

Modelling historical shoreline changes using Bayesian network model in Nanumea, Tuvalu

Shannon Bengtson¹, Liz Keller¹, Annemarie Christophersen¹, Moritz Wandres², Antonio Espejo², Hervé Damlamian²

1: GNS Science, Wellington, NZ

2: The Pacific Community (SPC), Suva, FJ

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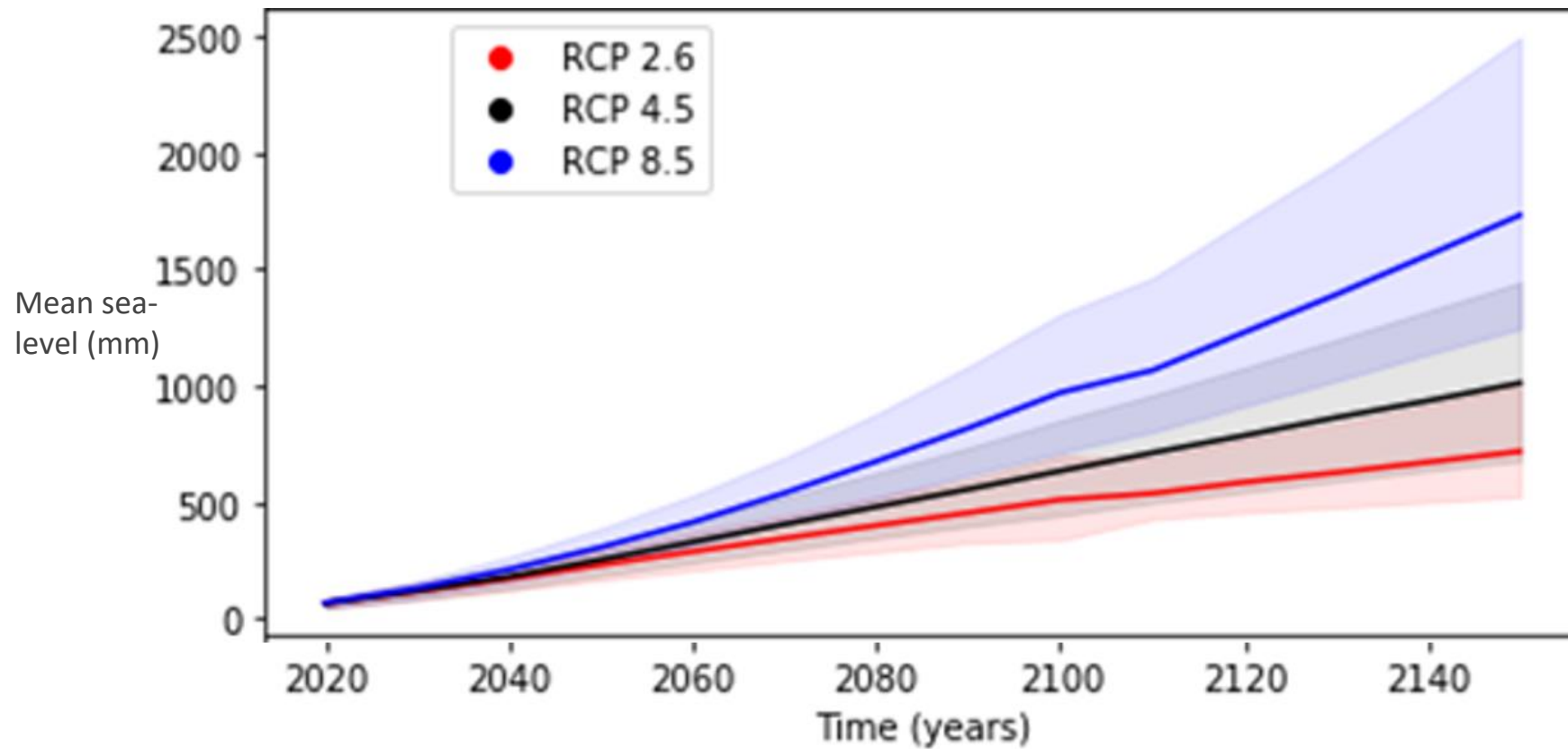
Pacific
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Nanumea, Tuvalu

