COST Action 735 WG3 Technical Workshop on Coastal CO_2/N_2O/CH_4 Data

IFM-GEOMAR, Kiel, Germany, 22/23 January 2009

Co-Chaired by HW Bange (IFM-GEOMAR) & AV Borges (Univ. Liège)

Short Workshop Summary

by HW Bange & AV Borges
Contact: hbange@ifm-geomar.de

The "open discussion" of the CO2 Task Group addressed the following points:

- Clarification of differences between CDIAC, LDEO and SOCAT data-bases.
- The CO2 group of COST735 WG3 decided to contribute to the SOCAT data-base and exploit the SOCAT data-base to achieve the goals of COST735 (coastal climatology of CO2 fluxes).
- PIs to carry out the secondary QC of the SOCAT data-base and to construct the climatology were identified. Potential PIs for coastal regions not covered were identified and will be contacted.
- The several techniques to achieve the secondary QC taking into account the specificities of coastal waters were discussed and protocols suggested.
- It was decided that grid resolution would be either 0.5°x0.5° or 1.0°x1.0° based on data availability, and that the extent of the coastal waters would be 4° offshore of the main coastal line.
- It was decided to collapse the pCO2 data into a single year (2005) assuming that surface waters track the increase of atmospheric CO2, and using the Mauna Loa atmospheric CO2 data.
- It was decided that to achieve the climatology, the inter-annual variability would not be taken into account.
- It was decided not to interpolate data to achieve the climatology that should stay close to the data.
- To compute the air-sea CO2 fluxes it was suggested to use 3 parameterizations (Nightingale et al. (2000); Ho et al. (2006); Sweeney et al. (2007)).
- No conclusion was reached regarding the best product for wind speed and several possibilities were discussed (NCEP, ECMWF, COAS, Quickscat, SCOW). Advice from the COST 735 WG2 and other SOCAT groups will be requested.

The N2O/CH4 Task Group (H Bange, M Cornejo, A Freing, G Uher, R Upstill-Goddard, G Zhang; guest on Friday: B Quack) discussed the following points:

- There is an overall agreement on the urgent need to establish a database for open and coastal N2O/CH4 data. Up to now there is no international operating data centre which is collecting and processing N2O/CH4 data.
- The Task group suggests to establish a joint COST Action 735-SOLAS initiative called MEMENTO (MarinE MethanE and NiTrous Oxide data collection) with the aims to collect N2O/CH4 open and coastal data as well as to archive and process the data. The database will be open for the public and a report describing the database should be published in the journal "Earth System Science Data" (see www.earth-system-science-data.net).
- Additional funding possibilities have been discussed: The N2O/CH4 Task Group sees an urgent need to get funding for a person (data manager?) when a critical amount of data has been collected. This person should process and archive the data as well as writing publications/reports and maintain the webpage
- A course of action for MEMENTO was suggested.

For more details see the Extended Workshop Report on the following pages.

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EXTENDED WORKSHOP REPORT

Report on parallel CO_2 group Presentations & Discussion

(Chair & rapporteur Alberto V Borges)

