

Catch-MEKONG – Saltwater Intrusion and Morphodynamics in the Mekong Delta: Status, Impacts and Future Developments. Results of a 5-year Research Project

Water Security
and Climate Change
Conference

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Huth, Juliane¹; Ottinger, Marco¹; Apel, Heiko²; Schlurmann, Torsten³; Jordan, Christian; Grimmeisen, Felix⁴; Heege, Thomas⁵; Lam Dao, Nguyen⁶; Chau Nguyen, Xuan Quang⁷; Kuenzer, Claudia¹

¹ German Aerospace Center DLR, Oberpfaffenhofen; ² German Research Centre for Geosciences, Potsdam; ³ Ludwig Franzius Institute of Leibniz University Hannover; ⁴ SEBA Hydrometrie GmbH & Co. KG; ⁵ EOMAP GmbH & Co. KG, Germany; ⁶ Vietnam National Satellite Centre, Ho Chi Minh City; ⁷ Vietnam National University, Ho Chi Minh City, Vietnam.

I N T R O D U C T I O N

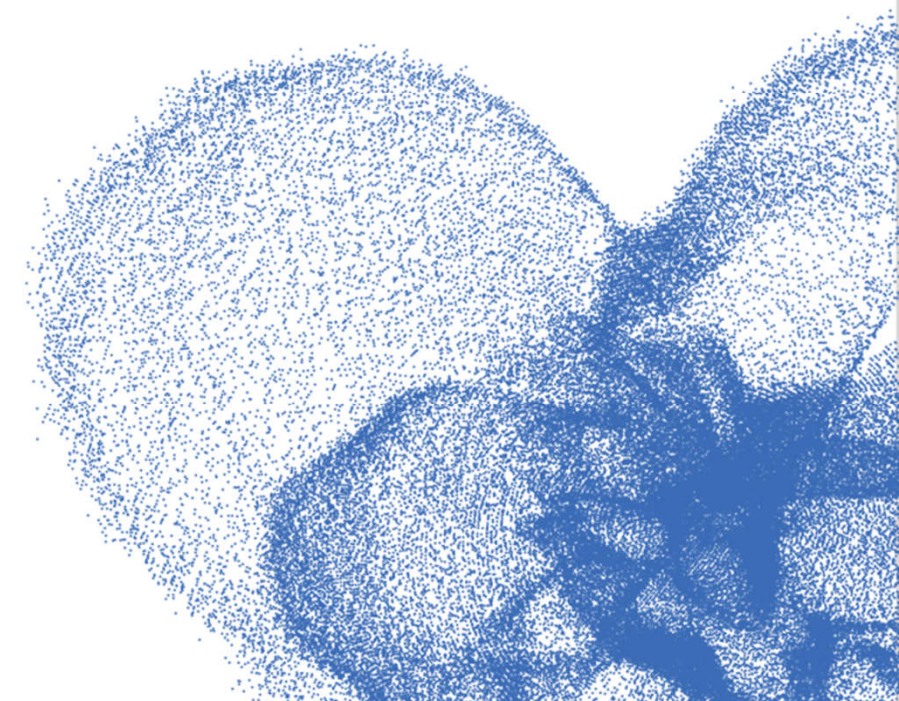
Environmental impacts of upstream developments for the Mekong Delta

→ Lack of water availability and sediment transport from upstream regions, lead to:

- **Riverbed erosion** and **coastal erosion** in the Delta due to lack of sediments
- Less nutrients bound to less **sediments**, needed for **soil fertility**
- Severe **agriculture/ aquaculture losses** due to water shortage
- Increased **salt water intrusion** in coastal areas exacerbated due to **sea level rise**

→ **Multi-disciplinary research project to assess impacts** → **See selected results**

