

SIO 229: GEOMAGNETISM TOPICS

1. Introduction to the Geomagnetic Field:

- History of Measurement
- Geomagnetic Elements
- Sources of the Geomagnetic Field
- Temporal and Spatial Variations

2. Classical Electrodynamics in Geomagnetism

- Helmholtz's Theorem and Maxwell's Equations
- The Static Case for Geomagnetic Field Modeling
- Constitutive Relations
- Application to the Geomagnetic Field

3. Gauss' Theory of the Main Field

- Gauss' Separation of Harmonic Fields into Parts of Internal and External Origin
- Upward Continuation
- Downward Continuation
- Geomagnetic Elements and Uniqueness
- Construction of Field Models
- Least Squares Estimation
- Regularization- an Alternative to Least Squares
- Results- Gauss Coefficients
- The Geomagnetic Spectrum
- Toroidal and Poloidal Fields

4. Magnetohydrodynamics

- Energy Sources for the Geodynamo
- Secular Variation
- Diffusion
- Frozen Flux and Alfvén's Theorem
- Some Applications of the Frozen Flux Hypothesis
- A Very Little Dynamo Theory

5. The Crustal Field

- Magnetic Permeability and Susceptibility
- Crustal Models
- The Magnetic Annihilator and Runcorn's Theorem
- Results – Magnetic Anomalies Everywhere

6. Electromagnetic Induction in Earth's Crust and Mantle

- Skin Depth
- Variable σ – Magnetotelluric Sounding
- Global Electromagnetic Sounding – Results