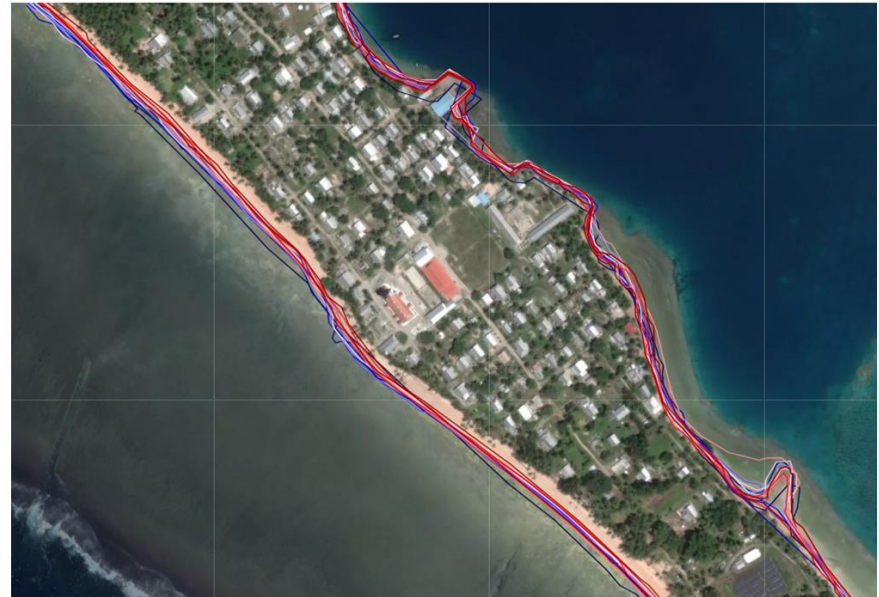


Rising Sea-levels

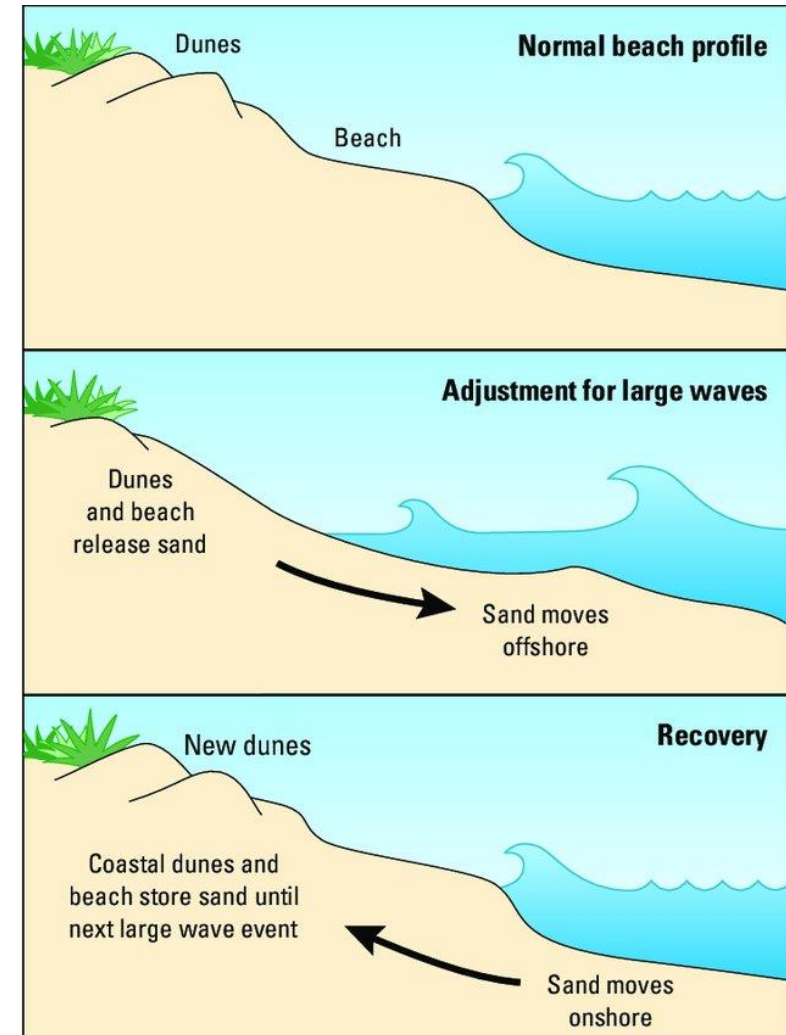
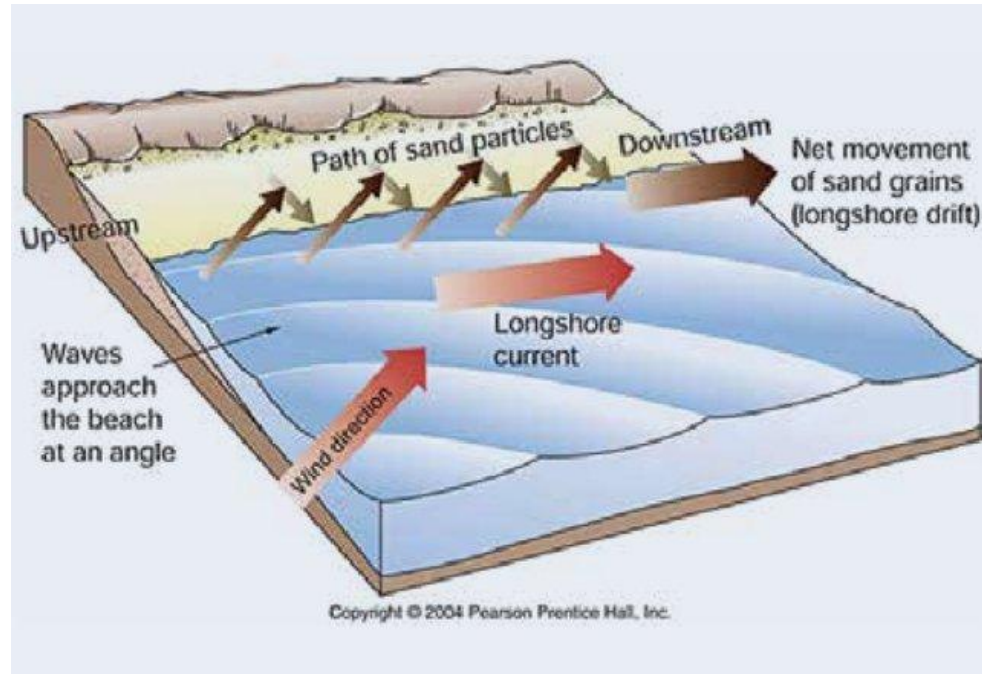


