

# Analysis of surface turbidity from Sentinel-2 images and a 3D-coupled model : Case study on Laucala Bay, Fiji Islands



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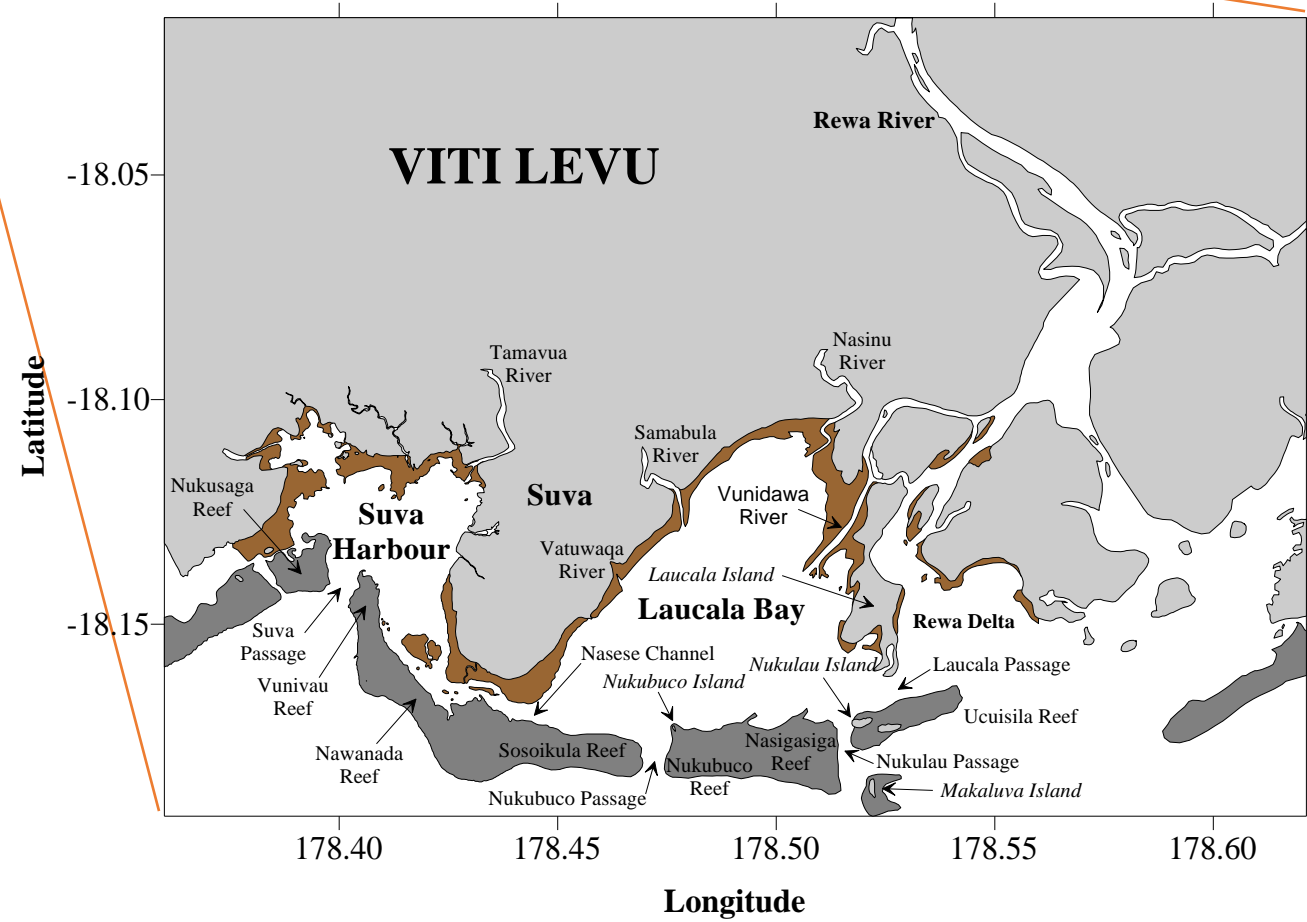
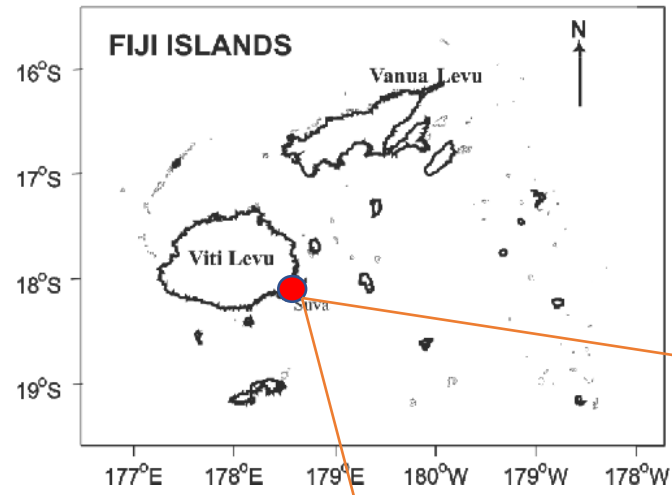
# Background

