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# Dynamic risk assessment of oil spill scenario for Three Gorges Reservoir in China based on numerical simulation

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## Abstract

A novel method for dynamic risk assessment of oil spill accidents based on numerical simulation was presented in this paper. The dynamic risk assessment model was developed consisting of a comprehensive list of caused consequences like environmental damage, asset loss, health impact and social effect as well as emergency actions preventing these losses. Contributing events in the Mater Logic Diagram (MLD) of the dynamic risk assessment model were valued based on the simulated evolvement of oil contaminants under spill scenario on quasi-static fluid, which was obtained by coupling an oil spill model with hydrodynamic module in Jialing river of Three Gorges Reservoir in China after the impoundment of the reservoir to 175 m water level in 2010. Calculated result of dynamic risk as grade *IV* indicated that the assessed oil spill was not as catastrophic as we thought because of the slow transport of oil fractions on water surface and absence of dispersed oil in water body due to the quasi-static fluid, very gentle wind and effective emergency actions, as well as by the reason that rare agriculture or industrial crops exist in spill adjacent area.

## Highlights

► Dynamic risk assessment of oil spill based on numerical simulation was presented. ► Model consists of environmental, asset, health and social consequences. ► Dynamic risk of assessed oil spill in Three Gorges Reservoir is grade *IV*. ► Oil fractions transport slow and dispersed oil absents duo to the quasi-static fluid.

## Keywords

Risk assessment; Oil spill; Three Gorges Reservoir; Numerical simulation

Figures and tables from this article:

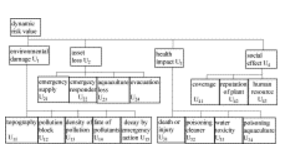

Fig. 1. Master Logic Diagram (MLD) of oil spill risk assessment events.

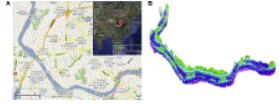

Fig. 2. Study area based on Googlemap captured on March 1, 2011 (http://maps.google.com/maps?hl=en&tab=wl) (A) and computational version (B).

Figure options

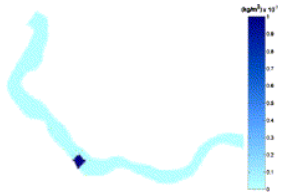

Fig. 3. Floating oil fraction at the 2.5th day post spill.

Figure options

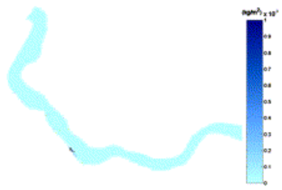

Fig. 4. Sticking oil fraction at the 2.5th day post spill.

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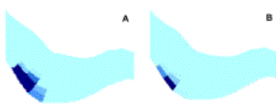


Fig. 5. Floating oil fraction at the 5.5th day post spill without (A) and with (B) emergency actions.

Figure options

Table 1. Matrix and weight of dynamic risk value *U*.

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Table 2. Matrix and weight of environmental damage event $U_1$.

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Table 3. Matrix and weight of asset loss event $U_2$.

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Table 4. Matrix and weight of health impact event $U_3$.

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Table 5. Matrix and weight of factor social effect event $U_4$.

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Table 6. Risk classes of shipping accidents.

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