Our Project

- Use BNs to constrain historical shoreline change
- Three shoreline proxies
 - Consistently one snapshot per year since 2005



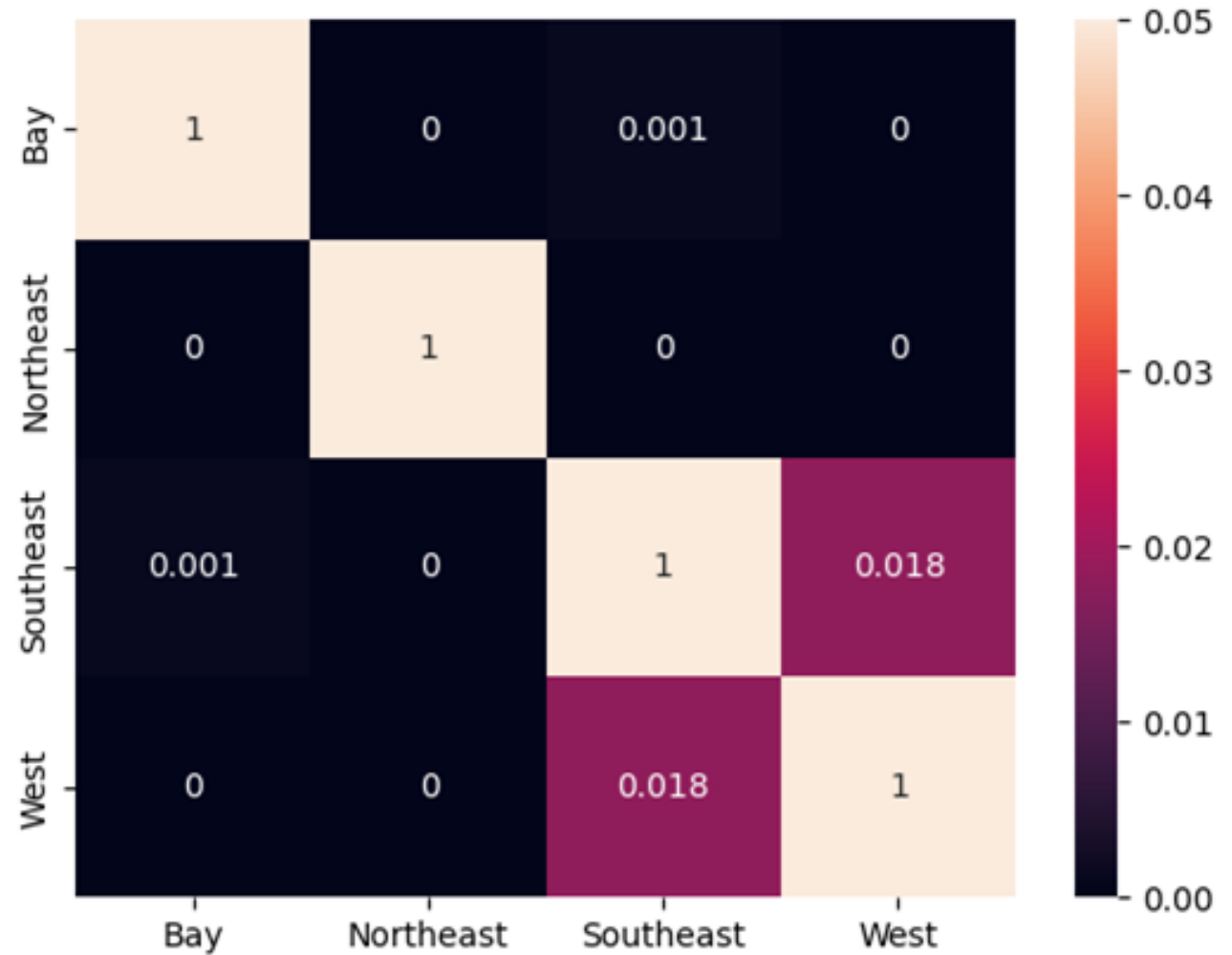
Coastal Transport - Different Timescales