- Vedula Sarma presented pH and DIC obtained in the frame of four initiatives :
  - Biogeochemical Response of coastal waters off Visakhapatnam to extreme climatic events and human interference – Surface Ocean Lower Atmosphere Study (SOLAS) since 2006 – (sampling at monthly scale)
  - Bay of Bengal Carbon Flux Study (BOBFLUX) – Council of Scientific and Industrial Research (CSIR) Since 2008 (sampling at diurnal to seasonal scales)
  - Variability of Ecosystem and Biogeochemistry in Godavari Estuarine System (VEBGES) – Supra Institutional Project (SIP) Of Council of Scientific and Industrial Research (CSIR) since 2007 (sampling at daily scale)
  - Coastal Ocean Monitoring and Prediction system (COMPAS) - Ministry of Earth Science since 2008 (sampling at seasonal scale)
- Minhan Dai presented CO2 data obtained from 2000 to 2007 in the South China Sea and in the East China Sea from 2005 to 2008. Emphasis was given on sources of error to estimate annual air-sea CO2 fluxes due to : 1) the small scale variability of seawater pCO2 for instance related to the presence of eddy structures; 2) diurnal variability of seawater pCO2; 3) Emphasis was given on changes in atmospheric CO2 due to changes on main wind direction related to the monsoon. Work to interpolate pCO2 data on remote sensing and neural network was presented. The Carbon cycling in China Seas (CHOICE-C) project was presented.
- Joe Salisbury presented data in the Gulf of Maine from 1) monthly sampling along cross-shore transect out to Wilkinson basin 2) monthly sampling along-shore up to Kennebec 3) high frequency sampling from the PMEL mooring. Data highlight strong inter-annual variability of dissolved inorganic carbon dynamics in the Gulf of Main, with wet years becoming stronger sinks of atmospheric CO2 due increased net community production.
- Burke Hales presented procedures to scale pCO2 data from algorithms using remote sensed data. Self organizing method (SOM) analysis based on remote sensed variables (SST, Chla and wind) are used to determine objectively defined regions where mechanistically justified non-linear algorithms are applied to compute pCO2 from remote sensed variables (SST, Chla).
- Francisco Chavez presented the climatology of CO2 fluxes in the coastal North America from The First State of the Carbon Cycle Report (SOCCR) based on LDEO data-base. Yet, the LDEO data-base does not include all coastal data-sets namely the MBARI data-base for the West coast. Data from surveys and moorings from the MBARI observatory were presented. Ship-board transects pCO2 off Monterey bay are running since 1993 to present and the M1 mooring is running since 2001 to present. These data show an overall increase of surface seawater pCO2 (2 ppm/yr) that is faster than atmospheric pCO2. This increase coincides with an overall decrease of SST during the last couple of decades that seems to be related to an increase of upwelling probably related to PDO.
- Simone Alin presented the three approaches used in the PMEL coastal CO2 observatory: 1) VOS lines on coastal research ships 2) moorings 3) large scale coastal surveys in the West, East and Gulf coasts. Data from the GOMECC cruise were presented. It was emphasized that the NOAA Coastal CO2 have been archived at CDIAC. Coastal Interim Synthesis Activity from the North American Carbon Program was presented.
- Benjamin Pfeil presented the Surface Ocean Carbon Dioxide Atlas (SOCAT) data base that at present time contains 10 10^6 SST and SSS data and 7 10^6 pCO2 data, some of which in coastal waters (Fig. 1). The difference between SOCAT and other CO2 data-bases is that the data is structured in a uniform format; data manipulation is transparent and traceable, and evolving. The tool to visualize and handle the data-base Live Access Server (LAS) and the tool to keep track of changes in the data-base Subversion (SVN) were also presented.
- The “open discussion” addressed the following points :

- Clarification of differences between CDIAC, LDEO and SOCAT data-bases.
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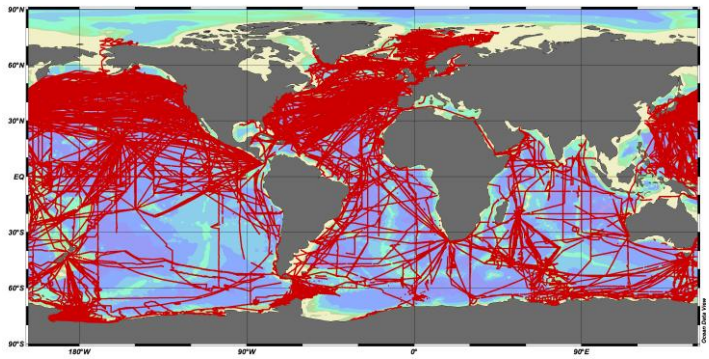
- To compute the air-sea CO2 fluxes it was suggested to use 3 parameterizations (Nightingale et al. (2000); Ho et al. (2006); Sweeney et al. (2007)).
- No conclusion was reached regarding the best product for wind speed and several possibilities were discussed (NCEP, ECMWF, COAS, Quickscat, SCOW). Advice from the COST 735 WG2 and other SOCAT groups will be requested.

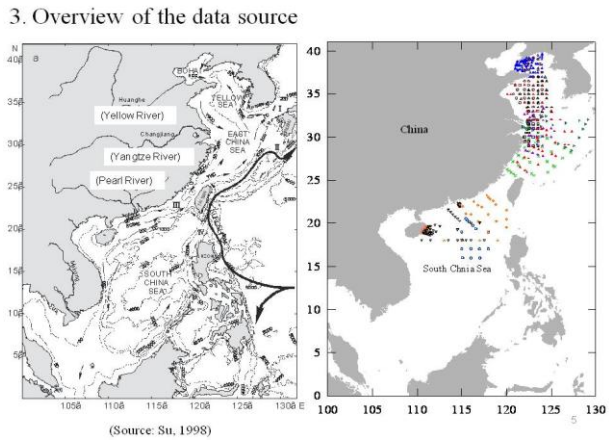
Fig. 1 - pCO_2 data availability in the Surface Ocean Carbon dioxide atlas (SOCAT) (end of 2008):



