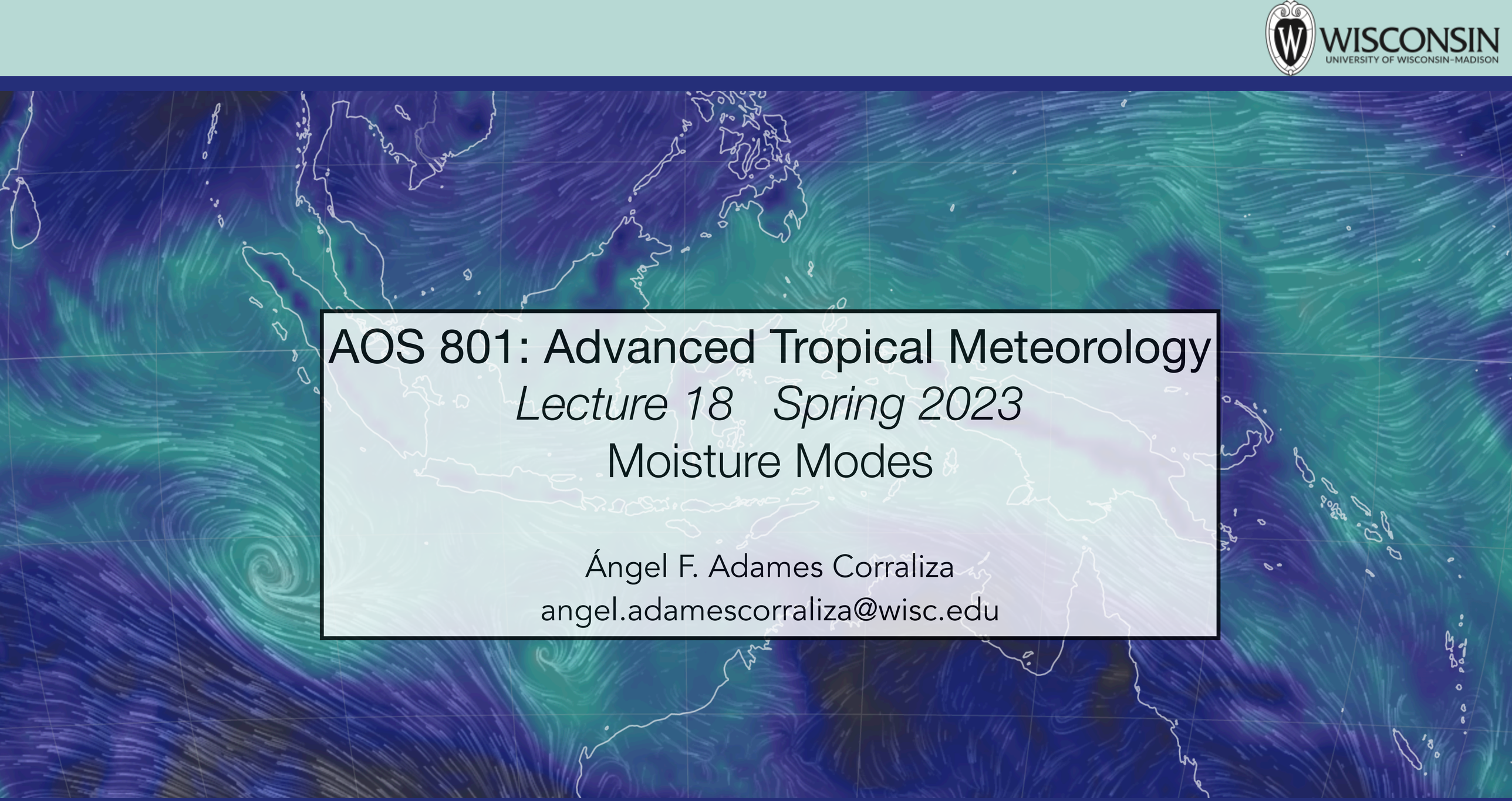

AOS 801: Advanced Tropical Meteorology

Lecture 18 Spring 2023

Moisture Modes

