

# Mixed layer depths from R/V Tangaroa cruise 61TG\_3052 in the Southern Ocean in 1999 (SOIREE project)

**Website:** <https://www.bco-dmo.org/dataset/2832>

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## Project

» [Southern Ocean Iron Release Experiment](#) (SOIREE)

## Program

» [Iron Synthesis](#) (FeSynth)

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## Dataset Description

### SOIREE Mixed Layer Depth

The mixed-layer depth is defined as the maximum depth at which the sea-water density is less than the density at 5m + 0.1 kg m<sup>-3</sup>. This picks up the top of the seasonal pycnocline, but is insensitive to the weaker stratification that occurred during the latter part of the experiment.

There is considerable cast-to-cast variation, suggesting the presence of internal waves. Despite this it appears that the average mixed-layer depth decreased by 5-10m between the 9th and the 16th of February, and then shoaled by a similar amount during the remainder of the experiment. The apparent rapid decrease between the 8th and the 9th of February is possibly due to the inclusion of CTD stations on the transect towards the experimental site, and may just reflect the general northward deepening of the surface layer.

The development of thermal stratification within the surface layer is visible from Day 5. This stratification is an order of magnitude weaker than the stratification within the pycnocline

### **Comments preserved from the original file:**

*Defined as the maximum depth at which the density is less than the density at 5m + 0.1 kg/m<sup>3</sup>.*

*Casts where the mixed layer depth is undefined, either due to bad data or because the cast was too short, are assigned a value of -1.*

*This depth is typically at the top of the seasonal pycnocline. During the latter part of the experiment there was persistent weak stratification at shallower depths.*

*The upcast column is 0 for downcasts and 1 for upcasts.*

## **Methods & Sampling**

See [SOIREE Preliminary Voyage Report](#)

See comments preserved from original file in dataset description as well

CTD data collection for SOIREE used NIWA's Seabird 911plus CTD and related

instrumentation - operated in its standard configuration, and according to standard procedures.

## **Data Processing Description**

See [SOIREE Preliminary Voyage Report](#)

See comments preserved from original file in dataset description as well

CTD data processing followed standard procedures.

These processes routinely result in pressure, temperature, salinity and

dissolved oxygen data that conform to WOCE Hydrographic Programme standards

(see WOCE HP Operations Manual WHP 91-1).

with the measurements referenced

to

(calibrated against) their respective international standards.

For SOIREE, the main exception was that there was no water-sample dissolved

oxygen data collected during the cruise. This meant that the dissolved O<sub>2</sub>

data could not be reliably calibrated to WOCE standards and that they are

only crudely indicative. It would be possible to somewhat further enhance

these dissolved O<sub>2</sub> data by applying a calibration from a previous or

following cruise that used the same sensor.

## **BCO-DMO Processing Notes**

Generated from original mixed\_layer\_depth.xls file provided on the

Deep-Sea Research II 48 (2001) accompanying CD-Rom

## **BCO-DMO Edits**

- parameter names modified to conform to BCO-DMO convention

- added 'T' to CTD Station number for compatibility with events in other spreadsheets

- date, time. Lat, lon added from SOIREE\_Stations\_MasterStationList.xls using GMT dates/times

- "-1" No data or Bad data flag changed to BCO-DMO standard of "nd"

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## Data Files

File
<b>CTD_MixedLayer.csv</b> (Comma Separated Values (.csv), 9.38 KB) MD5:0e78037f842186f03d8b322be3411e19
Primary data file for dataset ID 2832

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## Parameters

Parameter	Description	Units
station	Station Id (Text String)	text
date	date	YYYYMMDD
lon	longitude, negative denotes West	decimal degrees
lat	latitude, negative denotes South	decimal degrees
time	time	HHMM
cast	CTD cast number	integer
Upcast	Up/Down Cast Flag (0=Down, 1=Up)	integer
Mixed_layer_depth	Mixed Layer Depth	meters

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## Instruments

<b>Dataset-specific Instrument Name</b>	CTD Seabird 911
<b>Generic Instrument Name</b>	CTD Sea-Bird 911
<b>Dataset-specific Description</b>	NIWA's Seabird 911plus CTD and related instrumentation
<b>Generic Instrument Description</b>	The Sea-Bird SBE 911 is a type of CTD instrument package. The SBE 911 includes the SBE 9 Underwater Unit and the SBE 11 Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 and SBE 11 is called a SBE 911. The SBE 9 uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 and SBE 4). The SBE 9 CTD can be configured with auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). More information from Sea-Bird Electronics.

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## Deployments

### 61TG\_3052

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/57827">https://www.bco-dmo.org/deployment/57827</a>
<b>Platform</b>	R/V Tangaroa
<b>Report</b>	<a href="http://bcodata.whoi.edu/Fe_Synthesis/SOIREE/SOIREE_cruisereport.pdf">http://bcodata.whoi.edu/Fe_Synthesis/SOIREE/SOIREE_cruisereport.pdf</a>
<b>Start Date</b>	1999-01-31
<b>End Date</b>	1999-03-01
<b>Description</b>	Cruise to the Southern Ocean as part of the Fe Sythesis project whose aim was to maintain a coherent patch of iron-enriched seawater for the duration of SOIREE and to interpret any iron-mediated effects on the patch by conducting measurements and performing experiments during this period.