Report on parallel N2O/CH4 group Presentations & Discussion

(Chair & rapporteur Hermann W. Bange)

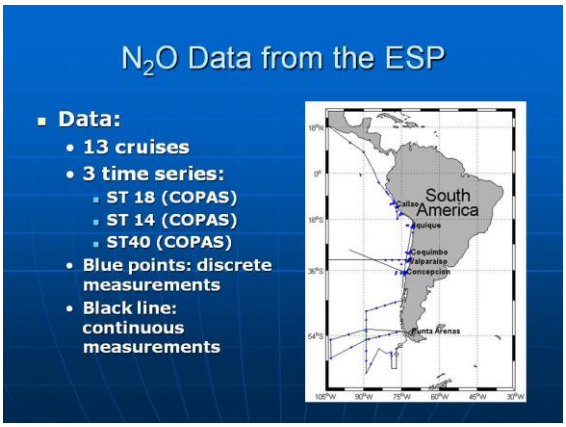
Guiling Zhang presented a comprehensive overview of the present state of research on CH4 and N2O in Chinese waters (Yellow Sea, East China Sea, South China Sea, Yangtze and Pearl River estuaries, Jiaozhou Bay and Daya Bay). These measurements have been funded by SOLAS-China and China GLOBEC-IMBER from 2004 to 2008. Part of the data are published. There is no central data management/centre in China to archive the CH4/N2O data.



Overview of the CH_4 and N_2O data source

Region	n	Cruise dates	Data	References
North Yellow sea	12	Apr.,06	CH_4/N_2O	
	30	Aug. 2006	CH_4/N_2O	Yang et al., 2009
	78	Jan. 2007	CH_4	
	77	Apr. 2007	CH_4/N_2O	
	80	Oct. 2007	CH_4/N_2O	
South Yellow sea	14	Mar. 2001	CH_4	Zhang et al., 2004
	39	Jan. 2003	CH_4/N_2O	
	14	Mar. 2005	CH_4/N_2O	
	29	Apr. 2006	CH_4/N_2O	
East China Sea	29	Apr., 2001	CH_4	Zhang et al., 2004
	15	May 2002	CH_4/N_2O	Zhang et al., 2008b
	28	Nov. 2002	CH_4/N_2O	Zhang et al., 2008b
	21	Sep. 2003	CH_4/N_2O	Zhang et al., 2008a
	24	Aug. 2005	CH_4	Zhang et al., 2008b
	14	June 2006	CH_4/N_2O	
	19	Aug. 2006	CH_4/N_2O	Zhang et al., 2008b
	26	Oct. 2006	CH_4/N_2O	
	32	Nov. 2006	N_2O	
	32	Feb. 2007	N_2O	
South China Sea	11	Jan. 2004	CH_4/N_2O	
	23	Sep. 04	N_2O	Xu et al., 2006
	23	Apr.-May 2005	N_2O	
	17	Jul. 2008	CH_4/N_2O	
	40	Aug. 2008	CH_4/N_2O	

Marcela Cornejo presented N2O data from the eastern South Pacific Ocean. Up to now, N2O measurements have been performed by the group of Laura Farias (COPAS, Univ. Concepcion) on 13 cruises (247 depth profiles and cont. underway measurements). Moreover, N2O has been measured at three coastal time series stations off Chile since 2002. There is also a limited set of CH4 measurements from the time series station #18 (measurements started in 2007). The measurements at the time series stations are run by COPAS (Centre for Oceanographic Research in the eastern South Pacific based in Concepcion, Chile). The data are partly published. There is no central data management/centre in Chile to archive the data.



Open Discussion

The N2O/CH4 Task Group (H Bange, M Cornejo, A Freing, G Uher, R Upstill-Goddard, G Zhang; guest on Friday: B Quack) discussed the following points:

- There is an overall agreement on the urgent need to establish a database for open and coastal N2O/CH4 data. Up to now there is no international operating data centre which is collecting and processing N2O/CH4 data.