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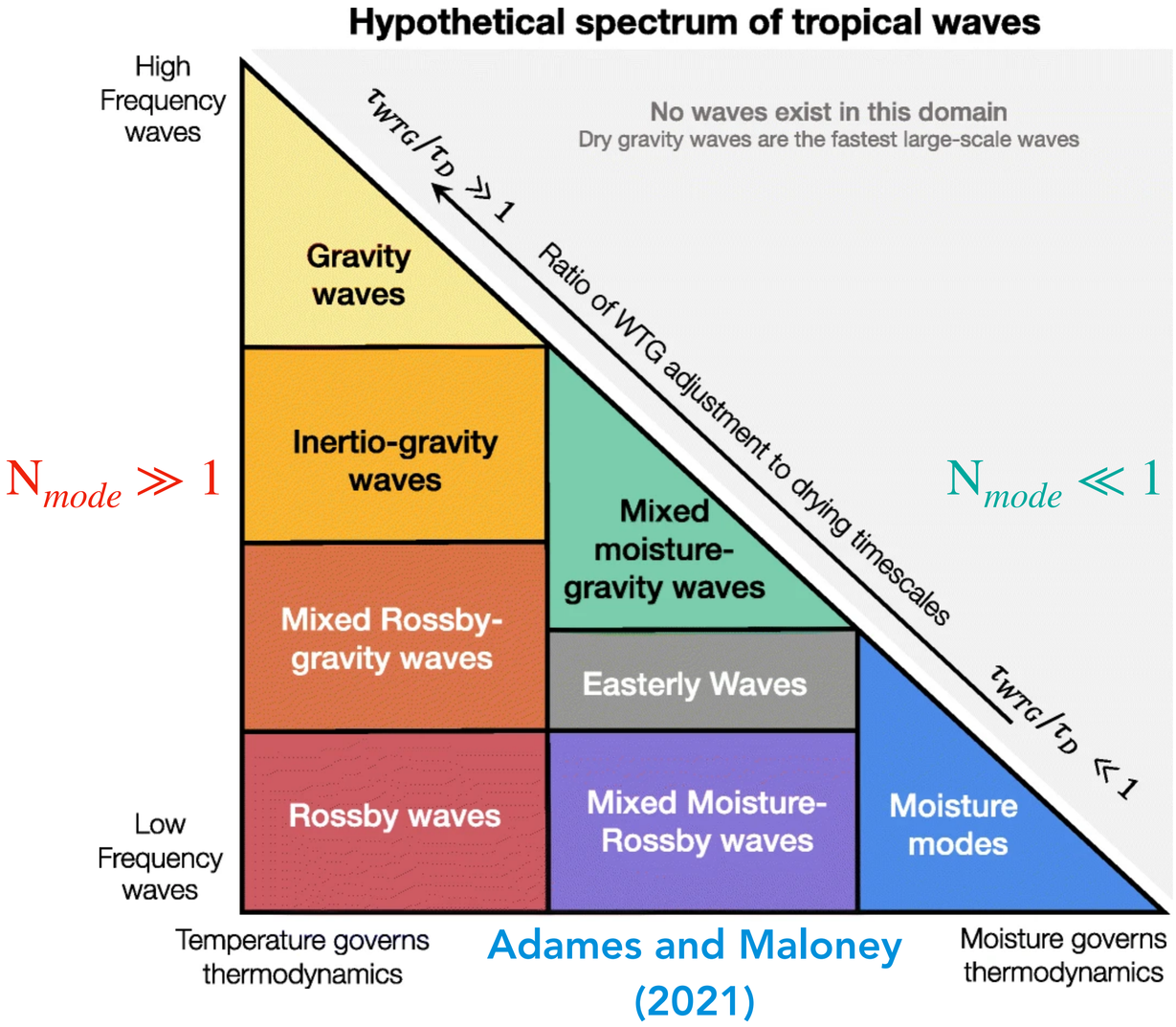
Under WTG balance: Tropical weather systems are diverse

