FEASIBILITY OF USING REMOTE SENSING AS A TOOL FOR SCHEDULING AND CONTROL OF DREDGING

HERMAN GERRITSEN [1], SHARON TATMAN [2], WOUTER DIRKS [3], GERARD HESSELMANS [4] and HEIN NOORBERGEN [5]

[1] Senior Researcher, WL | Delft Hydraulics, P.O. Box 177, 2600 MH Delft, The Netherlands
(Tel: +31-15-2858470, e-mail: herman.gerritsen@wldelft.nl)
[2] Advisor, WL | Delft Hydraulics, P.O. Box 177, 2600 MH Delft, The Netherlands
(Tel: +31-15-2858565, e-mail: sharon.tatman@wldelft.nl)
[3] Senior Engineer, Van Oord Dredging and Marine Contractors, Watermanweg 64, 3067 GG Rotterdam
(e-mail wdi@vanoord.com)
[4] Remote Sensing Specialist, Argoss, P. O. Box 61, 8325 ZH Vollenhove, The Netherlands
(e-mail: hesselmans@argoss.nl)
[5] Researcher, National Aerospace Laboratory NLR, Voorsterweg 31, 8316 PR Marknesse, The Netherlands
(e-mail: noorberg@nlr.nl)

Recent years show an increasing concern about the environmental effects of dredging in coastal waters, often related to large infrastructure projects. Of specific concern is the increased turbidity caused by resuspension of bottom sediment and spillage from dredging or land reclamation activities. In close cooperation with one of the leading dredging companies, the RESTSCOD project was set up to investigate the feasibility of a new method for synoptic monitoring of turbidity represented by Total Suspended Solids (TSS). The method aims at optimising information from operational dredging data, remote sensing data, water quality modelling of sediment transport and in-situ data by means of new data-model integration (DMI) techniques.

As a feasibility test case, Penny's Bay in the Hong Kong Special Administrative Region was selected. Using model simulations in combination with archived optical remote sensing (SeaWiFS and Landsat) and in-situ data, the background TSS levels are determined. Separately, the extent and concentration of dredging / disposal plumes is modelled using a particle tracking model. A new flexible input editor translates the relevant operational dredging data into consistent model information. An outline is given how remote sensing imagery and in-situ data can be assimilated to optimise the model nowcasts and so improve short period forecasting of the plume behaviour by the model.

A diagram of the conceptual approach of the DMI techniques for incorporation into the Dredging Information System is illustrated in Fig. 1 below. This pre-operational Dredging Information System can be used for planning purposes (forecasting mode) and assessments afterwards (hindcasting mode); its use as an operational near real-time system depends on frequency of satellite overflights and data delivery times.

The main results of the present RESTSCOD feasibility study are:

The Penny's Bay feasibility experiment was a realistic test case to assess the turbidity information (used here: TSS) that can be derived from in-situ data, remote sensing

imagery and water quality and plume modelling.

The prototype GUI of the Dredging Information System realised in this project has shown to be an effective tool, suited to streamlining the preparation of model input by field engineers and for avoiding common input errors.

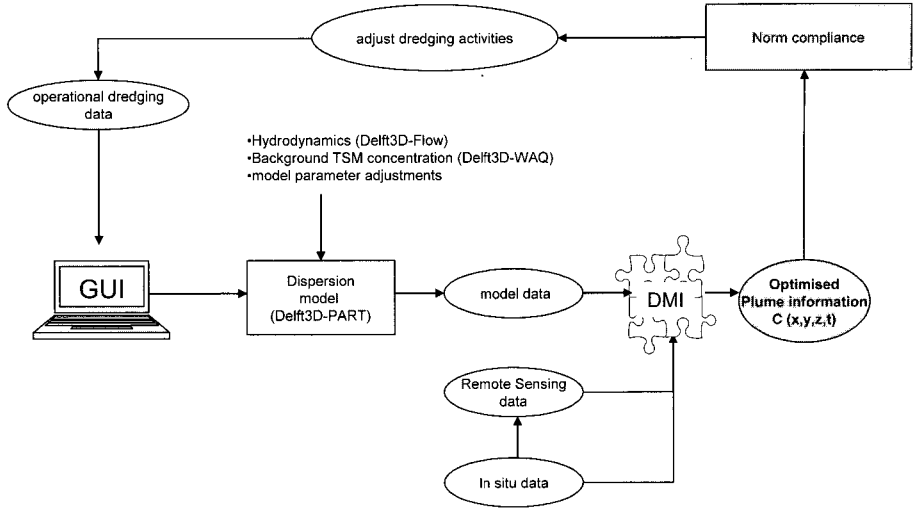

Fig. 1 Schematic of the Dredging Information System for dredging activities, based on optical remote sensing, operational dredging data, in-situ data, model data and data-model integration

The most effective approach for using remote sensing data in practice is likely to use both high resolution, less frequent imagery (Landsat) and lower resolution but more frequent imagery (SeaWiFS, or in the future e.g. MERIS or MODIS).

By assessment of the background concentrations from historic RS imagery and through modelling, the proposed technique has the potential to effectively and objectively separate sediment contributions due to operations from background concentrations, which assists the dredging industry in complying to realistic environmental norms

Structured combining of the three information sources on sediment concentrations by using formal DMI techniques to assess and optimise the concentration results is practically feasible; an outline of the presented technical approach will be realized in a follow up study.

Keywords: Dredging; Turbidity; Environmental impact; Remote Sensing; Plume modelling; Operational information system