Method

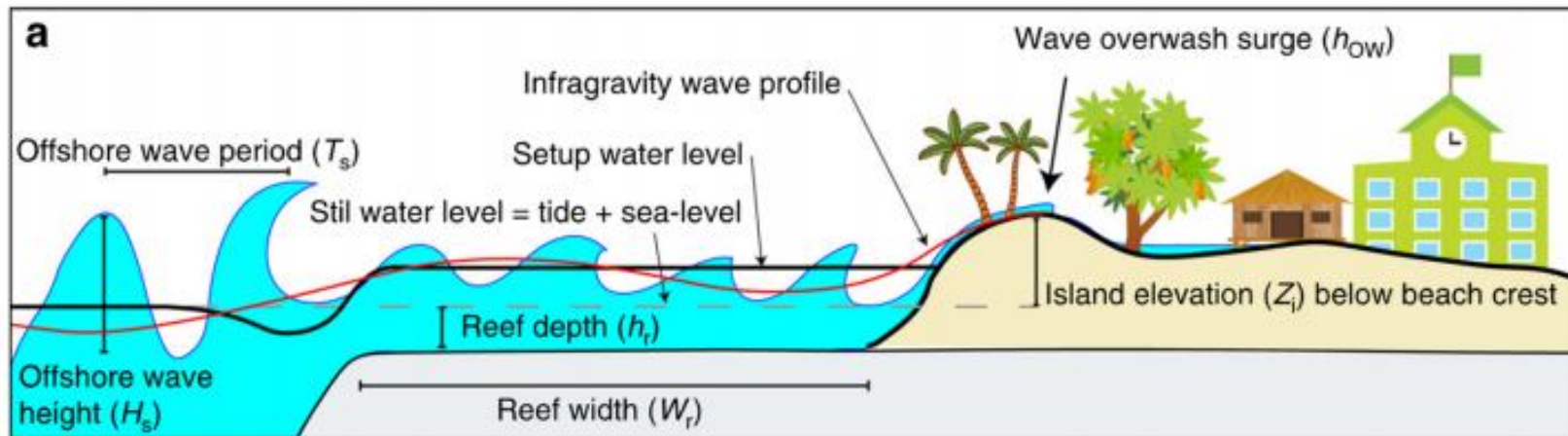
- Preprocessing:
 - Convert to shoreline segments
 - Define if shoreline eroded or accreted relative to 2003
- Divide into regions
 - Manual
 - K-mean
- BayesFusion SMILE engine
- Using Expectation-Maximisation to define the conditional probability tables
- Using jackknifing to assess skill

