Assessment of the potential for future deposition of tidal flats in the northern coast of Vietnam

Si Son TONG\textsuperscript{a,b}, Jean Paul DEROIN\textsuperscript{b}, Thi Lan PHAM\textsuperscript{c}

\textsuperscript{a} Space and Aeronautics department, University of Science and Technology Ha Noi, VIETNAM  
\textsuperscript{b} GEGENAA (EA 3795), Université de Reims Champagne-Ardenne, 51100 Reims, FRANCE  
\textsuperscript{c} Faculty of Geomatics and Land Administration, Ha Noi University of Mining and Geology, VIETNAM
Tidal flats

Tidal flats (Semidiurnal tide) in Shiokawa, Aichi, Japan

**Tidal flats:** - Areas between low and high tides, without vegetation
  - Alternately covered and uncovered by tides
  - Divided into Low tidal flats, mid tidal flats and high tidal flats
Introduction

Methodology

Results and discussions

Conclusions

Perspectives

Global distribution of tidal flats

Red river mouth
Diurnal tide
Lower macrotidal (range 3.5m)
Tidal flat width: 2km

Mont Saint Michel bay
Semidiurnal tide
Upper macrotidal (range 14.25m)

Tidal flats

Mangrove

Landsat 8
Resolution 30m
Acquired 25 Sep 2014

Flemming, 2005

(115x80) Tidal flat extent correlates with the tidal range

Global distribution of tidal flats

(619x88) Flemming, 2005

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Flemming, 2005
Tide domination

Wave domination
Sediments from Red river
High deposition

Conclusions
Perspectives

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Methodology                   Results and discussions                       Conclusions                    Perspectives

Study area

Tide domination
Coarse sediments
Tide domination
Coal sediments
Wave domination
Sediments from Red river
High deposition

Wave domination
Erosion coast
Objectives

- Monitoring the tidal flat change over period 1989-2014 using optical images

- Assessment of potentials for future deposition of tidal flats
**Data**

- **Satellite images:** 117 Landsat to build 3 new DEMs of tidal flats in 1989, 2000, 2014

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- **Tide level:** estimating at exactly acquisition time of images from SHOM service

- **Factor maps:** 14 factor maps related to Sediment resources, Tidal flat properties, Coastal properties, Ocean effects
General methodology

**Methodology**

1. **Optical satellite images**
   - Extracting waterlines
   - Build DEMs of tidal flat

- **Erosion analysis**
- **Deposition 1989-2000, 2000-2014**
- **ROC + MCE**

**Factor maps**

- **Sediment resources**
  - Net sediment budget
  - River sediment type
- **Tidal flat properties**
  - TF width
  - TF slope
  - TF exposure time
  - Roughness
  - TF moisture
  - Coastal direction
  - Coastal length
  - supratidal
  - Bottom slope
- **Coastal properties**
- **Ocean effects**
  - Wind, wave effects
  - Sea currents

**Potential for future deposition**

**Introduction**

**Methodology**

**Results and discussions**

**Conclusions**

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*ROC: Relative Operating Characteristic
MCE: Multi Criteria Evaluation*
1. Tidal flat changes

DEMs of tidal flats
RESULTS

1. Tidal flat changes

Volume change of tidal flats between 1989 and 2014

LEGEND

District borders
Provincial borders
25 Million m³
Erosion 1989-2014
Accretion 1989-2014
Rivers
Islands
Tidal flats

Terra image acquired 20101022
Projection WGS84 zone N48
Assessment of Potential for future deposition

1. Tidal flat changes

2. Potential deposition

**RESULTS**

**Factor maps**

- River mouth distance
- Net sediment budget
- River sediment type
- TF width
- TF slope
- TF exposure time
- Roughness
- TF moisture
- Coastal direction
- Coastal length
- Land cover of supratidal
- Bottom slope
- Wind, wave effects
- Sea currents

**Sediment resources**

- River mouth distance
- Net sediment budget
- River sediment type

**Tidal flat properties**

- TF width
- TF slope
- TF exposure time
- Roughness
- TF moisture
- Coastal direction
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**Coastal properties**

- River mouth distance
- Net sediment budget
- River sediment type

**Ocean effects**

- River mouth distance
- Net sediment budget
- River sediment type

**Empirical factors**

- River distance empirical

**Heuristic factors**

- River distance heuristic

**Kim Son Giao Thuy Cam Pha Mong Cai**
Selecting factors for making potential map

- **Factor with the higher ROC is higher explanatory historical deposition**
- **Selecting factors with higher ROC for mapping potential deposition**
RESULTS

1. Tidal flat changes

2. Potential deposition

Potential for future deposition

7 heuristic factors

5 empirical factors

Low

Medium

High
Map of potential for future deposition
Conclusions

- Unique DEMs of tidal flats in 1989, 2000, 2014 (Vertical accuracy: 14cm, horizontal: 30m with the average slope 0.75 degree)

- Erosion occurs in the north, deposition in the south

- Evolution information is important data for local government.
Potential for future deposition

- Successfully applied the GIS analysis for assessing potential for future deposition

- Difficult to integrate the extreme phenomena in the model. (storms, cyclones).

- Potential deposition is suitable for future 50 years in context of climate change.

(\textit{sea level rise 0.3cm/year \times 50 years = 15cm > 14.4cm accuracy of DEMs})
Thank for your attention