- The Task group suggests to establish a joint COST Action 735-SOLAS initiative called MEMENTO (MarinE MethanE and NiTrous Oxide data collection) with the aims to collect N2O/CH4 open and coastal data as well as to archive and process the data. The database will be open for the public and a report describing the database should be published in the journal "Earth System Science Data" (see www.earth-system-science-data.net). The final product will be the computation of N2O/CH4 flux fields.
- Additional funding possibilities have been discussed: The N2O/CH4 Task Group sees an urgent need to get funding for a person (data manager?) when a critical amount of data has been collected. This person should process and archive the data as well as writing publications/reports and maintain the webpage

- A course of action was suggested:

Projected course of action:

1st YEAR

- Public call for data submission: Writing of short project description for SOLAS news, IMBER Update and Eos-Transactions AGU
- Public call for data submission: Writing of 'initial position paper' for the journal "Environmental Chemistry"
- Designate regional representatives responsible for identification of PIs who could contribute data:
  Hermann Bange: European coastal waters, Indian Ocean, Arctic Ocean, Atlantic Ocean (N2O), North Pacific (N2O)
  Rob Upstill-Goddard: Atlantic Ocean (CH4), Southern Ocean (CH4), North Pacific (CH4), Siberian Shelf (CH4), mangroves, intertidal mud flats
  Guiling Zhang (Ocean Univ of China, Qingdao, PRChina): Chinese waters
  Laura Farias/Marcela Cornejo (Univ. Concepcion, Chile): South Pacific, Southern Ocean (N2O)
- Lists with PI's will be reported to H Bange (Kiel)
- Standard letter/questionnaire with a request for data will be send out from Kiel to the PIs
- Collection of data / archiving data in database (database to be chosen)
- Set up of webpage (as part of SOLAS Project Integration webpage) as interface to data contributors / regular updating of contributions / data accumulation index

2nd YEAR

- Data processing (quality check, outlier test, gridding, etc.)
- Publication of database description in the open access journal "Earth System Science Data"

3rd YEAR

- Computation of global flux fields
- Publication of global N2O/CH4 air-sea flux fields in high ranking peer-reviewed journal

List of participants

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Workshop Agenda

Thursday, 22 January 09

09:00 Welcome: D Wallace (SOLAS), E Breviere (COST Action), H Bange
09:15 Overview Lecture CO2: Alberto Borges, Univ. Liege, Belgium
10:00 Overview Lecture N2O: Alina Freing, IFM-GEOMAR, Germany
10:45 Coffee Break
11:15 Overview Lecture CH4: Rob Upstill-Goddard, Univ. Newcastle, UK

12:00 Lunch Break

Parallel CO_2 Group Presentations & Discussions
(Chair & rapporteur Alberto V. Borges)

13:30 Vedula Sarma: Time-series observations in Godavari Estuary and coastal Bay of Bengal
13:45 Minhan Dai: Air-sea CO2 fluxes in China Seas and their major estuarine systems
14:00 Joe Salisbury: Interannual variability in surface pCO2 in the western Gulf of Maine
14:15 Burke Hales: Ocean margin CO2 measurement and synthesis programs-- a minimalist's view
14:30 Francisco Chavez: MBARI CO2 observatory
14:45 Simone Alin: The NOAA Coastal CO2 Observational Network
15:00 Coffee Break
15:30 Benjamin Pfeil: SOCAT database & LAS
15:50–18:00 Open discussion “Synthesis of coastal CO2 data: who, where, how?”

Parallel N2O/CH4 Group Presentations & Discussions
(Chair & rapporteur Hermann W. Bange)

13:30 Guiling Zhang: CH4 and N2O in coastal waters of China
14:15 Marcela Cornejo: N2O data from the eastern South Pacific
15:00 Coffee Break
15:30–18:00 Task Group Discussion continued

19.00 Joint Dinner at Restaurant

Friday, 23 January 09

09:00-11:00: Parallel CO_2 Group open discussion (continued)
(Chair & rapporteur Alberto V. Borges)

09:00-11:00: Parallel N2O/CH4 Presentations & Discussions (continued)
(Chair & rapporteur Hermann W. Bange)

11:00 Coffee Break

11:30-12:30: Joint presentations of the Task Groups

IFM-GEOMAR Press Release, 22 January 2009:

TÜV-Abnahme für klimarelevante Daten aus dem Ozean

– Internationales Expertenteam legt Qualitätsstandards fest –

Die Teilnehmer des COST-Workshops am Kieler IFM-GEOMAR. Foto: J. Steffen, IFM-GEOMAR

