SOLAS - Links to JGOFS

Biogeochemistry

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SeaWiFS
Science Plan and Implementation Strategy

- Available online at: www.solas-int.org
  - National Reports
  - SSC Members
  - Join email list
  - Submit your research for endorsement

- Brochure available
Examples of National Programmes:
Canada - $9M, 5 years

Fe addition in North Pacific
North Atlantic Bloom

Moorings
Remote Sensing
Remote Sensing
Field observations (oceanic, atmospheric)
Coupled ocean-atmosphere models

http://csolas.dal.ca
Examples of National Activities: Japan

**SEED~S:** Subarctic Ocean Enrichment and Ecosystem Dynamics Study

**SNIFFS:** Subtropical Nitrogen Fixation Flux Study

**STAGE:** Studies on the Antarctic ocean and Global Environment by JARE

**SERIES:** Canadian SOLAS

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Examples of National Activities: Germany

Meteor 55: Oct-Nov 02
W-E Equatorial Atlantic

Research Areas:

Trace gases (ocean): N$_2$O, DMS, halocarbons, oxygenated organics, CO$_2$
*IfM-Kiel, MPI-Mainz, UEA (UK)*

Trace gases (atmos): all of the above + BrO + addl. Halocarbons
*IfM-Kiel, Uni-Heidelberg, NCAR (USA), MPI-Mainz*

Trace metals (ocean): *IfM-Kiel*
(atmos.): *UEA (UK)*

Nitrogen cycle: stable isotopes, DOC, molecular biology
*IfM-Kiel, IOW-Warnemuende Univ. Essex (UK)*

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Examples of National Programmes: UK and USA

UK: April 3rd 03 NERC announces 5-year £11M programme, UKSOLAS

USA: No programme yet, but large number of SOLAS-related projects
SOLAS in IGBP II
**SOLAS Science Meetings**

- **EGS/AGU Nice**
  - 7 - 11 April 2003, Nice, France

- **IUGG Sapporo**
  - 1 - 9 July 2003, Sapporo, Japan

- **Summer School**
  - 30 June - 11 July 2003, Corsica, France

- **SOLAS Science 2004**
  - 11 - 14 Oct 2004, Halifax, Canada
CO2

Organo-Halogens, NMHCs, DMS

Fe, Mn, Zn, DON, NO3, NH3, (Cu)

CH4, CO

N2O

C-org

Surface Water

Deep Water

Sediment

Phytoplankton

Bacteria

Zooplankton
Global climatology of the annual net air-sea CO$_2$ flux based on interpolation of air-sea pCO$_2$ differences referenced to the year 1995. (Takahashi et al., 2002)
Transfer velocity ($k$) determined by eddy correlation (direct covariance) in GasEx-98 and one $k$ measurement obtained using the SF$_6$ - $^3$He dual tracer pair, all plotted against windspeed. Also plotted are some widely-used parameterisations of $k$ versus windspeed. (McGillis et al., 2001)
Global DMS distribution Jan and July. (Kettle et al. 1999)
A conceptual model illustrating the biogeochemical cycle of DMS and DMSP (Kiene et al. 2000)
The global mean sea surface temperature as simulated in the Hadley Centre atmosphere/ocean coupled model (HadCM3). The simulation includes a representation of the effect of ocean DMS emissions on cloud properties. Sensitivity experiments show a strong climate response to changes in ocean DMS emissions (MeTO, 2001)
A simple schematic illustrating the cycling of iodine between the ocean and the atmosphere. A simplified version of the chemical pathway from volatile organo-iodine compounds to aerosol production is shown (Chuck and Liss, 2003).
Figure 1. IO, tidal height and solar radiation during 9-15 September, 1998. The dotted line on the IO graph represents the average detection limit. The grey areas mark the low tide periods.
Summary of Average IO Concentrations

**Mace Head, Ireland - May 1997**
- Max IO: 1.17 (0.64)
- Min IO: 0.61 (0.90)
- Total: 1.17 (0.64)

**Tenerife - June/July 1997**
- Max IO: 1.23 (0.58)
- Min IO: 1.21 (0.61)
- Total: 1.23 (0.58)

**Cape Grim, Tasmania - Jan/Feb 1999**
- Max IO:
  - Total: 0.53 (0.37)
  - Coastal: 0.88 (0.46)
  - Open Ocean: 0.38 (0.18)
- Min IO:
  - Total: 0.35 (0.48)
  - Coastal: 0.75 (0.59)
  - Open Ocean: 0.17 (0.27)

**Average IO from 3 locations**
- Max IO: 1.01 (0.63)
- Min IO: 0.76 (0.78)
- Total: 1.01 (0.63)
Satellite (Global Ozone Monitoring Experiment, GOME, on the ERS-2 satellite) observations of tropospheric BrO “clouds” in the Arctic and Antarctic. Total BrO column densities in the centre of the clouds exceed $10^{14}$ BrO molecules cm$^{-3}$. The clouds are associated with total loss of boundary layer ozone, occur only in springtime, and have a typical lifetime of one to a few days. (Wagner et al., 2001) Copyright 2001 American Geophysical Union.
$\text{N}_2\text{O}$ formation across the west Indian shelf (Naqvi et al., 2000)
$\text{N}_2\text{O}$ in the water column at various sites in the equatorial Atlantic (Walter, Bange and Wallace, 2003)
Fe addition to the ocean
SeaWiFS chlorophyll image (NASA real-time data) for July 29, 2002 showing the SERIES patch.

Enlargement of the patch. On July 29 a 700 km² area shows surface chl greater that 1 mg m⁻³. Patch position and shape agreed well with ship transects.
Surface water carbon dioxide fugacity ($f_{CO_2}$) during SOIREE (Watson et al., 2000)
Surface concentrations (5m) of DMS (nmol l⁻¹), methyl iodide (CH₃I) (ng l⁻¹), bromoform (CHBr₃) (ng l⁻¹) and chlorophyll \( \text{a} \) (mg m⁻³) during the EisenEx experiment highlight the varying responses to the iron addition. Measurements taken from within the fertilised patch are shown as filled squares, measurements from outside the patch are shown as open squares. DMS and CH₃I concentrations increased within the fertilised patch over the 21 days of the experiment, whilst CHBr₃ showed a greater increase in concentration outside of the patch. Chlorophyll \( \text{a} \) concentrations increased approximately 3-fold during the experiment (Chuck and Liss, 2003)
Changes in various ice core and marine sediment parameters between the Holocene and the end of the last ice age. a) delta$^{18}$O (a temperature proxy), Fe and MSA (an atmospheric oxidation product of DMS) from Antarctic ice cores. b) CO$_2$ from the Vostok ice core; TOC (total organic carbon), alkenones and dinosterol (proxies for surface ocean productivity) in a sediment core from the eastern tropical Pacific Ocean. (Turner et al., 1996)