

课程详述

COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 Course Title	地球科学多维数据分析/ Multidimensional Data Analysis in Geosciences
2.	授课院系 Originating Department	海洋科学与工程系/ Department of ocean science and engineering
3.	课程编号 Course Code	OCE340
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业选修课 Major Elective Courses
6.	授课学期 Semester	秋季 Fall
7.	授课语言 Teaching Language	中英双语 English & Chinese
8.	授课教师、所属学系、联系方式 Instructor(s), Affiliation & Contact (For team teaching, please list all instructors)	展鹏, 海洋科学与工程系, zhanp@sustech.edu.cn , 15966800719 Peng Zhan, Department of ocean science and engineering
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	无 NA / 待公布 To be announced
10.	选课人数限额(可不填) Maximum Enrolment (Optional)	

11. 授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other (Please specify)	总学时 Total
学时数 Credit Hours	48	0	0	0	48
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	线性代数/ Linear Algebra (MA107)				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite					
14. 其它要求修读本课程的学系 Cross-listing Dept.					

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程系统介绍地球科学（特别是海洋、大气、地球物理、遥感等学科）时空多维数据分析方法，包含空间最优插值、样本 Variograms 建模与参数估计、采样策略、Kalman Filter、时间序列分析、数据降维、特征提取等内容，并基于 Matlab 实践数据分析处理与可视化，为学生进一步学习反问题与数据同化提供必要的基础知识。通过学习本课程，使学生加深对地球科学问题中时空多维数据分析技术的理解与应用能力。

This course covers various processing and analysis methods for multidimensional data in the geosciences, including multivariate description and analysis, optimal interpolation, sample variograms modeling and parameter estimation, spatial interpolation (statistical Kriging methods, Bayesian-based Kalman filter), time-series analysis (filter, regression, harmonic analysis, spectrum analysis, wavelet analysis), search strategy, principal component analysis and scientific visualization based on Matlab. It provides the basic knowledge for students to further study inverse problems and data assimilation, and students would enhance their understanding and skills for spatiotemporal multidimensional data analysis in geoscience problems.

16. 预达学习成果 Learning Outcomes

学生完成本课程后，将对时空多维数据分析相关的问题建立批判性的思考，并掌握以下知识：

1. 时空多维数据质量控制与预处理；
2. 最优线性无偏估计、基于 Kriging 的空间插值与预测；
3. 样本 Variograms 建模与参数估计；
4. 随机变量和参数分布，数据降维；
5. 典型时间序列分析；
6. 时空多维数据可视化；

Upon completion of this course, students will develop critical thinking on issues related to the analysis of spatiotemporal multidimensional data and will learn the following knowledge:

1. Quality control and preprocessing of spatiotemporal multidimensional data;

2. Best linear unbiased estimation, spatial interpolation and prediction based on Kriging;
3. Sample Variograms modeling and parameter estimation;
4. Random variables and parameter distribution, principal component analysis;
5. Time series analysis;
6. Visualization of spatiotemporal multidimensional data;

17. 课程内容及教学日历（如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）

Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

1. 地球科学数据分析的背景介绍、基本方法，单变量和多变量数据描述 [3 课时]
2. 数据空间分布、空间连续特征 [3 课时]
3. 最优线性无偏估计、Kriging [9 课时]
4. Co-Kriging、Block Kriging [6 课时]
5. 采样策略、交叉验证 [3 课时]
6. 样本 Variograms 建模与参数估计 [6 课时]
7. Kalman Filter 简介 [3 课时]
8. 时间序列分析（滤波、回归、调和分析、频谱分析、小波分析） [9 课时]
9. 经验模态正交分解（主成分分析） [6 课时]
1. Background introduction, univariate and multivariate data analysis of geoscience data analysis [3 hours]
2. Spatial distribution, Spatial continuous characteristics [3 hours]
3. Best linear unbiased estimation, Kriging [9 hours]
4. Co-Kriging, Block Kriging [6 hours]
5. Sampling strategy, cross-validation [3 hours]
6. Sample variogram modeling and parameter estimation [6 hours]
7. Introduction to Kalman Filter [3 hours]
8. Time series analysis (filter, regression, harmonic analysis, spectrum analysis, wavelet analysis) [9 hours]
9. Empirical Orthogonal Function (Principal Component Analysis) [6 hours]

18. 教材及其它参考资料 Textbook and Supplementary Readings

Edward H. Isaaks and R. Mohan Srivastava, An introduction to applied geostatistics, Oxford University Press, New York, USA, (1989).

课程评估 ASSESSMENT

19. 评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance		5		
课堂表现 Class Performance		5		
小测验 Quiz		20		
课程项目 Projects		0		
平时作业 Assignments		40		
期中考试 Mid-Term Test				
期末考试 Final Exam		0		
期末报告 Final Presentation		30		
其它（可根据需要 改写以上评估方式） Others (The above may be modified as necessary)		0		

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20. 记分方式 GRADING SYSTEM

A. 十三级等级制 Letter Grading
 B. 二级记分制（通过/不通过） Pass/Fail Grading

课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过
This Course has been approved by the following person or committee of authority

海洋科学与工程系本科教学委员会
 Department of Ocean Science and Engineering Undergraduate Committee