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| **Week 1** | Foci:  Successful cal/val depends on high quality, in-water measurements  Measurements of the week– absorption, scattering, attenuation and fluorescence | | | | |
| **Monday** | **Morning - 0830** | **Lecturer** | **Afternoon - 1330** | | **Lead** |
| Introduction | Official welcome to Maine  History and uniqueness of the class | MJP | Lec. 2 | Overview of light in water: introduction to IOPs, AOPs and RTE. | CR |
|  | Welcome to DMC, logistics, safety. | MJP | Lab 1 | Playing with light: informal introduction to scattering, absorption, fluorescence, polarization | EB |
|  | Introductions and why we are all here. | ALL |  |  |  |
|  | Motivation for the 2011 class.  General themes’ and statement of issues.  Errors and uncertainties in measurements.  What is calibration? validation?.  Concepts/framework  ‘Side Box’  Overview of Syllabus – lecture, labs, sharing the workload, lab reports, portfolio, moving toward certification…. | Staff |  |  |  |
| Lec. 1 | Radiation and radiometry. | EB |  |  |  |
| **Tuesday** |  | | | |  |
| Lec. 3 | Absorption physics; overview of absorption spectra for water, CDOM, NAP, phytoplankton, etc. | CR | Lab 2 | Beer’s Law – mini-lecture (MJP)  Principles of ac-x operation, calibration, analysis (CR)  CDOM absorption | MJP |
| Lec. 4 | Phytoplankton - pigments, photo-adaptation, and taxonomic classification; proxies/surrogates for phytoplankton. | MJP |  |  |  |
| **Wednesday** |  | | | |  |
| Lab report | Synthesis & summary – CDOM lab | Students | Lab 3 | Particulate absorption | MJP |
| Lec. 5 | Fluorescence – fluorescence theory; physiology as advantage and challenge to interpretation. | MJP |  |  |  |
| Lec. 6 | Fluorescence – in situ measurements and calibrations | CR |  |  |  |

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| **Thursday** |  | | | | |  |
| Lab report | Synthesis & summary – particulate absorption lab | Students | Lab 4 | Fluorescence – CDOM and chlorophyll | | MJP |
| Lec. 7 | Physics of elastic and inelastic scattering, volume scattering and phase functions. Scattering by water constituents. | CM |  |  | |  |
| Lec. 8 | Introduction to calibration / validation issues. | JW |  |  | |  |
| **Friday** |  | | | | |  |
| Lab report | Synthesis & summary – fluorescence lab | Students | Lab 5 | Scattering | | EB |
| Lec. 9 | Scattering and attenuation ­– forward and backward, measurement issues and implications for cal/val. | EB |  |  | |  |
| Lec. 10 | Linking optical properties to real variables.  Round table on what is a proxy/surrogate. | EB & MJP |  |  | |  |
| **Saturday** | \**Start at 0900\* (breakfast at 0800)* | | | | |  |
| Lab report | Synthesis & summary – scattering lab | Students |  | *No lab in afternoon* | |  |
|  | Synthesis of first week – critique process of learning; Q&A on any topic; tie up loose ends. | Staff |  |  | |  |
|  |  |  |  | Bar-b-que at DMC | |  |
| **Week 2** | Foci:  Measurement–model closure to reduce uncertainty  Measurements of the week: radiometry and reflectance | | | | | |
| **Monday** |  | | | | |  |
| Lec. 11 | Radiometric quantities and their measurement | KV | Lab 6 | | Introduction to radiometers and radiometric measurements/ best practices/ SI units | KV & EB |
| Lec. 12 | AOPs introduction and Introduction to ocean color remote sensing. | CM | Lec. 13 | | Radiative transfer equation. | CM |
| **Tuesday** |  | | | | |  |
| Lab 7a | Introduction to Hydrolight – ½ class (all day) | | | | | CM |
| Lab 8a | Radiometry field day, preparation and cruise – ½ class (all day)*; weather permitting; if bad, schedule will be modified* | | | | | EB |
| **Wednesday** |  | | | | |  |
| Lab 7b | Introduction to Hydrolight – ½ class (all day) | | | | | CM |
| Lab 8b | Radiometry field day, preparation and cruise – ½ class (all day)*; weather permitting; if bad, schedule will be modified* | | | | | EB |

