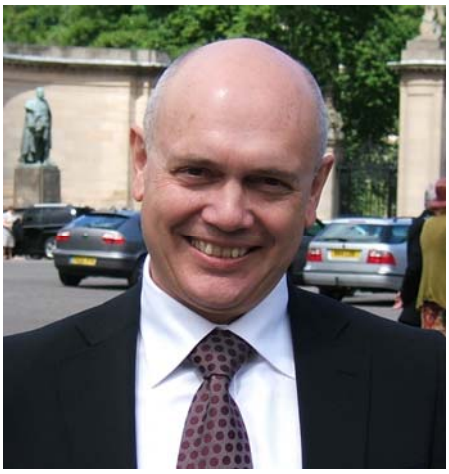
4th IAGA School
July 2 – 7, 2019
Station de biologie des Laurentides (near Montreal), Quebec, Canada

Program

Time/Date	02. July Tuesday	03. July Wednesday	04. July Thursday	05. July Friday	06. July Saturday	07. July Sunday
7:30		Breakfast	Breakfast	Breakfast	Breakfast	Breakfast
8:30		Welcome				Planetary Magnetism I
9:00		Geomagnetic Field I	Core Dynamics	Electromag-netic Induction I	Solar Physics I	
						Break
10:30		Break	Break	Break	Break	Planetary Magnetism II
11:00		Geomagnetic Field I & II	Ionosphere Magneto-sphere I	Electromag-netic Induction II	Solar Physics II	
	Arrival at SBL					Lunch
12:30		Lunch	Lunch	Lunch	Lunch	Project Presentations
13:30		Geomagnetic Field II	Ionosphere Magneto-sphere II	Outing	Project Work	
		Project Assignment				Departure
15:00		Break	Break		Break	
15:30		Project Work	Project Work		Project Work	
18:00	Dinner	Dinner	Dinner	Dinner	Dinner	

The Geomagnetic Field

David Kerridge
British Geological Survey, Edinburgh, UK



1. Geomagnetic observations

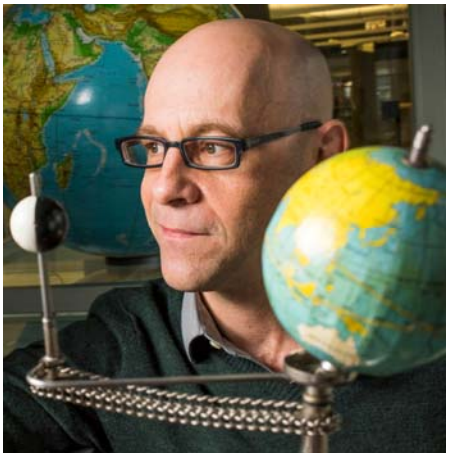
- A little bit of history of people and observations
- Magnetic observatories and instruments. INTERMAGNET.
- Magnetic surveys: from Captain Cook to the 3-satellite Swarm mission
- Magnetic activity indices and observatory data applications

2. Modelling the geomagnetic field

- Spherical harmonic analysis
- The International Geomagnetic Reference Field: the main field and its secular variations
- Building ‘comprehensive models’ that incorporate other magnetic field sources
- Using geomagnetic field data to investigate the core

Core dynamics and the geodynamo

Mathieu Dumberry
University of Alberta, Canada



- Force balance in the Earth's fluid core
- Quasi-geostrophic flows
- Magnetic field generation: competition between dynamo action and decay
- Observed magnetic field variations
- Decadal to millennial timescale flows in the core

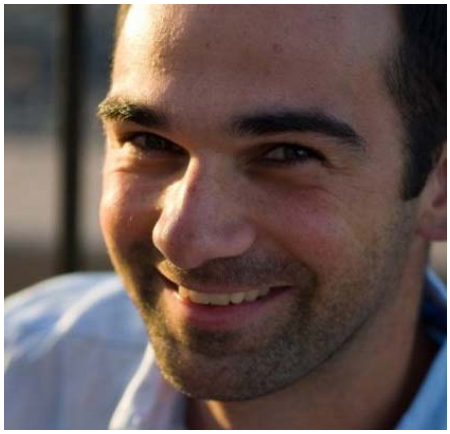
Ionosphere and Magnetosphere

Andrew Yau
University of Calgary, Canada

- Formation of planetary ionosphere
- The Earth's ionosphere: composition and structure
- The Earth's (internal and external) magnetic field: the solar wind
- The Earth's magnetosphere: origin, composition and structure
- Dynamics of the ionosphere: plasma processes in a magnetic field
- Magnetosphere-Ionosphere Coupling: the aurora and space weather