Simple Approach – Dividing Regions



Possible nodes

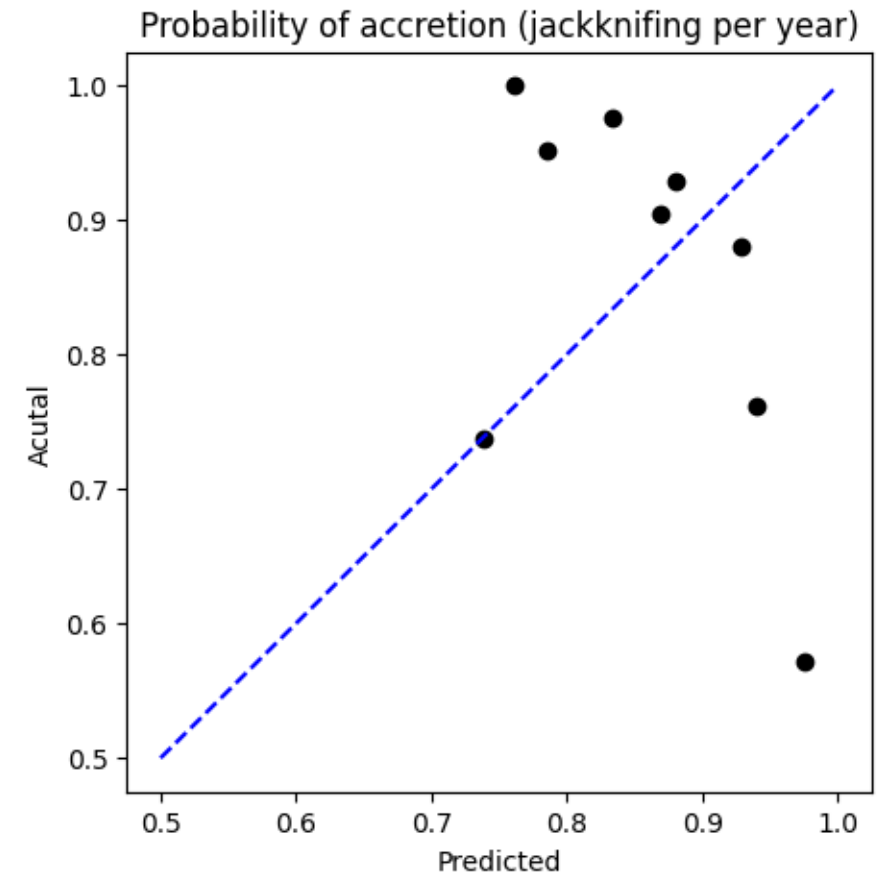
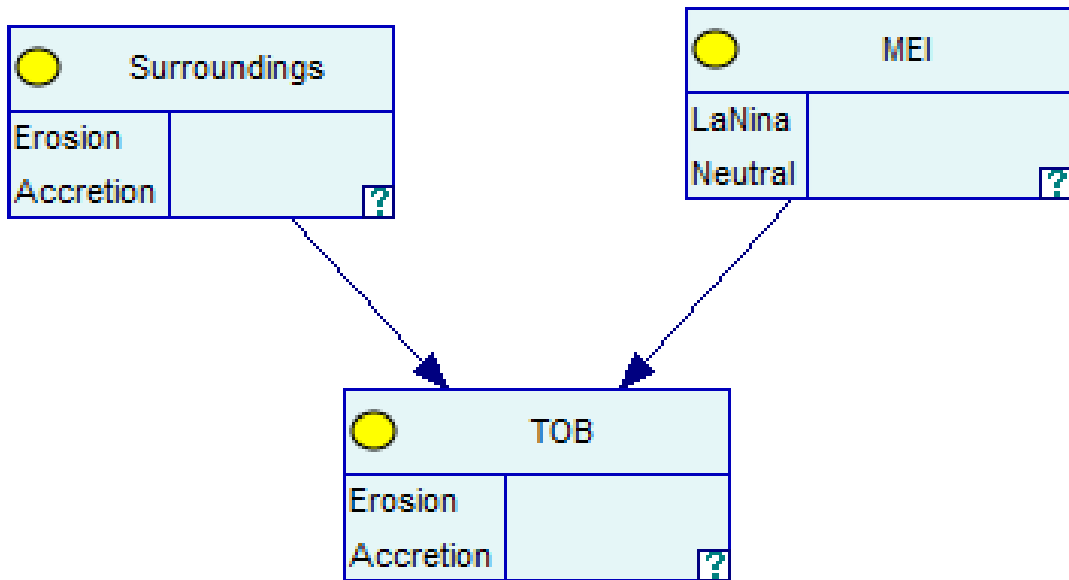
- Wave action
- Mean sea-level
- Nearby building density, vegetation
- Tides (high watermark)
- Precipitation (vegetation line)
- Reef characteristics



