Department of Atmospheric Science
Graduate Core Curriculum Revision
March 21, 2006

Objectives –

The development of a professional atmospheric scientist requires experience with both theoretical and practical tools. The latter include computer programming languages, data visualization interfaces, statistical data analysis techniques and atmospheric measurement systems. In addition, there is demand for practitioners with an understanding of the synergy between theory and observation, how this synergy furthers the overall goal of knowledge creation and how its application can lead to the resolution of problems imposed by changing physical and societal constraints. Given these demands, and the evolution of the scientific workplace that has occurred in the twenty years since our last curriculum revision, we are guided by three overarching objectives:

Objective 1 – Incorporate "real-life" problem solving into the curriculum. The first step in this direction, as well as the one that has the most impact on the revision, is the splitting of four core graduate courses into theoretical and problem sections. In the problem sections we will employ group learning, project-based assignments and one-on-one teacher-student engagement. Expected outcomes are the promotion of active learning (as opposed to passive note taking) (Manogue and Krane, 2003), the acceleration of competency with computer coding, and improved understanding of atmospheric measurement systems. This objective also facilitates the bridging between coursework and graduate research.

Objective 2 – Maintain a core curriculum that accommodates the pedagogical needs of all graduate student categories: a) those terminating with a Master of Science degree, b) those with potential for doctoral studies, and c) those of true doctoral caliber. This is important even in light of demands placed on ATSC to graduate more students with a Ph.D. in Atmospheric Science. Regardless of shifts in the make-up of the ATSC student body, for instance those that result due to the current emphasis on Ph.D. degrees, we feel that our program must cater to the development of both MS-level and Ph.D.-level students. Hence, the curriculum revision is constrained by policy set by the requirements for entry into the federal civil service meteorological positions (see Assessment).

Objective 3 – Renew focus on atmospheric phenomenon of horizontal scale smaller than a few hundred of kilometers (i.e., the mesoscale). In contrast to the existing curriculum, with significant investment in the description of phenomenon at larger scales (e.g., the synoptic scale), the revised curriculum recognizes the changing make-up of the ATSC faculty and their expertise at the mesoscale, and in smaller domains. Further, the revision is consistent with tools utilized by the faculty for their research (e.g., radar, lidar, aircraft- and balloon-based measurement platforms) and is consistent with the Department's reputation for expertise in the observation, and the interpretation, of the internal structure of cloud, and aerosol, fields.

Objective 4 – Recognize the curriculum is dynamic and that several factors will drive changing course content, including student feedback, the discipline of atmospheric science, and changing make up of the faculty. Coordination among the faculty will be needed for implementing these changes, particularly when one faculty is teaching a theoretical section in parallel with another teaching a problem section. Detailed implementation of this coordination will involve a) warehousing of syllabi, notes, assignments and solutions, b) institutionalization of regular meetings for the teaching faculty, and c) periodic updating of textbooks and course material.

Specifics of the Curriculum Revision –

Our plan is outlined in Figures 1 and 2 with the new courses indicated in red and the revised core graduate curriculum indicated by asterisks. We are proposing to discontinue six graduate-level courses (ATSC5000, ATSC5015, ATSC5150, ATSC5170, ATSC5180 and ATSC5190). These six are components of the preexisting core graduate curriculum. In addition, we plan to discontinue nine upper-division undergraduate courses cross-listed with the preexisting graduate curriculum (ATSC4000, ATSC4015, ATSC4020, ATSC4100, ATSC4150, ATSC4160, ATSC4170, ATSC4180 and ATSC4190). Discontinuation of the undergraduate courses is justified by ATSC involvement in the undergraduate Earth System Science program and the low enrollment in the ATSC4000 to ATSC4190 courses.