- Fiji is made up of >300 islands and islets; has two main islands Viti and Vanua Levu
- Fiji population 2017 – 884,887; Urban Areas – 494,252 (55.9%)
- Suva City falls under Rewa/Naitasiri province and is densely populated – 266,720 (30%)
- Huge pressure on the Suva lagoon via erosion, human activities, fluvial input, sediment load – which are indicators of marine health
- Sediments play an important role in water quality management in coastal areas - sediment alone degrades water quality for municipal supply, recreation, industrial consumption and cooling, hydroelectric facilities and aquatic life
- In addition, chemicals and wastes are assimilated onto and into sediment particles by which they can be physically transported from the source (for example, factories, waste management facilities, etc.) to the marine environment. Sediments are a major source of water pollution and serve as a catalyst, carrier and storage agent of other forms of pollution.

# Suspended sediments (turbidity)

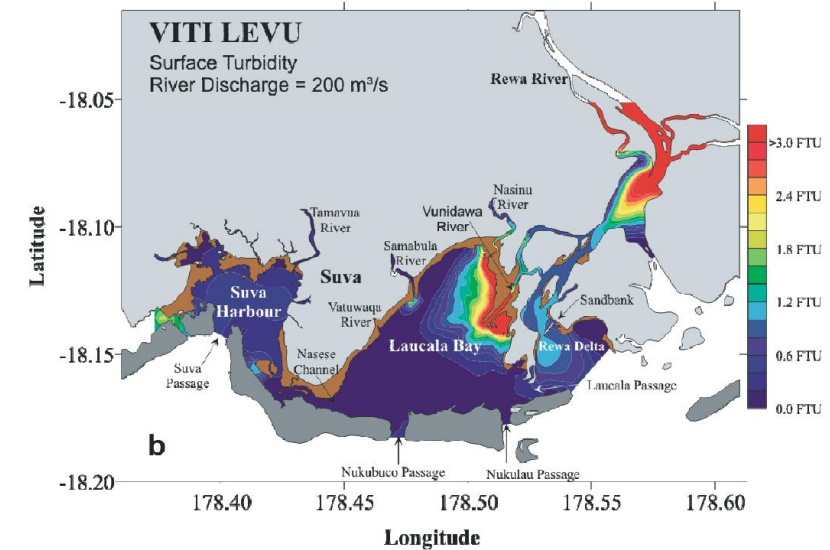
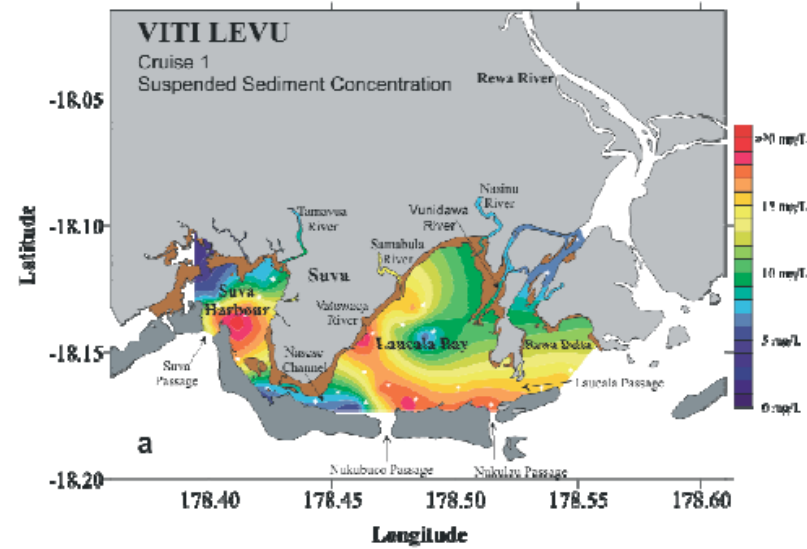
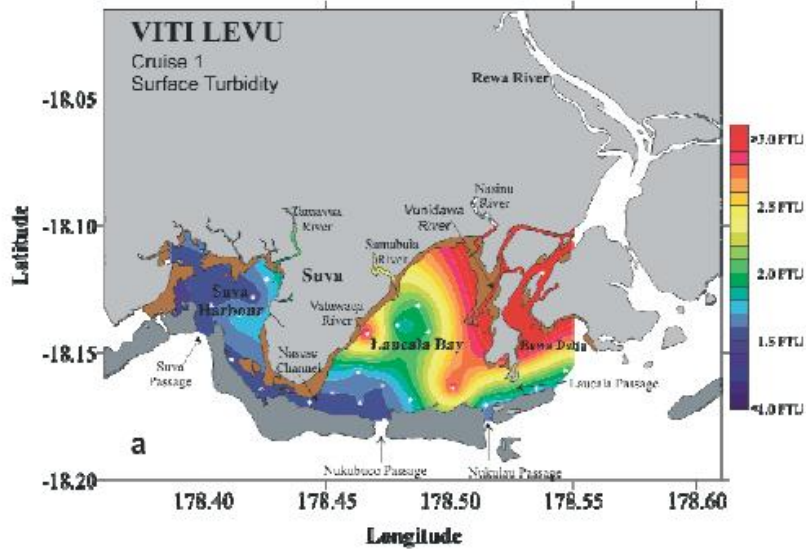
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# Suva Lagoon