Moist thermodynamics are determined by:

$$\mathrm{N}_{mode} = \frac{\mathrm{DSE}'}{L_v q'} \sim 10\frac{\tau_g^2}{\tau^2}$$



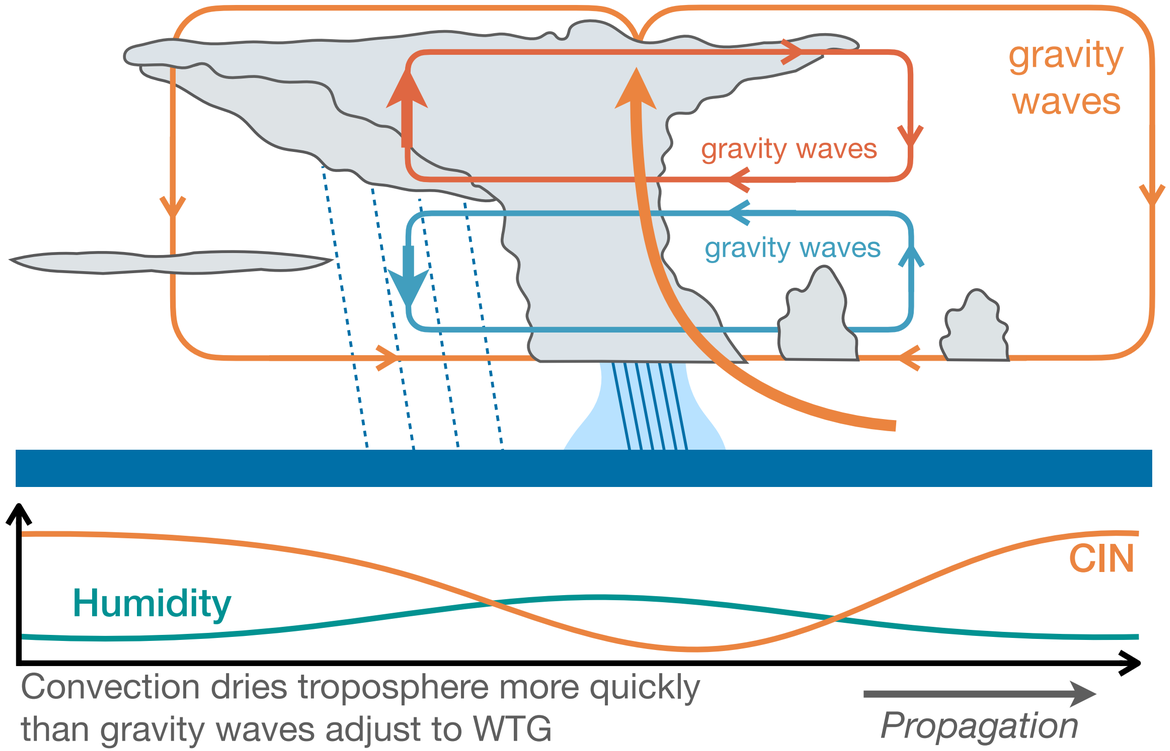
