

Class title	Upper Atmosphere (고층대기)	Credit	3
Class room	SCI551 (과551)	Time	Mon2,3,4 (월2,3,4)
Lecturer	In-Sun Song (송인선)	Affiliation	Dept. Atmos. Sci. (대기과학과)
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Email	songi@yonsei.ac.kr	Visit hour	Mon5 (월5)
Level	Graduate students in atmospheric science, space science or other disciplines		
Objectives	Introduction to dynamical and chemical processes that determine the mean states and perturbations of wind, temperature, and plasma density in the upper stratosphere, mesosphere, thermosphere, and ionosphere. Understanding of physical processes required for whole atmosphere global modeling and potential impacts of the solar and upper atmospheric processes in near-surface climate.		
Pre-requisites	Undergraduate-level knowledge of thermodynamics, dynamic meteorology and electromagnetism can help (e.g., Ideal gas law, thermodynamic energy equation, Navier Stokes equation, hydrostatic and geostrophic balances, Rossby and gravity waves, Lorentz force, conductivity, and electromagnetic induction).		
Format	Mixture of online and offline (Online or offline weeks). Offline lectures will be announced in advance when they are expected to be possible.		
Evaluation	Relative or absolute grading (Mid-term: 40%, Final-term: 40%, Assignment: 20%)		
References	R1: The Earth's Ionosphere: Plasma Physics and Electrodynamics (2009), 2nd edition, Academic Press by Michael C. Kelley. R2: Middle Atmosphere Dynamics (1987), Academic Press by David G. Andrews, James R. Holton, and Conway B. Leovy. R3: Modeling the Ionosphere-Thermosphere System (2013), AGU Geophysical Monograph 201, AGU by Jeseoph Huba, Robert Schunk, and George Khazanov. R4: Global model (NCAR CESM, CAM, WACCM, or WACCM-X) reference manuals or related SCI(E) papers R5: SCI(E) papers on Madden Julian Oscillation, solar variability, energetic particle precipitation, or middle atmosphere ozone chemistry		
Lecturer info	In-Sun Song Visit https://undividedlife.github.io for details		
Language	Korean		

Week	Period	Contents	Materials	Others
1	2021-03-02 2021-03-07	Backgrounds and structure of atmosphere and ionosphere	R1-Ch.1 ^a	(3.2.)개강 (3.5.–3.9.) 수강신청 확인 및 변경
2	2021-03-08 2021-03-14	Basic equations for neutral air and plasma	R1-Ch.2	(3.5.–3.9.) 수강신청 확인 및 변경
3	2021-03-15 2021-03-21	Electromagnetism in the ionosphere	R1-Ch.2	
4	2021-03-22 2021-03-28	Rossby normal modes (Hough function), tides, and planetary waves	R2-Ch.4 R5	
5	2021-03-29 2021-04-04	Rossby normal modes (continued), atmospheric gravity waves	R2-Ch.4 R5	
6	2021-04-05 2021-04-11	Equatorial ionosphere and winds in F and E region	R1-Ch.3	(4.5.–4.7.) 수강철회
7	2021-04-12 2021-04-18	Equatorial plasma instability due to various waves from the troposphere and stratosphere	R1-Ch.4	
8	2021-04-19 2021-04-25	Mid-term exam		(4.19.–4.23.) 중간시험
9	2021-04-26 2021-05-02	Mid-latitude ionosphere dynamics	R1-Ch.5	
10	2021-05-03 2021-05-09	Waves and mid-latitude instability due to waves propagating from the troposphere and stratosphere	R1-Ch.6 R1-Ch.7	(5.5.) 어린이날
11	2021-05-10 2021-05-16	High-latitude electrodynamics	R1-Ch.8	
12	2021-05-17 2021-05-23	High-latitude ionospheric disturbances due to geomagnetic disturbances and energetic particles	R1-Ch.8	(5.19.) 부처님 오신 날
13	2021-05-24 2021-05-30	Radiation scheme for global whole atmosphere modeling	R3 R4	
14	2021-05-31 2021-06-06	Mesospheric chemistry (D-region) related to energetic particle precipitation and its impacts in the stratospheric ozone chemistry	R5	(6.6.) 현충일
15	2021-06-07 2021-06-13	Potential impacts of solar and geomagnetic activities in near-surface climate	R5	(6.7.–6.11.) 자율학습 및 보충학습 기간
16	2021-06-14 2021-06-20	Final exam		(6.14.–6.18.) 기말시험

^aChapter 1 in the reference 1 (R1)