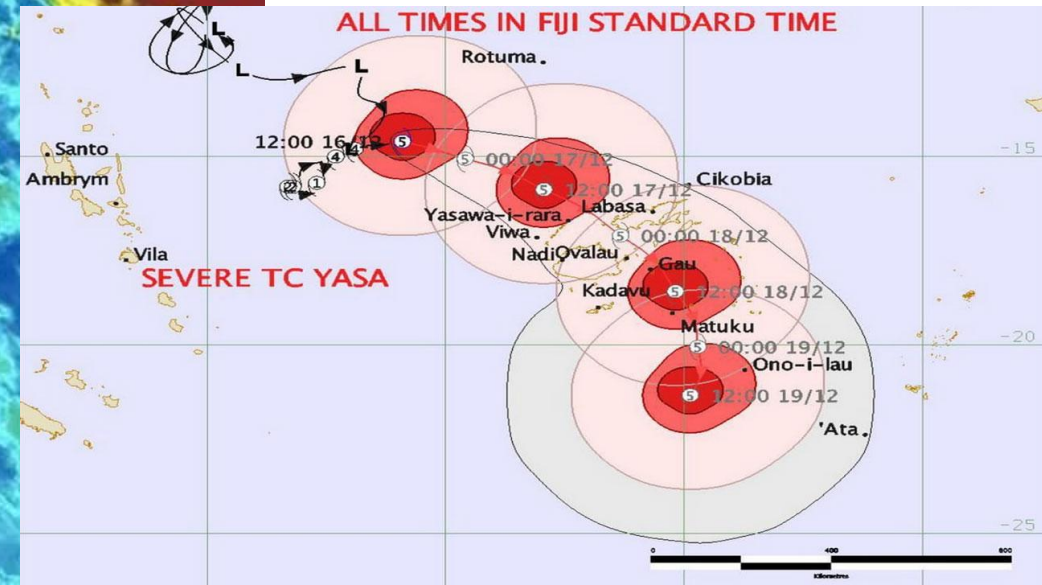