Left side of the spectrum

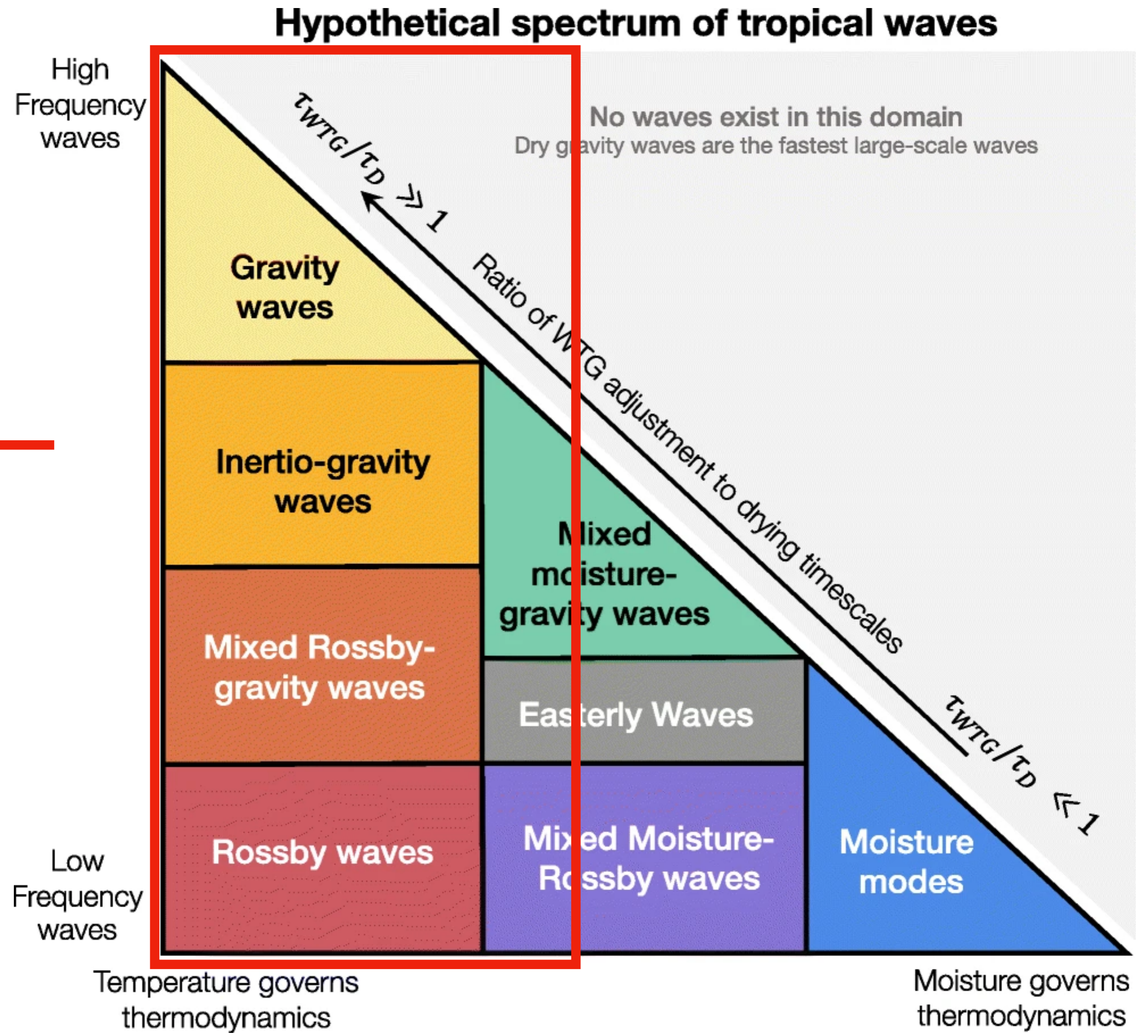
In the motions systems on the left temperature plays governs their thermodynamics.

