Modelling the Impact of Climate Change on the Australian Southeast Seabed

Li, Fangjun[1], Cedric Griffiths[1], Chris Dyt[1], Evelina Paraschivoiu[1] (1) CSIRO Petroleum, Perth, Australia

Abstract
The Australian seabed is influenced by extreme weather conditions of various types: cyclones, high tidal ranges, offshore currents and storm waves. Over the past two centuries substantial progress in our understanding of the seabed and environmental conditions has been made by studies of seabed sedimentology, hydrodynamics, and habitat mapping. As part of the CSIRO Wealth from Oceans Flagship programme the Predictive Geoscience team are involved in a new five year study to investigate and predict the effect of possible climate change scenarios on the seabed over the next 50 years. As an initial phase of this project we have taken the southeast region of the Australian seabed as our study area. The seabed responses to current climate, and future possible climatic conditions into the next 50 years have been simulated for the first time by a state-of-the-art numerical model, Sedsim. It was found that: • the contribution of river carried sediment (redistributed by marine processes) to the region's seabed, even with the wettest predicted climate change, is limited. In general the fluvial sediment in the southeast region can not keep pace with the action of strong marine forces, such as waves and currents. Therefore, most of the seabed suffers from erosion, due to lack of sediment to distribute. This situation would get worse if the local climate swings towards the high energy side; • the general high wave energy, significant tidal currents, and frequent surges of wind-driven currents make the local seabed highly mobile and sensitive to hydrodynamic change; • the change of turbidite activity between different climate scenarios is insignificant in both the number of submarine slope failures and the affected areas as is the seabed median grain size.

Hydrochemical Characterization of Produced Formation Water, and Shallow Aquifers at the Kenmore and Bodalla South Oil Fields, Queensland, Australia

Secombe, Katherine[1], Mansour Edraki[1], Thomas Baumgartl[1], David Mulligan[1] (1) The University of Queensland, Brisbane, Australia

In a few petroleum and coal seam gas fields of Australia, large volumes of saline produced formation waters which potentially contain inorganic salts, trace metals and organic compounds have been traditionally released into unlined impoundments, or evaporation ponds. A better understanding of the geochemical properties and the environmental impacts of these waters, as they interact with neighbouring soils and ground waters, is the key to the rehabilitation of the ponds and the surroundings. The aim of this study is to (1) accurately characterize the produced formation water and local ground waters at two study sites, Kenmore and Bodalla South oil fields in southwest Queensland, (2) delineate those geochemical properties that are helpful in investigating fate, transport and attenuation of the contaminants; and (3) investigate the extent of the contribution of produced water to the salinity of the lands surrounding the ponds.
Produced water at the outlet is warm (~60°C) alkaline with pH values ranging from 8.12 to 9.82 and salinities ranging up to 5000 mg/L TDS. The produced water at both sites is Na-HCO3 type waters, whereas sampled waters from the monitoring wells are Na-Cl type. The pond waters do not appear to have caused the accumulation of salts, which is in accord with the local soils showing signs of dry land salinization exacerbated by land clearing. However, local seepage from the ponds was detected by some trace elements and hydrocarbons, supported by geochemical modelling and oxygen isotopes. The seepage in fact remobilises the natural salts already present in the soil.

Physio-Chemical Characterization of Unsaturated Zone with Special Reference to Chemical Processes

Elango, Lakshmanan[1], Ramasubramaniam Kannan[2] (1) Anna University, Chennai, India (2) Anna University,