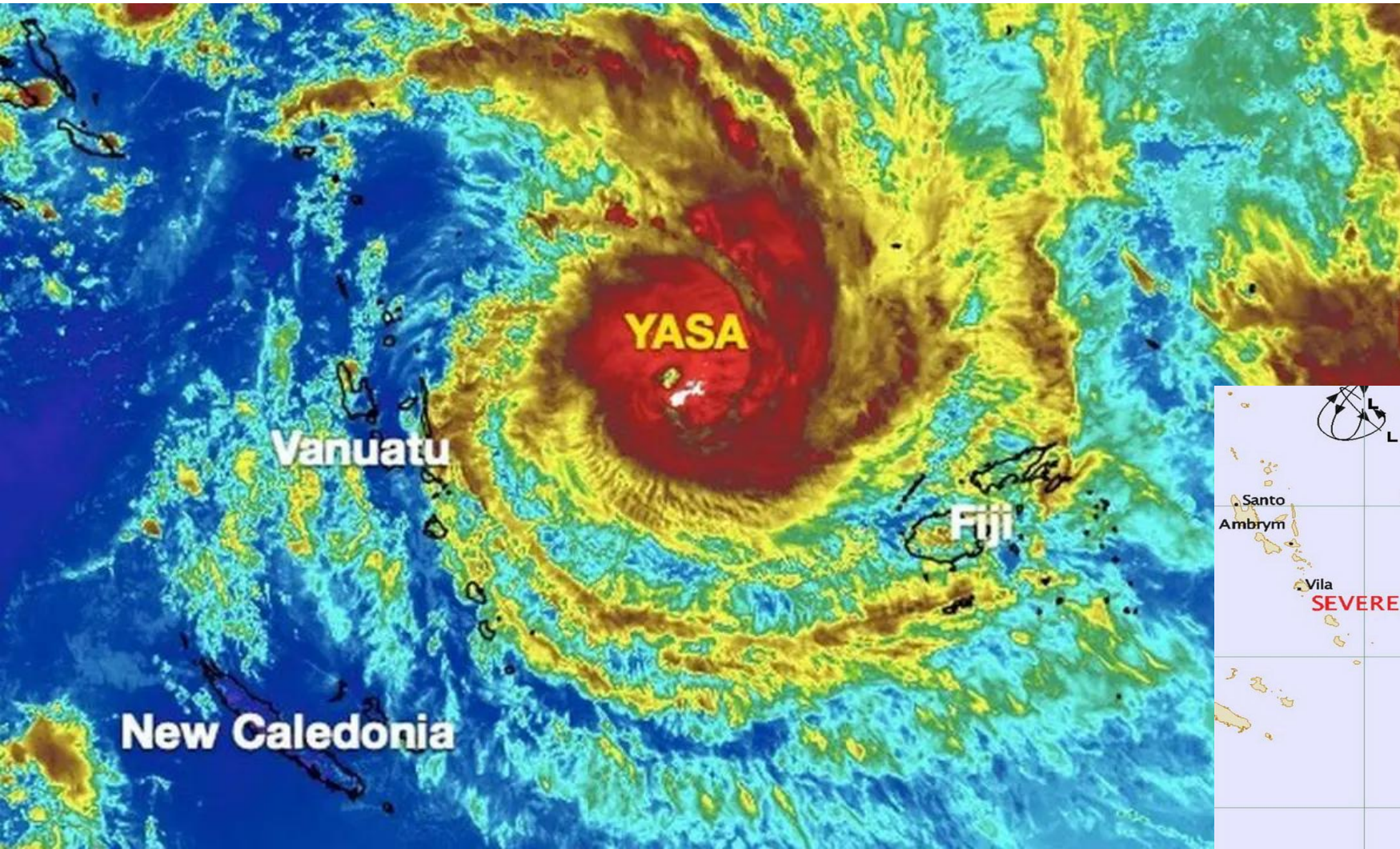
03 April 2006