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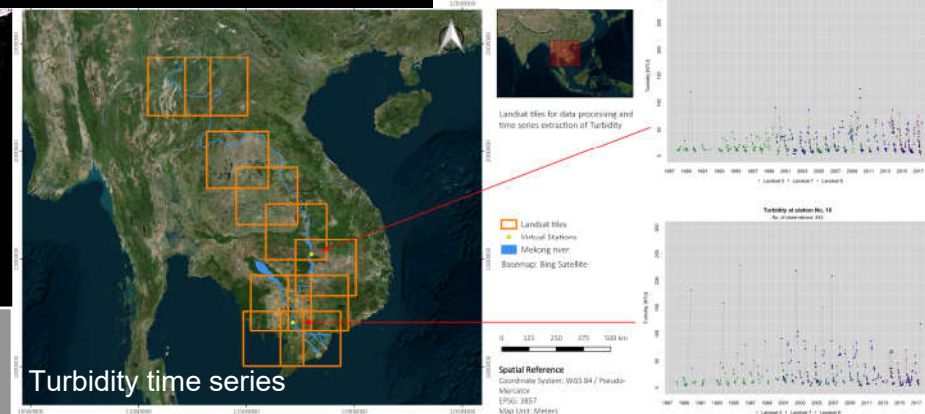
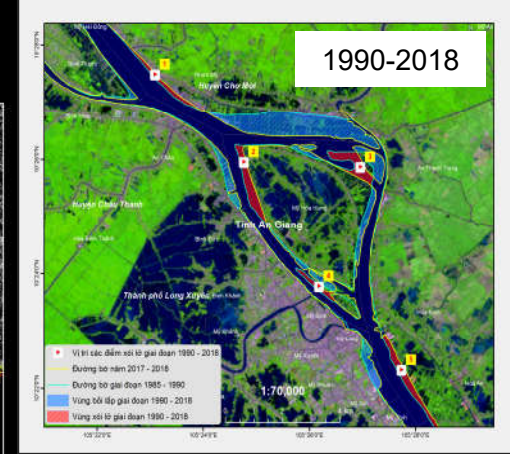
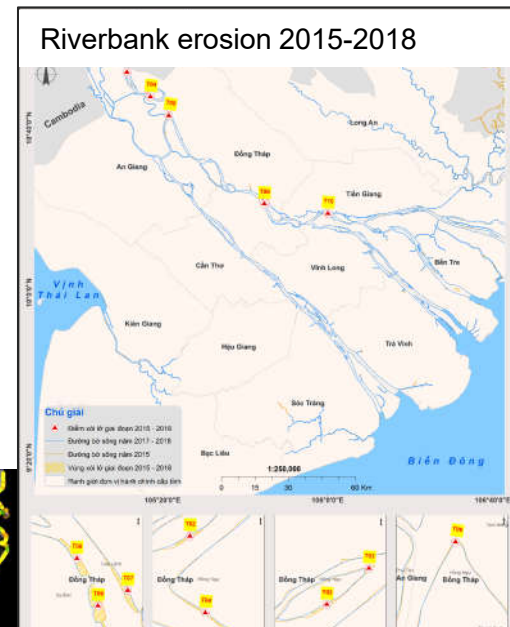
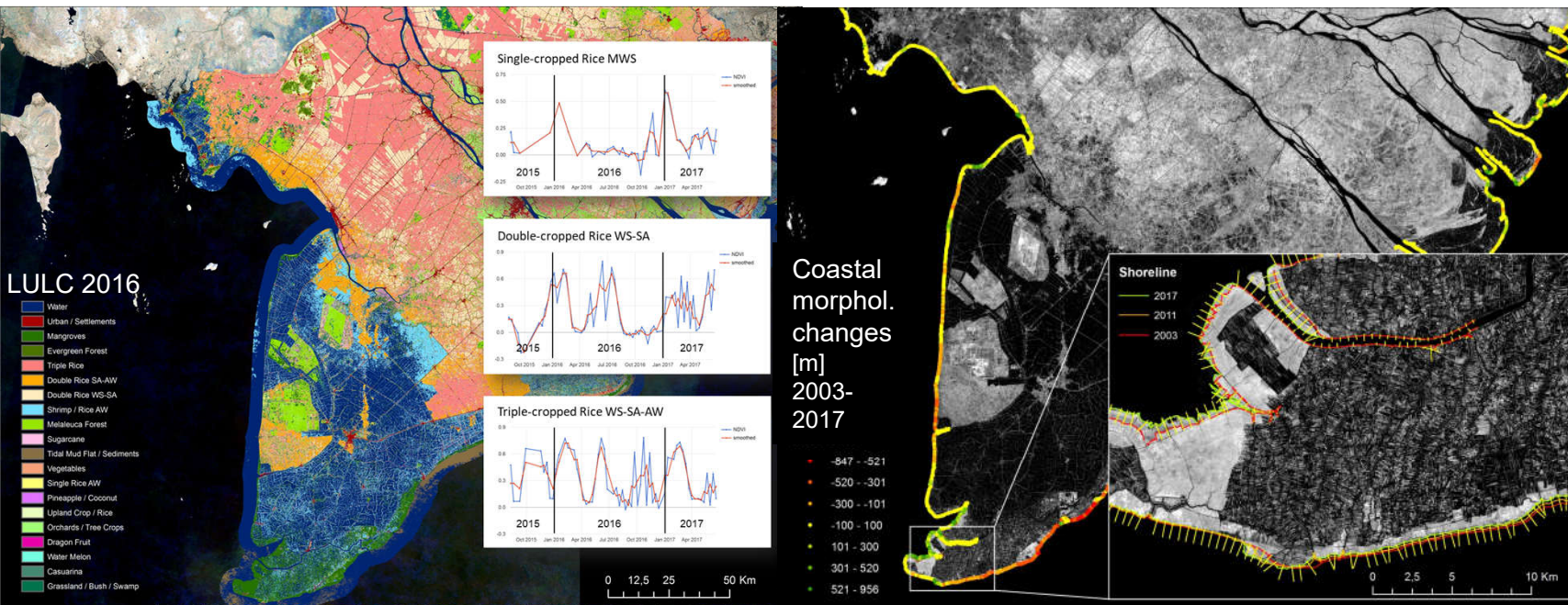


High Resolution Data from Earth Observation

Results in a nutshell – Derivation of relevant information for the entire Mekong Delta

- Multi-sensor satellite approach used for high-resolution **flood** and **water dynamics** mapping
- Long-term **coastal morphological changes** quantified for the **entire Mekong Delta coast**
- Consistent **long-term time series** of **turbidity** along the **entire Mekong river** - virtual turbidity stations
- Long-term **riverbank erosion** analyses
- **High resolution Land Use Land Cover** from **Sentinel-2** satellite time series

➔ Development of **Mekong Knowledge Hub** for communication of project results



Salinity Intrusion in the Mekong Delta: Future Trends

Design of the study

- **Hydrodynamic modelling** of **salinity intrusion** of the whole Mekong Delta
- Estimation of **future changes** by sensitivity based approach
- **Range of change** of boundary conditions **from literature**
- **Comparison** of **mean salinity** intrusion of base line period **2000 – 2010** to future time horizon **2050 – 2060**

Base line

- Daily Q Kratie of 2000-2010 \Rightarrow mean daily discharge of hydrological year (June 1 – May 31)
 - + and mean observed ocean salinity of that period
- \Rightarrow continuous simulation of salinity intrusion under mean conditions of reference period

Results in a nutshell – Mean Salinity Intrusion from February to March

- **Climate change** \rightarrow lower Mekong discharge dry season \rightarrow salinity intrusion \uparrow
- **Sea level rise** \rightarrow higher sea water levels & intrusion \rightarrow salinity intrusion \uparrow
- **Dam development** \rightarrow higher Mekong dry season discharge \rightarrow salinity intrusion \downarrow

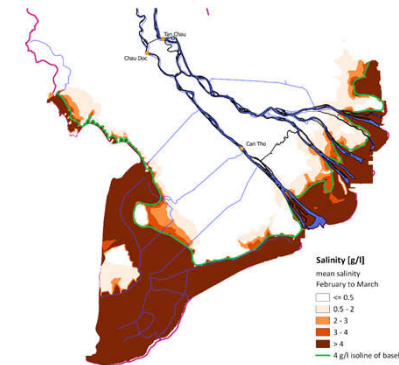
\Rightarrow Competing impacts of future drivers of salinity intrusion

\Rightarrow Dam development could offset salinity intrusion to certain extent

However, **dam development is not recommended** as a mitigation strategy, **because of the numerous negative impacts** of dam development (sediment reduction, river bank and bed erosion, reduction in wild fish production, ecological instability,...) and the uncertainty in actual dam construction and eventual operation schemes.

Thus, **adaptation is required** in order to deal with the **expected increase** in the **area affected by critical salinity levels** of > 4 g/l in the range of 2% - 17% in the coastal provinces of the Mekong Delta.