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## Project Information

### Southern Ocean Iron Release Experiment (SOIREE)

**Coverage:** Southern Ocean

Project in the Southern Ocean aimed at maintaining a coherent patch of iron-enriched seawater for the duration of project and to interpret any iron-mediated effects on the patch by conducting measurements and performing experiments during this period of the project.

The Southern Ocean Iron RElease Experiment (SOIREE), was the first in situ iron fertilization experiment performed in the polar waters of the Southern Ocean. SOIREE was an interdisciplinary study involving participants from six countries, and took place in February 1999 south of the Polar Front in the Australasian-Pacific sector of the Southern Ocean.

Approximately 3800 kg of acidified FeSO<sub>4</sub>.7H<sub>2</sub>O and 165 g of the tracer sulphur hexafluoride (SF<sub>6</sub>) were added to a 65-m deep surface mixed layer over an area of ~50 km<sup>2</sup>. Initially, mean dissolved iron

concentrations were ~2.7 nM, but decreased to ambient levels within days, requiring subsequent additions of 1550-1750 kg of acidified FeSO<sub>4</sub>.7H<sub>2</sub>O on days 3, 5 and 7 of the experiment.

During the 13-day site occupation, there were iron-mediated increases in phytoplankton growth rates, with marked increases in chlorophyll a (up to 2 µg l<sup>-1</sup>) and production rates (up to 1.3 gCm<sup>-2</sup>d<sup>-1</sup>). These resulted in subsequent changes in the pelagic ecosystem structure, and in the cycling of carbon, silica and sulphur, such as a 10% drawdown of surface CO<sub>2</sub>.

The SOIREE bloom persisted for >40 days following our departure from the site, as observed via [SeaWiFS remotely sensed observations of Ocean Colour](#).

#### **BCO-DMO Note:**

All original data and metadata provided on a CD-Rom accompanying the Deep-Sea Research II 48 (2001) volume. The CD-Rom contains the main SOIREE datasets and ancillary information including the pre-experiment 'desktop' database study for site-selection, and satellite images of the SOIREE bloom.

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## **Related files**

[SOIREE Preliminary Voyage Report](#)

[SOIREE Introduction and Summary, Deep-Sea Research II 48 \(2001\) 2425-2438](#)

[SOIREE Cruise Track](#)

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## **Program Information**

### **Iron Synthesis (FeSynth)**

**Coverage:** Global

The two main objectives of the Iron Synthesis program (SCOR Working Group proposal, 2005), are:

1. Data compilation: assembling a common open-access database of the *in situ* iron experiments, beginning with the first period (1993-2002; Ironex-1, Ironex-2, SOIREE, EisenEx, SEEDS-1; SOFeX, SERIES) where primary articles have already been published, to be followed by the 2004 experiments where primary articles are now in progress (EIFEX, SEEDS-2; SAGE, FeeP); similarly for the natural fertilizations S.O.JGOFs (1992), CROZEX (2004/2005) and KEOPS (2005).

2. Modeling and data synthesis of specific aspects of two or more such experiments for various topics such as physical mixing, phytoplankton productivity, overall ecosystem functioning, iron chemistry, CO<sub>2</sub> budgeting, nutrient uptake ratios, DMS(P) processes, and combinations of these variables and processes.

SCOR Working Group proposal, 2005. "The Legacy of *in situ* Iron Enrichments: Data Compilation and Modeling".

[http://www.scor-int.org/Working\\_Groups/wg131.htm](http://www.scor-int.org/Working_Groups/wg131.htm)

See also: SCOR Proceedings Vol. 42 Concepcion, Chile October 2006, pgs: 13-16 2.3.3 Working Group on The Legacy of *in situ* Iron Enrichments: Data Compilation and Modeling.

The first objective of the Iron Synthesis program involves a data recovery effort aimed at assembling a common, open-access database of data and metadata from a series of *in-situ* ocean iron fertilization experiments conducted between 1993 and 2005. Initially, funding for this effort is being provided by the Scientific Committee on Oceanic Research (SCOR) and the U.S. National Science Foundation (NSF).

Through the combined efforts of the principal investigators of the individual projects and the staff of Biological and Chemical Oceanography Data Management Office (BCO-DMO), data currently available primarily through individuals, disparate reports and data agencies, and in multiple formats, are being collected and prepared for addition to the BCO-DMO database from which they will be freely available to the community.

As data are contributed to the BCO-DMO office, they are organized into four overlapping categories:

1. Level 1, basic metadata

(e.g., description of project/study, general location, PI(s), participants);

2. Level 2, detailed metadata and basic shipboard data and routine ship's operations

(e.g., CTDs, underway measurements, sampling event logs);

3. Level 3, detailed metadata and data from specialized observations

(e.g., discrete observations, experimental results, rate measurements) and

4. Level 4, remaining datasets

(e.g., highest level of detailed data available from each study).

Collaboration with BCO-DMO staff began in March of 2008 and initial efforts have been directed toward basic project descriptions, levels 1 and 2 metadata and basic data, with detailed and more detailed data files being incorporated as they become available and are processed.

## Related file

[Program Documentation](#)

The Iron Synthesis Program is funded jointly by the Scientific Committee on Oceanic Research (SCOR) and the U.S. National Science Foundation (NSF).



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