Eight new courses are proposed for the revised core graduate curriculum (ATSC5001, ATSC5002, ATSC5003, ATSC5004, ATSC5005, ATSC5006, ATSC5007 and ATSC5008). Of these, four are "Problems" courses; this aspect of the revision reflects our objective of injecting more real-life problem solving into the curriculum. Of the four remaining new courses, two place emphasis on expertise in Mesoscale Meteorology and Atmospheric Radiation coming from our most recent faculty hires (B. Geerts and Z. Wang). The remaining two courses present topics found in the old curriculum (Atmospheric Energetics and Microphysics); however, the new courses are packaged into a shorter format (2 versus 3 credit hour) and are complimented by "Problems" courses (ATSC5003 and ATSC5006). In addition, the theory sections of Dynamic Meteorology (ATSC5100) and Synoptic Meteorology (ATSC5160) and are reduced from 4 to 3 credit hours and 3 to 2 credit hours, respectively. All of these actions are formalized in Course Action Request forms (http://www-das.uwyo.edu/~jsnider/atsc).

Bibliography –

Manogue, C.A. and K.S.Krane, Paradigms in physics: Restructuring the upper class, *Physics Today*, 53-58, 2003

Table 1 – Summary of New, Retained and Discontinued Courses. Asterisks indicate courses in the revised core graduate curriculum (the eight new courses proposed for the revised graduate curriculum are shown in red).

ATSC Courses			
New Courses		Discontinued Courses	
5001	Atmospheric Energetics*	5000	Physical Meteorology I
5002	Atmospheric Radiation*	4000	Physical Meteorology I
5003	Problems in Energetics and Radiation*	4020	Physical Meteorology Lab
5004	Problems in Dynamic Meteorology*	4100	Atmospheric Dynamics
5005	Microphysics*	4160	Synoptic Meteorology
5006	Problems in Microphysics*	5015	Physical Meteorology II
5007	Problems in Synoptic Meteorology*	4015	Physical Meteorology II
5008	Mesoscale Meteorology*	5150	Weather Analysis
Retained Upper Division and Graduate Courses		4150	Weather Analysis
4010	Atmospheric Processes	5170	Synoptic Meteorology Laboratory
5100	Atmospheric Dynamics*	4170	Synoptic Meteorology Laboratory
5020	Physical Meteorology Lab*	5180	Weather Briefing
5160	Synoptic Meteorology*	4180	Weather Briefing
5320	Ocean Environment	5190	Advanced Weather Briefing
4320	Ocean Environment	4190	Advanced Weather Briefing
5330	Boundary Layer Meteorology		
4330	Introduction to Micrometeorology		
5400	Physical Basis for Climate		
4400	Physical Basis for Climate		
5210	Cloud and Precipitation Systems*		
5310	Atmospheric Dynamics II		
5340	Radar Meteorology		
5350	Atmospheric Aerosols		
5370	Meteorological Instrumentation		
5500	Atmospheric Radiation and Optics		
5880	Atmospheric Science Problems		

Table 2 – The Revised Core Graduate Curriculum and Short Syllabi (new courses in red).