$$N_{mode} \gg 1$$

(a) **Convectively-coupled gravity waves**

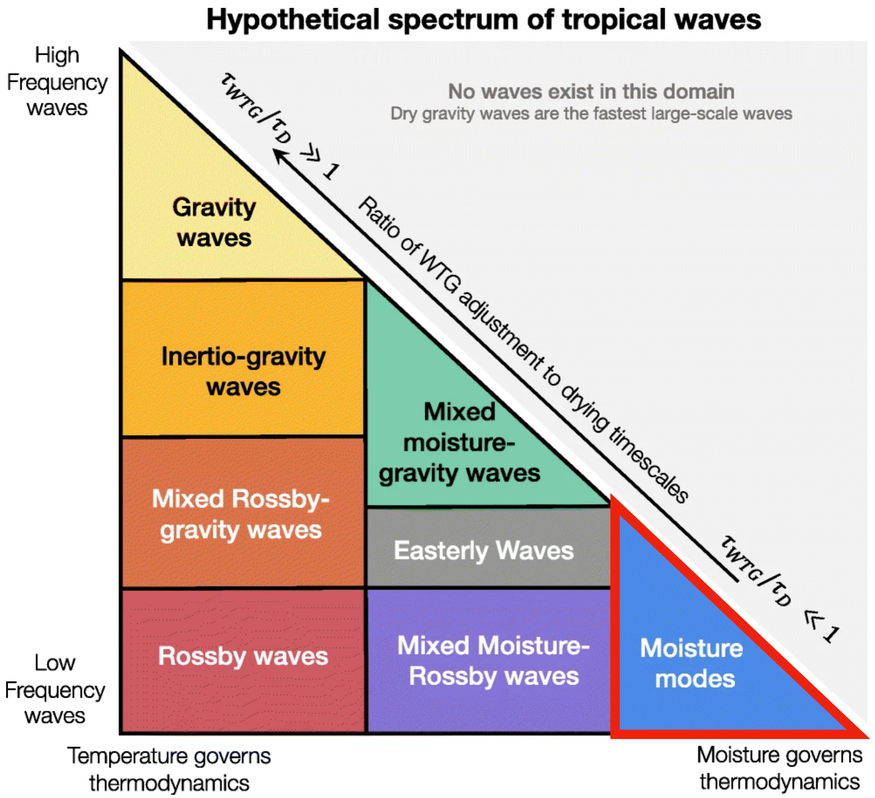
$$\tau_{WTG} \gg \tau_D$$

