Lake Izabal water level fluctuations from ENVISAT RA-2. Relationships with water inputs from a numerical runoff model


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Lake Izabal settings

Guatemala, Central America
Caribbean coastal zone

Lake surface: 679 Km²
Mean depth: 12 m
Data sets

Gauge station daily dataset (25 km from the track segment)

23 km-long ENVISAT descending ground track segment

Time series: three years (2004-2006)
Processing

Range → Ocean, Ice-1, Ice-2, Sea Ice

Retracking algorithm: Ice-1
Geophysical corrections

- Dry troposphere (Model)
- Wet troposphere (Model)
- Ionospheric correction (DORIS)
- Solid earth tide (Model)
- Pole tide (Model)
Comparison with in-situ Measurements

\[ y = 0.5274x + 0.0535 \]

\[ R^2 = 0.9988 \]
RA-2 timescale sensitivity

![Graph showing lake level changes over time with specific dates marked.]

- Lake Level RA-2 (m)
- Date
- Lake Level in-situ (m)
- RA-2 timescale sensitivity
Seasonal fluctuations

Fitted curves with LOWESS

Lake Level (m)

RA-2

Field
Available information for Water Inputs
Climate-driven Hydrologic Model: HYDROTREND 3.0

BASIC EQUATIONS:

\[ Q = A \sum_{i=1}^{ne} (P_i - E_{vi} \pm S_{ri}) \]

\[ Q = Q_{rain} \pm Q_{gw} - Q_{Ev} \]

\[ Q_r = q_{se} + q_{ie} \]

\[ Q_{gw} = \alpha \left( \frac{GW_{store}}{GW_{max}} + \frac{GW_{min}}{GW_{min}} \right)^\beta \]
Model Validation

Polochic River water discharge (1987-1993)

- in-situ
- Model
Relationships: Climate, water input, lake level.

- Rainfall
- Evapotranspiration

- Lake level RA-2
From tributaries discharge to lake level variations
Conclusions

• RA-2 is highly accurate in monitoring Lake Izabal relative level variations
• Level variations are driven by climate cycle of rainy and dry seasons
• HYDROTREND is able to predict and monitor the Polochic water discharge
• Combination of remote sensing and numerical models could be used in studying Lake Izabal water storage and interchange
Work to do…

- Innundated area variations from ASAR
- Hydrologic factors forcing water discharge: soils, land use, geology, etc.
- Relationships with the Caribbean Sea level variations
Thank you!!!