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| **Thursday** | | | | | |  |
| Lec. 14 | | Atmospheric correction and adjacency effect. | KV | Lab 9 | Analysis of radiometry profiles.  (Ed0-, Lu, Lu/Ed0-, Kd, Ku)  Above water reflectance; link with in-water radiometry. Lw, R ~ Lu below surface /Ed0+ , f/Q)  Entire class works on same profile. | EB, KV |
| Lec. 15 | | Polarization | KV |  |  |  |
| **Friday** | |  | | | |  |
| Lab report | | Synthesis & summary of radiometry field data and above-water reflectance from dock. | Students | Lab 9 cont’d | Analysis of radiometers and AOP data from cruise. |  |
| Lec. 16 | | In situ support for atmospheric correction. | JW |  |  |  |
| Lec. 17 | | Rrs inversion methods a: statistical methods to obtain [chl] and/or IOPs (ratio, Neural Network). | CM |  |  |  |
| **Saturday** | |  | | | |  |
|  | | No formal class – continue work on data Compute IOPs – apply calibrations, etc. Profiles of a, b, c total and dissolved, bb, bb/b. Etc., etc., etc. | | | |  |
| **Week 3** | | Foci:  Sampling strategy – instruments, space/time scales  Synthesis and student products | | | | |
| **Monday** | | | | | | |
| Lab report | Synthesis and summary of Rrs & IOP data from field | | Students | Lab 10 | Forward closure lab with Hydrolight, using field data | CM, EB |
| Lec. 18 | Measurement–model closure. | | CM |  |  |  |
| Lec. 19 | Measurement-measurement closure. | | EB et al. |  |  |  |

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| **Tuesday** | | | | | |
| Lab report | Synthesis of forward closure | Students | Lec. 22 | Uncertainty analysis and propagation of error. | EB,JW |
| Lec. 20 | Rrs inversion methods: semi-analytical models to obtain IOPs. | CR & JW | Lab 11 | Inversions from remote sensing to IOPs | CR, JW |
| Lec. 21 | Life of a pixel and nitty-gritty of NASA calibration; issues of cal/val; sampling and measurement strategies, including scales: m to km and seconds to years. | JW et al. |  |  |  |
| **Wednesday** | | | | | |
| Lab report | Synthesis of inversions | Students | Lab 12 | Mie theory | EB |
| Lec. 23 | Primary productivity – various approaches. | MJP | Lab 13 | Inversion models – including models in NASA operational satellite processing software | JW |
| Lec. 24 | Link between particle properties (size, packaging, composition, shape, internal structure) and IOPs. | EB |  |  |  |
| Lec. 25 | POC & other proxies– optical properties | IC, MJ |  | Lobster bake for dinner – Round Pond |  |
| **Thursday** | | | | | |
| Lab report | Synthesis of Mie Lab and inversions. | Students | Lec. 27 | Rrs inversion methods for shallow-water remote sensing (spectrum matching) | CM |
| Lec. 26 | Major synthesis of cal/val. | EB et al. | Lab. 14 | Portfolio completion:  Each student will create a portfolio, and submit it. Each derived parameter or measurement should have methods, uncertainties and closure.  Document with figures (and figure captions) showing progression from raw to calibrated data.  Example data set with data for each step, from raw to fully calibrated.  Documented code for processing each instrument.  Photos, as appropriate, showing instrument set up. |  |
| **Friday – assessment and presentations** | | | | | |
|  | Practicum and assessment |  |  | Practicum and assessment |  |