The MJO Provides a New Capability for Extended-Range Weather & Short-Term Climate Forecasts

International Efforts are Exploiting the Tropical Madden-Julian Oscillation (MJO) to Provide New and Improved Environmental Predictions with Lead Times of 1-3 Weeks

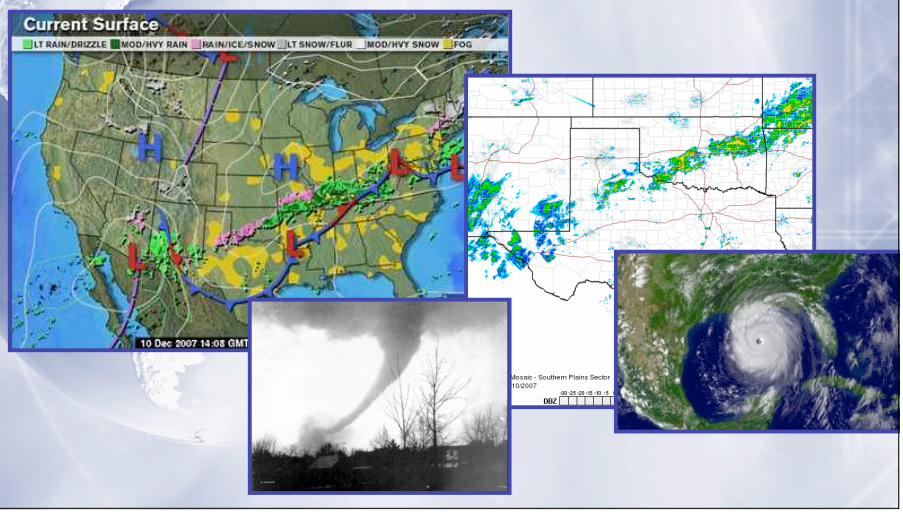
Duane Waliser
NASA Jet Propulsion Laboratory/Caltech
Pasadena, CA

On behalf of the US CLIVAR MJO Working Group

AGU, December 2007
New Frontiers in Predicting Precipitation
Press Conference

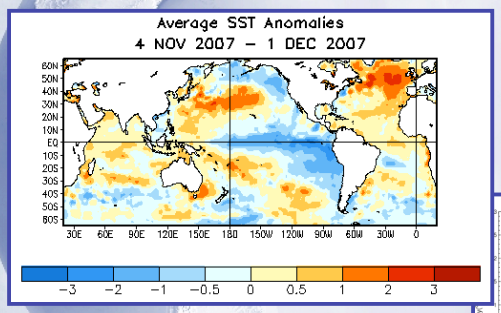
Traditional Forecasting Targets

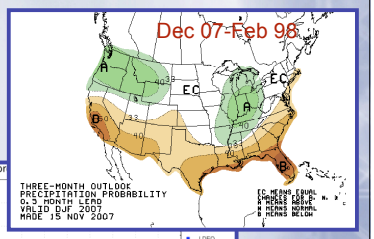
- **Weather** (~Hours to 5 days Lead Time)

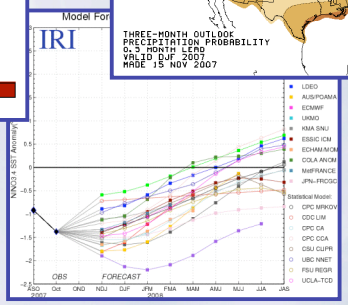


Traditional Forecasting Targets

- **El Nino/La Nina** (Seasonal Outlooks; 1 to 3 Months)



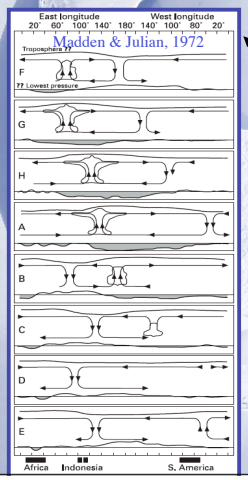




What About In Between?