Electromagnetic induction methods and applications

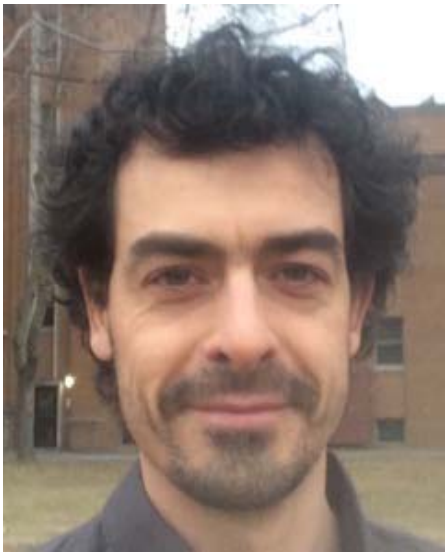
Stephan Thiel
Geological Suvey of South Australia



- Introduction to electrical and EM methods
- Electrical conductivity of Earth materials
- Source fields for electromagnetic induction
- Theoretical background of electromagnetic methods with focus on magnetotellurics
- Analysing MT data: dimensionality, strike, anisotropy
- Modelling of MT data: from 1D to 4D
- Case studies: Tectonics and mineral exploration
- Case studies: Geothermal exploration and hydraulic fracture monitoring

Solar magnetic fields and activity cycle

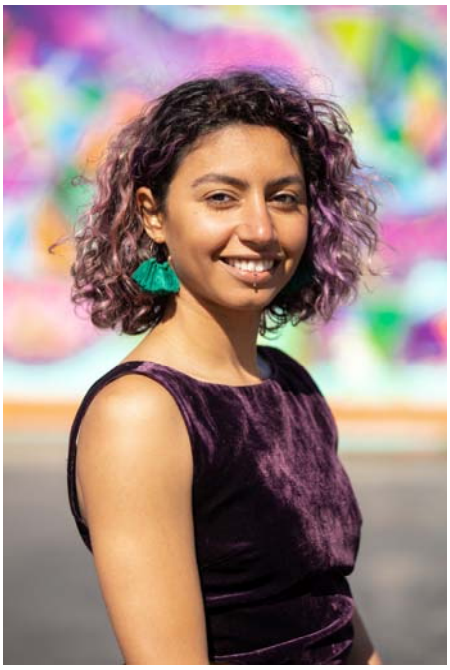
Alexandre Lemerle
Collège de Bois-de-Boulogne, Canada



- Observations of solar activity
- Solar magnetism
- The solar dynamo
- MHD induction
- Full set of MHD equations
- Numerical modeling
- Solar activity forecasting
- Eruptive events, radiative variability, coronae, etc.

Planetary Magnetic Fields

Manar Al Asad
University of British Columbia



- A tour of planetary magnetic fields: our solar system
- Flybys vs orbital data
- Data sets available: how/where to get them
- Separating internal and external fields
- Upward and downward continuation
- Core, crustal and induced fields
- Discussion of Science/Nature papers

Projects:

Geomagnetism

David Kerridge
British Geological Survey, Edinburgh

Guided computer-based exercises including:

- Signals in magnetic observatory data from seconds to decades
- Examples of spherical harmonic analysis in action including using the IGRF to trace field lines and find conjugate points
- Building a 'mini-IGRF' from a Swarm data set
- Estimating the core radius using geomagnetic field models

Magnetometers

(emphasis on fluxgate low frequency)

Martin Connors
Athabasca University, Canada

- Magnetic detection, B and dB/dt
- Signal transduction (A/D conversion)
- Control and data transmission systems (small computers)
- Assembly of test system
- Data storage and plotting
- Near-real-time results
- Remote data access and magnetometer networks
- Aspects of data inversion (advantages and pitfalls of indices; problems with inversions)

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