Base line



Climate Change + Sea Level Rise + Dams – maximum Impact

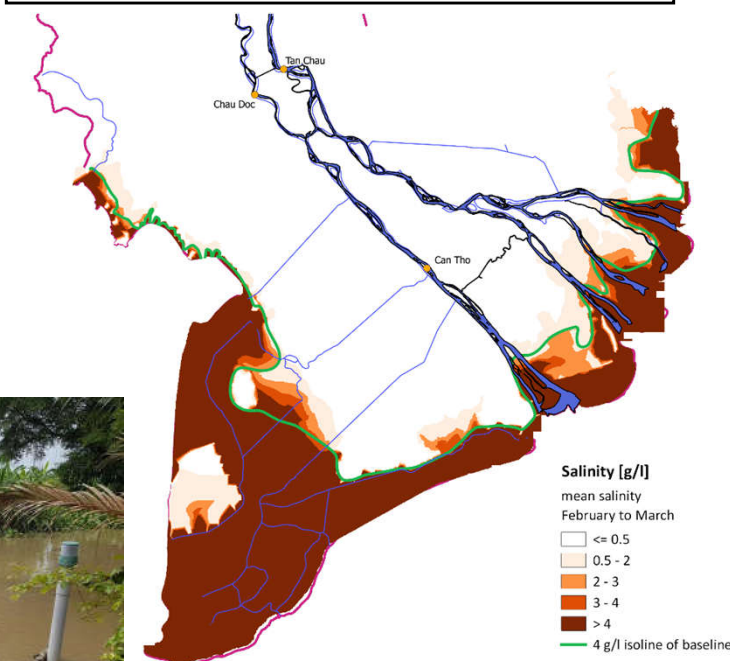


Figure: project measuring stations in canals

Figure: modelling results



Current Estimates of Sand Mining Volumes in the Mekong Delta

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Design of the study

- **Bathymetric surveys** (2018 dry and wet season) along 20 km section of the **Tien River branch** (between Sa Dec and Vinh Long)
- **Median-filtering** of surveyed bathymetry to extract **regional signal** of bathymetry
- Subtraction of regional bathymetry from original surveyed dataset to calculate **residual bathymetry** (i.e. separation of mining sites from the surrounding bathymetry)
- Annual sand mining volume for the study area was estimated from residual bathymetry: $\sim 4.64 \pm 0.31 \text{ Mm}^3$ or $8.63 \pm 0.58 \text{ Mt}$
- Discrepancies between estimated sand mining volume and reported statistics indicate **informal sand mining activity**

Results in a nutshell – Sediment deficit and land lost to erosion

- Annual sand transport of $\sim 3.80 \text{ Mt}$ (suspended + bed load) for the whole Tien River branch, reported by Stephens et al. (2017), is significantly smaller than observed sand mining
- ➔ **Substantial sediment deficit (8.63 Mt vs. 3.80 Mt)**
- ➔ Local erosion processes are triggered or at least accelerated by sediment deficit: $\sim 1.86 \text{ km}^2$ of land was lost to erosion between **2003 and 2017** along surveyed river section

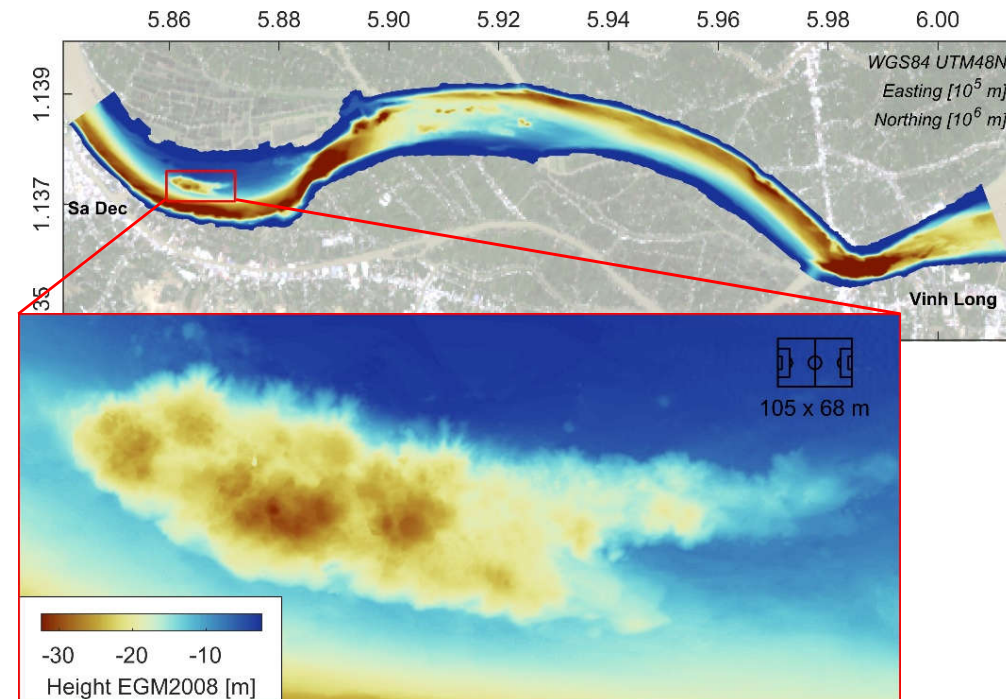


Figure: Exemplary sand mining site in the Tien River during the 2018 dry season



Figure: Impressions of sand mining in the Tien River

All related publications

can be found under:

<https://catchmekong.eoc.dlr.de/publications>