# Suva Lagoon – 15 March 2006



- In situ measurements used to validate a 3D coupled hydrodynamic-sediment transport coupled model 😊
- The model considered river runoff, wind stress, bathymetry, bottom friction and the tidal constituents
- Unfortunately no clear image of remotely sensed image during this time 😞
- Fast forward 14 years ... 😊

# TC Yasa affected Fiji group 16-19 December 2020

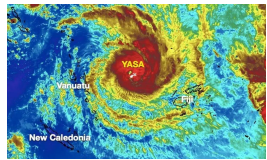


# Sentinel-2 images

10 September 2020



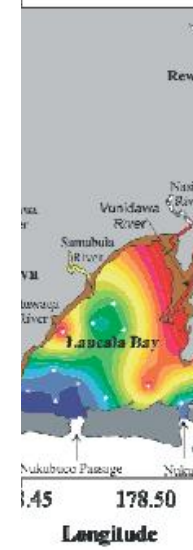
11 November 2020



19 December 2020

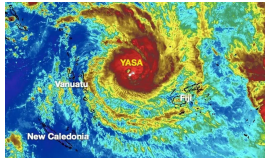


24 December 2020

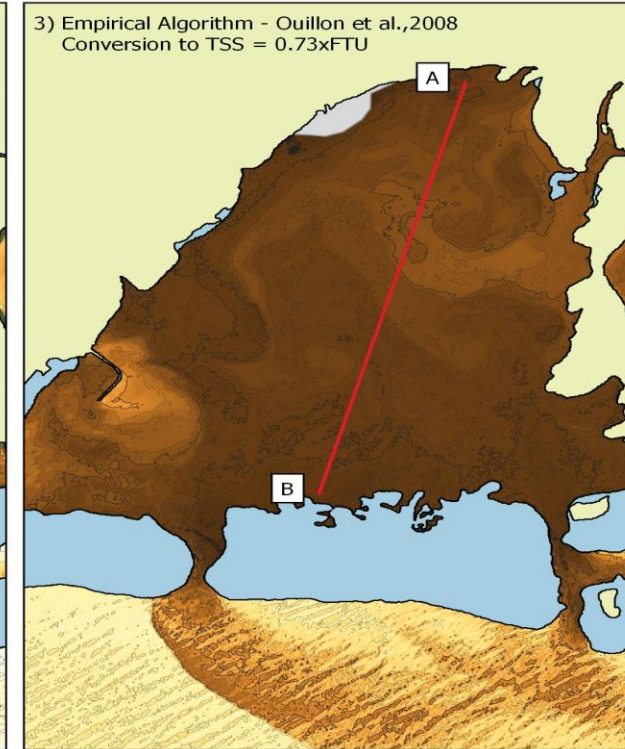
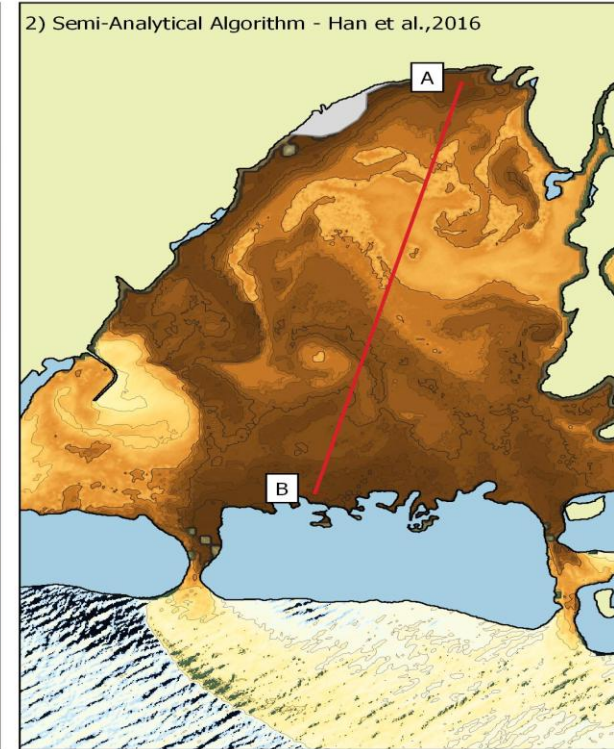


## Algorithms

1. C2RCC algorithm – Brockmann et al. (2016)
2. Semi-analytical algorithm – Han et al. (2016)
3. Empirical algorithm – Ouillon et al. (2008)



# Suva Lagoon – 19 December 2020



- In situ measurements were not available ☹️
- Sentinel-2 images were available 😊
- Different suspended sediment algorithms were available 😊
- **Need to validate algorithms with in situ measurements and Sentinel-2 images**
- **Can revisit modelling efforts to better simulate suspended sediments**
- **Under various global warming scenarios, we can model the impact of increased rainfall on suspended sediments**



# Way forward

- Implications of this study are many including:
  - A validated algorithm for automatic detection of suspended sediments from satellite imagery;
  - This can help in planning purposes for municipalities, industry, etc. to take control of their actions in discharging effluent into the Suva lagoon; and
  - Understanding distribution of suspended sediments allows us to understand how different ecosystem components that are responsible for ecosystem services interact with each other.
- Looking for a Masters student to conduct this research 😊