Sensitivity Analysis of Filtering Methods for Tropical Easterly Waves Classification

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Tropical Easterly Waves (TEWs):

o Synoptic-scale processes.
o Quasi-periodic wave-like disturbances in the trade winds regime (Kiladis et al., 2006).
o Peak activity observed from July to October (Cárdenas et al. 2017).
o Influence on circulation dynamics, humidity transport and connective activity (Salas et al., 2022; Dominguez et al., 2019).
o Identified as precursors of tropical cyclones (Serra et al., 2010)

This study evaluates the sensitivity of different spectral bands and a track methodology in classifying TEWs based on daily vorticity at 700 hPa crossing the Caribbean at 80°W, during the Organization of Tropical East Pacific Convection (OTREC) campaign.

Datasets:

o TEWs in real-time and OLR from NOAA web services: https://www.nhc.noaa.gov/marine/.
o Relative Vorticity from ERA5 Reanalysis
o TEWs Track by Hollis et al. (2023)

Methodology:

1. TEWs were identified in real-time using data from NOAA.
2. We employed two filtering methodologies and a track methodology (Table 1).
3. Convective TEWs, OLR < 240 W/m^2 (Lau et al. 1997; Collimore et al. 2003)

Table 1. Detection methods.

Fast Fourier Transform (FFT)	Ensemble Empirical Mode Decomposition (EEMD) (Wu and Huang, 2009)	Track TEWs algorithm Hodges (1995)
3–10 days	3–6 days	Identifies ciclonic vorticity >1 x10^{-1}, and create tracks conecting this scores
2.5–12 days	4–12 days	
2.5–15 days	3–15 days	

Results:

Table 2. TEW days chronology from each methodology.

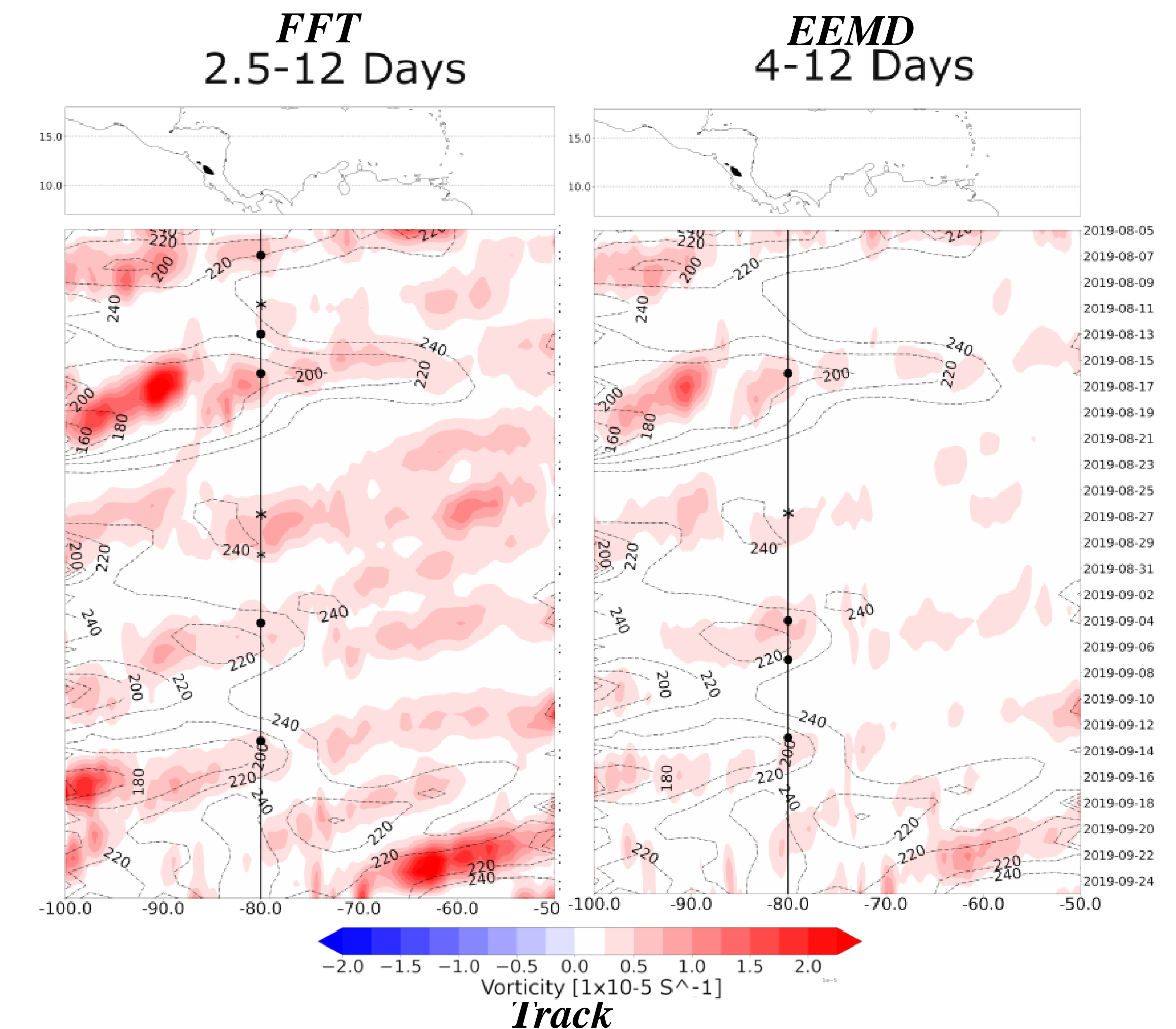| TEWs	NOAA	FFT 3-10 Days	FFT 2.5-12 Days	FFT 2.5-15 Days	EEMD 3-6 Days	EEMD 4-12 Days	EEMD 3-15 Days	Track
Convective	7-Aug	x	x	x	x		x	x
	13-Aug		x	x	x		x	
	16-Aug	x	x	x	x	x	x	x
	20-Aug							
	4-Sep	x	x	x	x	x	x	
	7-Sep		x	x	x	x		
	13-Sep	x	x	x		x	x	
	18-Sep							
Non-Convective	11-Aug							
	24-Aug							
	27-Aug	x	x	x		x	x	x
	30-Aug	x	x	x			x	
	9-Sep							

Figure 1. Examples of TEW detection for each method.

Conclusions:

o TEWs classification is sensible to the methods and periodicity band windows.
o EEMD and FFT at a similar band window shows similar results.

References: