

Introduction and thermodynamics review:
Why thermodynamics is important for atmospheric science. Reviews of the ideal gas law, first law of thermodynamics. Isothermal and adiabatic processes. Potential temperature. Hydrostatic equation, hypsometric equation, geopotential height and thickness. *Note: this is mainly a review of material that has been covered in about 8-10 lectures in 301.*

Second law of thermodynamics:
Carnot cycle, second law, principles of entropy, phase changes, Clausius-Clapeyron equation

Adiabatic processes, stability and thermodynamic charts:
Moist and dry adiabatic processes and stability concepts, conditional instability. Thermodynamic charts with moisture. Wet-bulb temperature, dewpoint temperature, equivalent and wet-bulb potential temperature, Normand's rule. Layer lifting, convective instability. CAPE

Macrophysical cloud formation processes:
Review of basic cloud types (previously covered in 301) and essentials. Convective vs stratiform clouds. Importance of ascent and vertical velocity. Liquid and ice clouds.

Activation and growth of water drops
Formation of cloud drops via homogeneous and heterogeneous processes. Importance of atmospheric aerosol, CCN. Kohler curves, growth of drops by condensation. Coalescence, warm rain.

Nucleation and growth of ice particles
Ice nucleation mechanisms. Vapor deposition processes. Ice enhancement processes. Riming and aggregation.

Possible Matlab project for this course:

Modeling cloud microphysics
This would be to introduce a simple parcel model and allow the students to work with Matlab

ATMS 341: Atmospheric Radiative Transfer (S, 3 credits)

Text: "*An Introduction to Atmospheric Radiation*" by K.N. Liou; Chapter 4 in "*Atmospheric Science: An Introductory Survey*" by J.M. Wallace and P.V. Hobbs

Introduction and basic terminology and concepts
The importance and relevance of the subject in the atmospheric sciences; the role of radiative transfer in the global energy balance; spectrum of radiation; radiance and irradiance; scattering and absorption.

Thermal emission
Blackbody radiation; Kirchhoff's law; Greenhouse effect.

Simple aspects of radiative transfer
Beer-Bouguer-Lambert law; Schwarzschild's equation; plane-parallel atmospheres; remote sensing applications.

Solar radiation at the top of the atmosphere
The sun as an energy source; the Earth's orbit about the sun (seasonal effects and orbital effects); solar spectrum and solar constant; solar insolation.

Atmospheric absorption
Absorption line formation and broadenings; Absorption spectrum of the atmosphere; HITRAN data base; band models; solar and IR radiative heating rates; CO_2 and climate; radiation and ozone formation.

Atmospheric scattering:
Rayleigh scattering and scattering by particles; radiative transfer including multiple scattering.

Earth radiation budget:
Earth radiation budget at the top of the atmosphere and at the surface; Cloud radiative forcing.

Remote sensing applications:
Meteorological satellites; passive sensing using solar radiation and emitted IR and microwave radiation; active sensing using lidar and radar.

ATMS 431: Boundary-Layer Meteorology (A, 3 credits)

Text: S. Pal Arya, *Introduction to Micrometeorology*

Introduction:
What is micrometeorology and why is it important? What is the planetary boundary layer (PBL) and why does it exist? Different types of boundary layers.

Energy budget near the surface:
Concept of a surface energy budget; energy budget of a layer; impacts of surface fluxes; radiative balance; energy budgets of canopies, different surface types.

Subsurface temperature and heat transfer:
Surface and subsurface temperature and their interaction; thermal properties of soil and how this impacts heat transfer in soils; ground heat flux and its parameterization; ocean mixed layer and impacts on sea-surface temperature

Air temperature and humidity in the PBL:
Why do the air temperature and humidity have the values they do? Thermodynamic relations and the energy equation; differences between unsaturated and saturated air; How does static stability impact boundary layer properties? local and nonlocal concepts of static stability; mixed layers and inversions; vertical profiles of temperature and humidity; what happens over the course of a day?.

Wind distribution in the PBL:
What happens to the wind near the surface? What controls the strength and direction of the wind in the PBL? Geostrophic and thermal winds; frictional effects and the surface roughness; effects of stability and mixing. What do observations tell us? How does the wind vary over the course of a day?

Viscous flows:
What is viscosity? Laminar and turbulent flows. Concepts of the Ekman layer. Laminar boundary layers

Atmospheric turbulence, turbulent kinetic energy (TKE), and PBL momentum Equations:

Flow instability and transition to turbulence; the maintenance of turbulence; general characteristics; concept of high and low frequency variables (Reynolds averaging); turbulent fluxes and turbulent kinetic energy; eddies and their scales; important hypotheses about turbulence. How do we represent turbulent effects mathematically? TKE budget equation; concept of viscous eddies; gradient transport

Near-neutral boundary layers and stable surface layers
Velocity profile scaling laws. Concepts of surface roughness and drag. Basic similarity theory.

Stratified boundary layers:
Different types of boundary layer, turbulent scalings, cloud-topped boundary layer, convective boundary layers, nocturnal boundary layers.