Die Wechselwirkungen zwischen Ozean und Atmosphäre sind komplex und für unser (zukünftiges) Klima von entscheidender Bedeutung. Die Meere nehmen beispielsweise das Treibhausgas Kohlendioxid in erheblichen Mengen auf und bremsen damit die Klimaerwärmung. An anderer Stelle setzen sie Gase wie Lachgas und Methan frei, die den Treibhauseffekt verstärken. Um diese umfangreichen Wechselwirkungen verstehen zu können, benötigen Wissenschaftler verlässliche Daten. Diese Daten müssen bestimmten Qualitätskriterien entsprechen, denn die Änderungen sind oftmals klein und nur mit genauen Messungen über lange Zeiträume erkennbar. Nur aus „TÜV-geprüften“, erstklassigen Daten können dann zuverlässig Schlüsse gewogen werden. Deshalb treffen sich insgesamt 30 Wissenschaftler aus 12 Nationen, darunter Experten aus Indien, China, USA und Chile, heute (22. Januar 2009) und morgen am Kieler Leibniz-Institut für Meereswissenschaften (IFM-GEOMAR), um gemeinsam derartige Qualitätskriterien festzulegen. Ein besonderes Augenmerk der Wissenschaftler liegt dabei auf Messergebnissen, die in Küstengebieten erhoben werden.

Der Kieler Workshop findet statt im Rahmen der COST Action 735

„Wenn wir die Qualität der Daten nicht sicher einschätzen können, dann nutzen sie nur wenig, um verlässlich zu berechnen, in wie weit die Ozeane langlebige Treibhausgase speichern oder sie freisetzen“, erläutert der Organisator des Workshops, Dr. Hermann Bange vom IFM-GEOMAR. Dieses Wissen sei aber wichtig um die zukünftige Klimaentwicklung vorher sagen zu können.

Für Daten zum Kohlendioxid-Gehalt der Ozeane, zu dem inzwischen mehr als 6 Millionen Messungen existieren, gibt es bereits etablierte Qualitätsprüfungen. Doch für andere klimarelevante Gase wie Lachgas und Methan stehe man in dieser Beziehung erst am Anfang, erläutert Bange weiter. „Die ausführlichen Diskussionen während des Workshops in Kiel sollen hierfür einen Anfang machen“.

Das Forschertreffen wird von der EU im Rahmen des COST Programms finanziert, einer Initiative zur Förderung der Zusammenarbeit in Wissenschaft und Technik.

Links:
COST: http://www.cost.esf.org/
COST Action 735: http://www.uea.ac.uk/env/cost/

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Newspaper article published in “Kieler Nachrichten”, 23 January 2009:

Kieler Nachrichten
Freitag, 23. Januar 2009
Nr. 19

Experten legen Standards für Messungen fest

Kiel – Vor diesem TÜV haben Wissenschaftler großen Respekt: Um Wechselwirkungen zwischen Ozean und Atmosphäre mit Blick auf den Klimawandel verstehen zu können, brauchen sie verlässliche Daten. In Kiel tagen bis heute etwa 30 Forscher aus zwölf Nationen, um Qualitätskriterien für Überprüfungen von Lachgas- und Methan-Messungen festzulegen.

Die Meere nehmen das Treibhausgas Kohlendioxid in erheblichen Mengen auf und bremsen damit die Klimaerwärmung. An anderer Stelle setzen sie Gase wie Methan und Lachgas frei, womit sie den Treibhauseffekt ankurbeln. Um die oft kleinen Änderungen der Wechselwirkungen zu erfassen, müssen die Messungen über lange Zeiträume genau bleiben. Nur aus TÜV-geprüften erstklassigen Daten, erklärte gestern das Kieler Leibniz-Institut für Meereswissenschaften (IFM-GEOMAR), könnten zuverlässig Schlüsse gezogen werden. „Wenn wir die Qualität der Daten nicht sicher einschätzen können, nutzen sie nur wenig, um zu berechnen, in wie weit die Ozeane langlebige Treibhausgase speichern oder sie freisetzen“, gibt der Organisator des zweitägigen Arbeitstreffens, Dr. Hermann Bange (IFM-GEOMAR), zu bedenken.

Mittlerweile liegen bereits mehr als sechs Millionen Messungen zum Kohlendioxid-Gehalt der Ozeane vor, deren Qualität von Datenzentren in Bergen (Norwegen) und Oak Ridge (USA) geprüft und für gut befunden wurden. Doch für Lachgas und Methan steht ein TÜV erst am Anfang. Das von der EU geförderte Treffen in Kiel soll erste Schritte einleiten, um die bisher vereinzelten Datenmessungen dieser Gase zusammenzuführen. Ein Schwerpunkt liegt dabei auf Messergebnissen aus den Küstengebieten: Dort spielten sich wegen der Einträge vom Land wesentlich mehr biologische Prozesse als auf dem offenen Meer ab, so Bange. mad