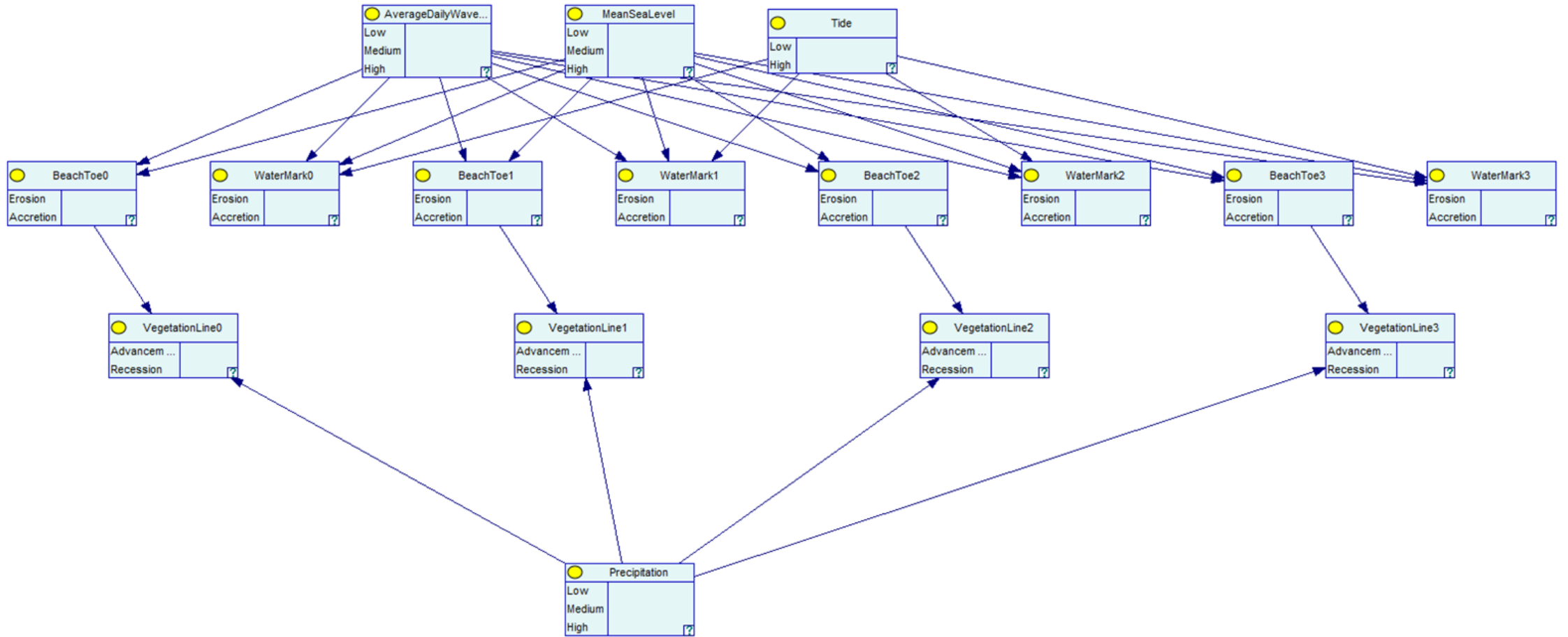
Summary Statistics

	Pearson Correlation Coefficient				R ² (linear model)
	Tropical cyclone season	Multivariate ENSO Index (MEI)	Changes in surrounding regions	Previous shoreline position	
Bay	0.02	0.08	0.05	-0.06	0.39
Northeast	-0.02	0.33	-0.13	0.01	0.51
Southeast	0.09	-0.44	-0.38	0.15	0.92
West	-0.04	0.07	0.01	0.15	0.40

Initial Statistical Results



A More Complex BN



Conclusions and Next Steps

- Some ability to constrain shoreline change using MEI, changes in surrounding regions, and previous shoreline change position
 - Explore linking across regions
 - Explore other ways to model seasonality
- Potentially revisit wave action