Department of Atmospheric Sciences, National Central University
Chair Professor Lectures supported by the MOST, Taiwan

Course Syllabus

Course Information

Course Number (課號)	AP8120
Course Title	Dynamical Mountain Meteorology (山地動力氣象特論)
Term	Summer 2017
Days & Times	T, W, R (Th): 9-10:30 and 14:00-15:30

Professor Contact Information

Professor	Dr. Yuh-Lang Lin North Carolina A&T State University Greensboro, North Carolina, USA
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Office Location	中央大學科學二館（大氣系舘）621B
Office Hours	11:00-12:00, 16:00-17:00
Other Information	MesoLab website: http://mesolab.ncat.edu
Teaching Assistants	William Agyakwah and Chia-Hung Sheng

Course Pre-requisites, Co-requisites, and/or Other Restrictions

Dynamic Meteorology, Atmospheric Dynamics or equivalent

Course Description

Many well-known weather phenomena are directly related to flow over orography. This course is divided into four parts, namely (I) basic wave dynamics, (II) orographically forced flows, (III) thermally forced flow over orography, and (IV) orographic precipitation. In Part I, governing equations and linearization of them for basic dynamics of stratified fluid flow will be discussed. In Part II, linear and nonlinear dynamics associated with two-dimensional and three-dimensional stratified fluid flow over mesoscale mountains will be studied. Applications of the mountain-wave theories will be discussed. In part III, combined thermally and orographically forced flows will be discussed. Applications to some weather phenomena will also be discussed. In part IV, the dynamics of moist fluid flow over mountains will be studied. Topics in this part include formation and enhancement mechanisms, control parameters, moist flow regimes, and orographic rain ingredients.

Suggested Textbooks and Materials

Mesoscale Dynamics by Yuh-Lang Lin, Cambridge Univ. Press, 2007

Presentation Schedule [6/26 – 7/25/17] Tue. Wen. Thu.: 9:00-10:30 & 14:00-15:50

Wk-day (T, W, R)	Lec# (ref)	Topics	Remarks (Lin 2007)
1-T	1	Introduction	Ch. 1
1-T	2	Governing equations for mesoscale motions	Ch. 2
1-T	3	Shallow-Water Wave Dynamics	Sec. 3.4
1-W	4	Pure Gravity Waves – I	Sec. 3.5
1-W	5	Pure Gravity Waves – II	Sec. 3.5
1-R	6	Inertia-Gravity Waves	Sec. 3.6
1-R	7	Reflection levels; Critical levels	Sec. 3.7-3.8
2-T	8	Wave Generation Mechanisms	Sec. 4.1-4.2
2-T	9	Wave Maintenance Mechanisms	Sec. 4.3
2-W	10	Energy Propagation & Momentum Flux	Sec. 4.4
2-W	11	Flow over 2D sinusoidal mountains	Sec. 5.1
2-R	12	Flow over 2D isolated mountains	Sec. 5.2
2-R	13	Nonlinear flow over 2D mountains (nonlinear flow regimes, generation of severe downslope winds)	Sec. 5.3
3-T	14	Flow over 3D mountains (linear theory & generation of lee vortices)	Sec. 5.4
3-T	15	Flow over large-scale mountains (rotational effects, lee cyclogenesis, orographic effects on cyclone tracks)	Sec. 5.5
3-W	16	Other orographic effects (effects on frontal passage, coastal trapped disturbances, cold-air damming, gap flow)	Sec. 5.6
3-W	17	Thermally Forced Flow - I	Sec. 6.1
3-R	18	Thermally Forced Flow - II	Sec. 6.2
3-R	19	Application of thermally forced flow theories to mesoscale circulations	Sec. 6.3
4-T	20	Effects of shear, 3D, and rotation on thermally forced flows	Sec. 6.4
4-T	21	Dynamics of sea and land breeze	Sec. 6.5
4-W	22	Dynamics of mountain-solenoidal circulations	Sec. 6.6
4-W	23	Mesoscale instabilities (static, conditional, potential instabilities & K-H instabilities)	Sec. 7.3
4-R	24	Orographic influence on climatological distribution of precipitation and preexisting disturbances	Sec. 11.1-11.2
4-R	25	Common ingredients of orographic precipitation	Sec. 11.2
5-T 5-T	26	Formation and enhancement mechanisms, control parameters, and moist flow regimes of orographic precipitation	Sec. 11.3-11.4
5-W		Final Exam	