1st sem	ATSC5001	ATSC5002	ATSC5003	ATSC5100	ATSC5004	
Course Name	Atmospheric Energetics	Atmospheric Radiation	Problems in Energetics and Radiation	Atmospheric Dynamics	Problems in Atmospheric Dynamics	
10	2	3	1	3	1	
	State/Parcel Concepts	Blackbody radiation	IDL - Basics	Equation of Motion	IDV and gempak: Basics	
	Adiabatic Motion	Radiative Temperature	IDL - Graphics	Horizontal frictionless flows	Aerological Diagrams	
	Air/water systems	Eqn Rad Trans	Adiabatic Cloud Parcel Model	Continuity equation	Geostrophy	
	Saturating Processes	Absorption and Scattering	Long/Shortwave heating profiles	Thermal wind	Thickness	
	Entrainment	Solar Radiation at the TOA	Inverse Radiative Problems	Circulation and vorticity	Thermal Wind	
		Remote sensing		Atmospheric Oscillations	Vorticity	
				Planetary boundary layer	Ageostropic Flow	
				Quasi-geostrophic motion		
2nd sem	ATSC5005	ATSC5006	ATSC5020	ATSC5160	ATSC5007	
Course Name	Microphysics	Problems in Microphysics	Physical Meteorology Lab	Synoptic Meteorology	Problems in Synoptic Meteorology	UW Elective
10	2	1	1	2	1	3
	Single Particle Mechanics	Size Spectra Measurement	IDL-Data Analysis	general circulation energetics	Case Studies	
	Equilibrium Conditions	Microphysics in a rising parcel	Solar Constant Measurement	QG theory	Real-time Weather Briefing	
	Water Nucelation	Continuous coalescense model	Humidity Measurement	baroclinic instability	Numerical Weather Prediction	
	Growth Equations	Mixed-phase cloud model	Nephelometer	Isentropic Coordinates	Idealized Flows-IDL	
		Accretion growth model	Neph / Mie Closure	symmetric instability		
			CCN Measurement	jet streak dynamics		
				frontal disturbances		
3rd sem	ATSC5210	ATSC5008				
Course Name	Cloud and Precipitation Systems	Mesoscale Meteorology				
5	3	2				
	Classification	internal gravity waves				
	Cirrus cloud	topographically forced flows				
	Convective Cloud	thermally forced flows				
	Coalescence ppt	density currents and bores				
	Ice ppt	cumulus dynamics				
		supercell dynamics				
		MCS dynamics				
4th Sem		ATSC5960 or ATSC5980				
Course Name	ATSC Elective	Thesis or Dissertation Research				
7	3	4				
32						

Assessment of ATSC Curriculum and US Government Requirements for GS-1340

Requirements for GS-1340 (Meteorology Series) based on the following website:
http://www.opm.gov/qualifications/SEC-IV/B/GS1300/1340.HTM

A degree in meteorology, atmospheric science, or other natural science major that included at least 24 semester hours of credit in meteorology/atmospheric science including a minimum of:

Category	*Description of Category*
A	6 semester hours (SH) of atmospheric dynamics and thermodynamics*
B	6 SH analysis and prediction of weather systems
C	3 SH physical meteorology
D	2 SH remote sensing of the atmosphere and/or instrumentation.
E	6 SH physics, with at least one course that includes laboratory sessions*
F	3 SH ordinary differential equations*
G	At least 9 SH of course work appropriate for a physical science major in any combination of three or more of the following: physical hydrology, statistics, chemistry, physical oceanography, physical climatology, radiative transfer, aeronomy, advanced thermodynamics, advanced electricity and magnetism, light and optics, and computer science.

*There is a prerequisite or corequisite of calculus for course work in atmospheric dynamics and thermodynamics, physics, and differential equations. Calculus courses must be appropriate for a physical science major.

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Assumed starting point for entry into the ATSC Graduate Program:

3 semester hours of differential equations

One-year sequence in physics lecture and laboratory courses, with calculus as a prerequisite or corequisite

6 semester hours of physics lecture

1 semester hour of physics laboratory

ATSC Graduate Curriculum and US Government Requirements for GS-1340

Course #	Title	SH in ATSC Curriculum	Category of Requirement	Total SH in ATSC Curriculum	U.S. Gov. Requirement
ATSC5001	Atmospheric Energetics	2	A		
ATSC5003	Problems in Energetics and Radiation	1	A		
ATSC5100	Atmospheric Dynamics	3	A	6	6
ATSC5004	Problems in Atmospheric Dynamics	1	B		
ATSC5160	Synoptic Meteorology	2	B		
ATSC5007	Problems in Synoptic Meteorology	1	B		
ATSC5008	Mesoscale Meteorology	2	B	6	6
ATSC5005	Micorophysics	2	C		
ATSC5006	Problems in Microphysics	1	C		
ATSC5020	Physical Meteorology Lab	1	C	4	3
ATSC5002	Atmospheric Radiation	3	D	3	2
Prerequisite	College Physics	6	E		
Prerequisite	College Physics Laboratory	1	E	7	7
Prerequisite	Differential Equations	3	F	3	3
UWElective		3	G		
ATSC5210	Cloud and Precipitation Systems	3	G		
ATSCElective		3	G	9	9