The unsaturated zone has a large degree of control over the transmission of water to aquifers, as well as to the land surface through overflow, plant uptake and to the atmosphere by evaporation. Key physical phenomena such as thermodynamic interactions, transport processes of various kinds, and chemical reactions occur in the unsaturated zone. The highly complex chemical reactions can be rebuilt by performing mass balance modelling with the soil-waters collected at different depths in the unsaturated zone. This modelling can lead to understanding of transport of contaminants to the groundwater. Chemical reactions that take place in the unsaturated zone were identified at an agricultural site in lower Palar River basin, Tamil Nadu, India. The measured physico-chemical parameters of the soil and soil water were used to identify the net geochemical reactions along the downward infiltration flow path, with the help of standard mass balance modelling software code. Inverse mass balance models prove that calcium carbonate precipitation, CO2 out gassing, Ca/Na ion exchange, Ca/K reverse ion exchange and Mg/Na ion exchange are the dominant reaction in the unsaturated zone. The models however, suggest Ca/Na reverse ion exchange occurs between 1-2 and 5-6 feet, calcite dissolution between 3-5 feet, Ca/K ion exchange between 1-2 and 4-5 feet and may be due to the addition of external water to soil water in the unsaturated zone. Gypsum dissolution was very low throughout the 6 feet of unsaturated zone. Similar experimental techniques can be adopted to understand the chemical reactions during hydrocarbon migration through unsaturated zones. Knowledge of these chemical processes will lead to improved understanding of reactive transport through unsaturated zones.

Managing Environmental Risks through the Application of ISO 14001: Environmental Management System Standards

Schwarz, Steffi[1] (1) SAI Global Limited, East Perth, Australia

While Environmental Management is applicable across all sectors of industry and Government, it is of particular importance for the petroleum industry, as the environmental risk faced could have particularly severe consequences.

ISO 14001 specifies the requirements for an Environmental Management System, providing a framework for an organisation to identify and manage the environmental impact of its activities, products and services, and to improve its environmental performance continually.

Environmental Management Systems enable organisations to improve environmental, social and economic performance, thereby contributing to global sustainability.

Businesses are provided with an opportunity to benchmark against emerging trends in regulatory, community, stakeholder and trade requirements.

The benefits of Certified Environmental Management Systems include:

· Improved environmental risk management
· Enhanced public image,
· Enhanced community acceptance,
· Enhanced environmental stewardship,
· Improved sustainable decision-making, and
· Lower insurance costs.

Examples as to how Environmental Management Systems enable organisations to improve performance and mitigate risks will be given.

The revised international standards on Environmental Management Systems (ISO 14001:2004) are illustrated.

This paper further discusses sustainability reporting and verification of sustainability reports.

Environmental, Social, and Health Impact Assessment (ESHIA): A Systematic Process for Assessing and Minimizing Potential Impacts of Major Capital Projects Worldwide, with an Example from the LNG Business

Minnery, Greg[1] (1) Chevron Global Gas, Houston, TX

Chevron International Exploration and Production has initiated a logical and systematic process to help ensure compliance with corporate and in-country environmental, social, and health standards and regulations and achieve corporate goals for operational excellence. The Environmental, Social, and Health Impact Assessment (ESHIA) is designed to be used early in project development which also provides key information for quality business decisions by helping to identify potential "show stoppers," gain effective input from local and regulatory stakeholders, and better assess costs related to compliance, mitigation, or project delays. Specific objectives of ESHIA are to protect human health and the environment, minimize or eliminate potential liabilities from operations, provide greater understanding of community needs and expectations, deliver sustainable benefits, and promote consistency and efficiency within and between projects.

The process is scalable to cover a wide range of project complexity, but the general procedure consists of five procedures performed from project inception through operations. The steps include: Screening (a checklist-guided process to determine if full assessment is warranted), Scoping (identify, scale, and prioritize issues identified in the screening process), Impact Assessment (evaluation of potential impacts and mitigation measures), Stakeholder Engagement (on-going communication and feedback from all local, regulatory and business stakeholders), and a Management Plan (links impact and mitigation assessments to construction and operations to help ensure compliance).

The ESHIA process generates value by providing clearer understanding of potential environmental and social potential impacts from proposed projects, improves project efficiency and decision-making quality, and helps ensure ongoing operational compliance.