- **Tropical Madden-Julian Oscillation (MJO)**

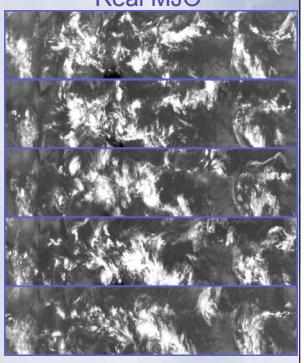
(Potential predictions at Lead Times of 1-3 Weeks;
i.e. Extended-Range Weather / Short-Term Climate)



MJO Schematic

~40-50 days

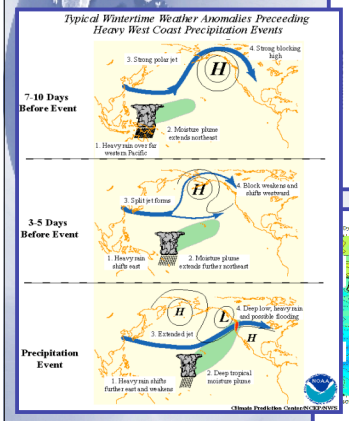
Real MJO

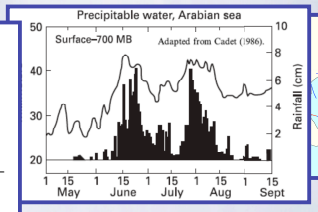


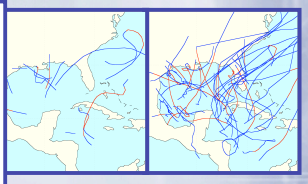
MJO Links to Weather & Climate Processes

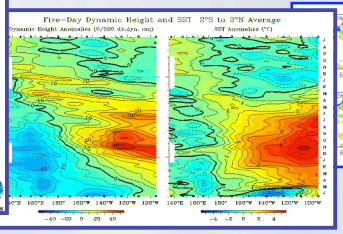
- Influences: Mid-Latitude Weather, Summer Monsoons, Hurricane Development, Ocean Chlorophyll, El Nino and La Nina, Tropical Weather, Atmospheric Composition

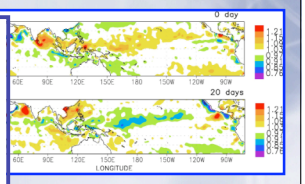
=> MJO Prediction Capabilites Have Significant Potential





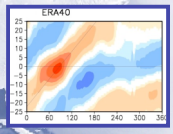


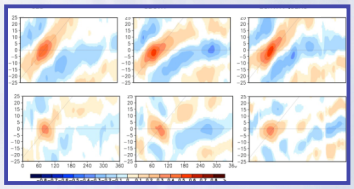




Simulating and Predicting the MJO with our Weather and Climate Models has been a Significant Challenge

Observed MJO





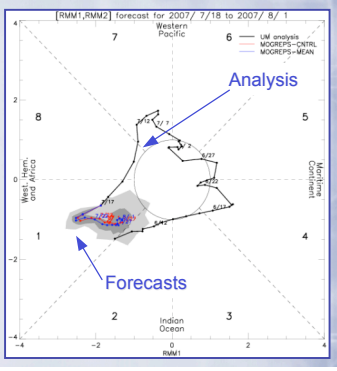
3 "Good" Models

3 "Poor" Models

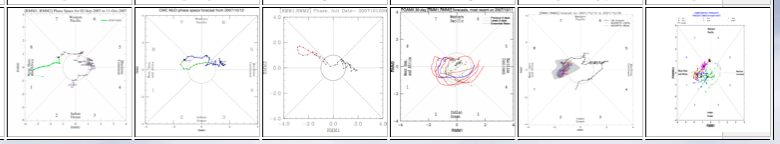
Long-Term US & International Efforts and Recent Activities by the US CLIVAR Working Group Have Led to Tangible Gains in MJO Forecasting Capabilities

US CLIVAR MJO Working Group Has Recently Established an **MJO Forecast Metric**

- This metric is now in use or will be adopted by a number of operational weather forecast centers (e.g., ECMWF, US, Canada, UK, Australia).
- Use of a common forecast metric allows for:
  - ✓ quantitative forecast skill assessment
  - ✓ targeted model improvements
  - ✓ even friendly competition to motivate further improvements.



Based on Wheeler & Hendon 2004

	Forecast Center					
	NCEP	CMC	PSD	BMRC	UK Met	ECMWF
All RMM plots						

http://www.cdc.noaa.gov/MJO/Forecasts/index_phase.html

Summary

- Improved capabilities in representing the tropical Madden-Julian Oscillation (MJO) in our weather and climate forecast models is providing new socially-relevant forecast potential at lead times between those based on “weather” and “El Nino/La Nina” - i.e. at ~1-3 weeks.
- While this capability is intermittent (~ 2-6 events/year), it will still help us to develop a “seamless” set of environmental forecast products.
- These newly established and improving MJO forecasts will have a positive impact on our forecasts of summer monsoon onsets and breaks, favorable locations & periods for hurricane formation, persistent mid-latitude weather conditions, atmosphere composition & air quality, etc.
- For more information - see:
  http://www.usclivar.org/Organization/MJO_WG.html
  http://www.cdc.noaa.gov/MJO/Forecasts/index_phase.html