Class title	Applied Mathematical Methods in Atmospheric Sciences (기상응용수학)	**Credit**	3
Class room	SCI551 (과551)	**Time**	Mon2,3,4 (월2,3,4)

Lecturer	In-Sun Song (송인선)	**Affiliation**	Dept. Atmos. Sci. (대기과학과)
Office	Room 548, Science Hall (과548)	**Contact**	02-2123-XXXX
Email	songi@yonsei.ac.kr	**Visit hour**	Mon6 (월6)

Level	Graduate students in atmospheric science
Objectives	Understanding and application of mathematical and numerical methods in processing atmospheric observational and modeling data or in formulating numerical model
Pre-requisites	Undergraduate-level knowledge of advanced engineering mathematics or mathematical physics can help (e.g., Linear algebra, Eigen value problem, Sturm-Liouville equation, Fourier transform, differential geometry).
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	Absolute grading (Mid-term: 40%, Term project report: 60%)
References	R1: Numerical Recipes in Fortran 77 (1992), Cambridge University Press by William Press, Saul Teukolsky, Willam Vetterling, and Brian Flannery (Free online version at http://s3.amazonaws.com/nrbook.com/book_F210.html) R2: GNU Scientific Library: https://www.gnu.org/software/gsl R3: SLATEC: https://www.netlib.org/slatec R4: FITPACK: https://www.netlib.org/fitpack R5: Tricubic interpolation in three dimensions (2005), International journal for numerical methods in engineering by F. Leikien and J. Marsden (https://doi.org/10.1002/nme.1296). R6: MINPACK: https://www.netlib.org/minpack R7: LAPACK: https://www.netlib.org/lapack R8: Statistics in a nutshell: A desktop quick reference, 2nd edition (2013), O'Relly by Sarah Boslaugh R9: Hands-on machine learning with Scikit-Learn, Keras & TensorFlow 2nd Edition, O'Reilly by Aurélien Géron RA: FFTPACK: https://www2.cisl.ucar.edu/resources/legacy/fft5 RB: On the power spectrum of "Red Noise" (1963), Journal of the Atmospheric Sciences by D. L. Gilman, F. J. Fuglister, and J. M. Mitchell. https://doi.org/10.1175/1520-0469(1963)020<0182:OTPSON>2.0.CO;2 RC: A practical guide to wavelet analysis (1998), Bulletin of the American Meteorological Society by C. Torrence and G. P. Compo. (https://paos.colorado.edu/research/wavelets/) RD: SPHEREPACK: https://www2.cisl.ucar.edu/resources/legacy/spherepack RE: QUADPACK: https://www.netlib.org/quadpack RF: A discontinuous Galerkin transport scheme on the cubed sphere (2005), Monthly Weather Review by R. D. Nair, S. J. Thomas, and R. D. Loft (https://doi.org/10.1175/MWR2890.1)
Lecturer info	In-Sun Song Visit https://undividedlife.github.io for details
Language	Korean or English

Week	Period	Contents	Materials	Others
1	2021-03-02 2021-03-07	Introduction, using Git or Github, interpolation (linear, Lagrange, cubic, tricubic)	R1-Ch.3[a], R2, R3, R4, R5	(3.2.)개강 (3.5.–3.9.) 수강신청 확인 및 변경
2	2021-03-08 2021-03-14	Least-square fit, B-spline fit, nonlinear regression	R1-Ch.15, R2, R3, R4, R6	(3.5.–3.9.) 수강신청 확인 및 변경
3	2021-03-15 2021-03-21	Linear algebra, matrix, Eigen value problem	R1-Ch.2, R1-Ch.11, R7	
4	2021-03-22 2021-03-28	Optimization, minimization, Lagrange multiplier	R1-Ch.10, R6	
5	2021-03-29 2021-04-04	Empirical orthogonal function (EOF), singular value decomposition (SVD)	R1-Ch.2, R1-Ch.11, R7	
6	2021-04-05 2021-04-11	EOF and SVD (continued)	R1-Ch.2, R1-Ch.11, R7	(4.5.–4.7.) 수강철회
7	2021-04-12 2021-04-18	Statistical inference	R1-Ch.14, R2, R8	
8	2021-04-19 2021-04-25	Mid-term exam		(4.19.–4.23.) 중간시험
9	2021-04-26 2021-05-02	Machine learning primer	R9	
10	2021-05-03 2021-05-09	Machine learning primer (continued)	R9	(5.5.) 어린이날
11	2021-05-10 2021-05-16	Fast Fourier transform, periodogram, red noise spectrum, rotary spectrum, Hibert transform	R1-Ch.11, R1-Ch.12, RA, RB	
12	2021-05-17 2021-05-23	Lomb-Scargle spectrum, wavelet analysis	R1-Ch.13, RA, RC	(5.19.) 부처님 오신 날
13	2021-05-24 2021-05-30	Spherical harmonics, Helmholtz decomposition	RD	
14	2021-05-31 2021-06-06	Numerical integration, quadrature	R1-Ch.4, RE	(6.6.) 현충일
15	2021-06-07 2021-06-13	Nonorthogonal coordinate, global unstructured grids	RF	(6.7.–6.11.) 자율학습 및 보충학습 기간
16	2021-06-14 2021-06-20	Presentations of term project		(6.14.–6.18.) 기말시험

[a] Chapter 3 in the reference 1 (R1)