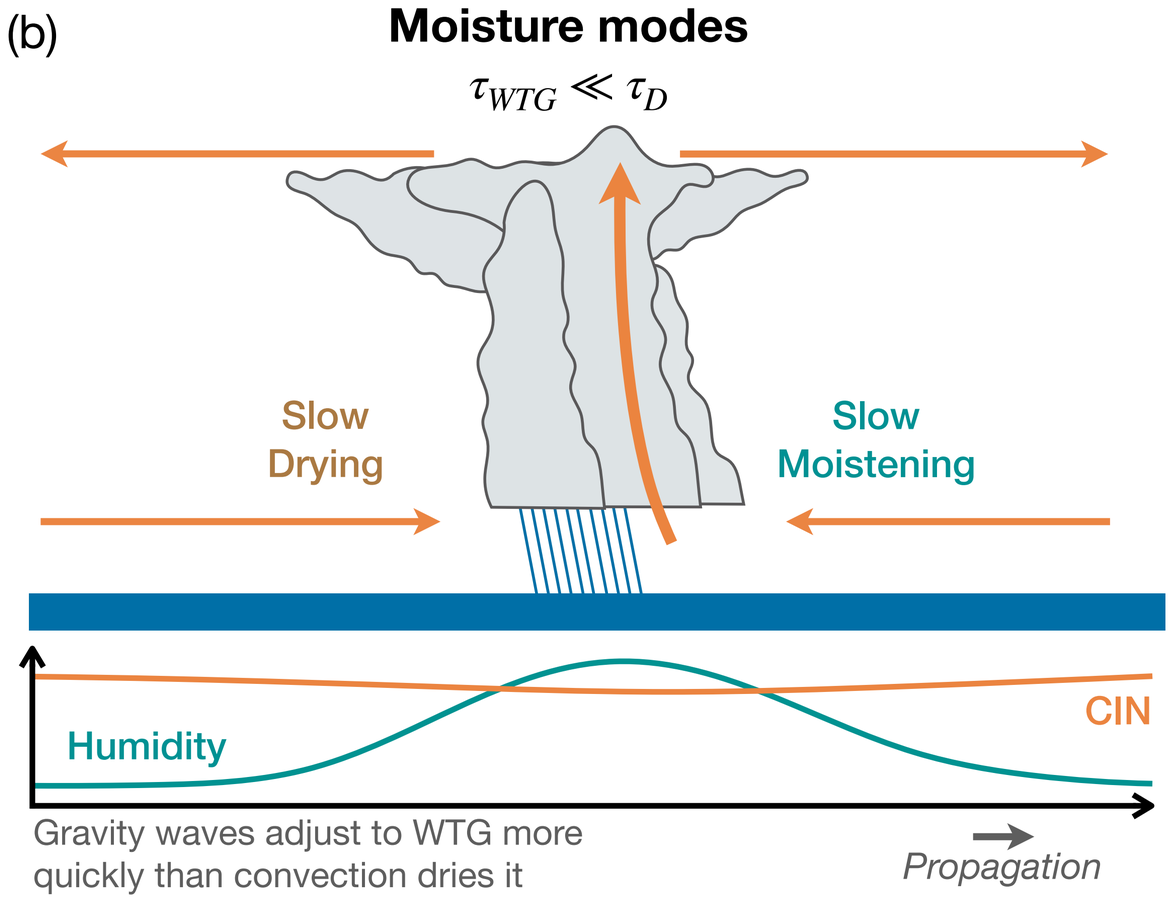




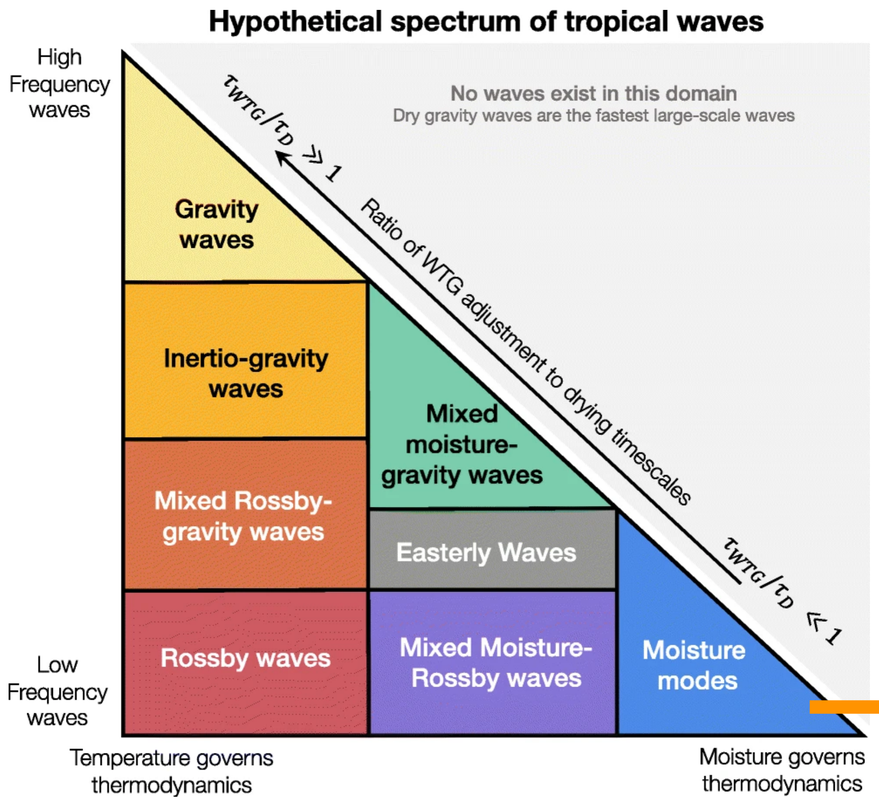
Moisture Modes

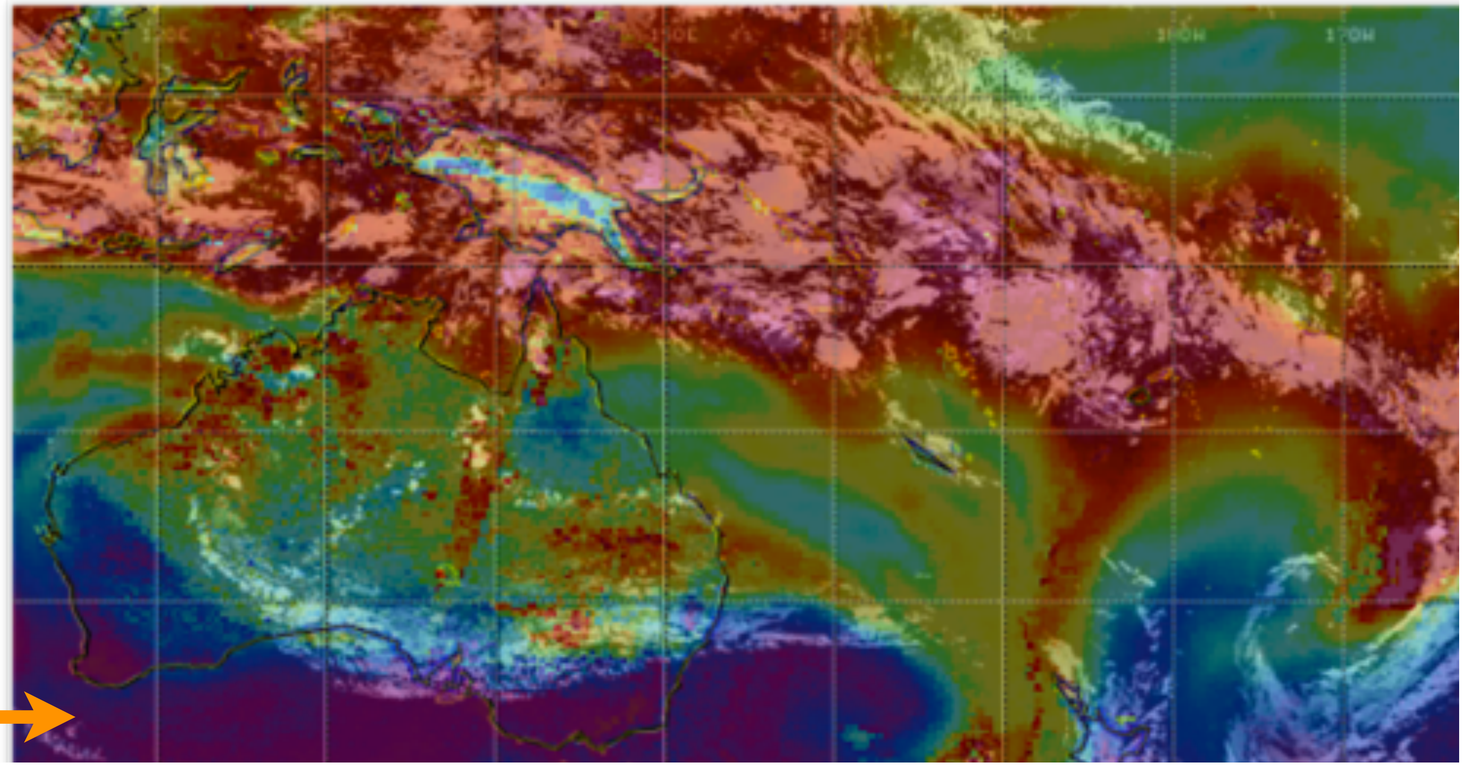
In the motions systems on the right water vapor plays governs their thermodynamics and they are often referred to as moisture modes.



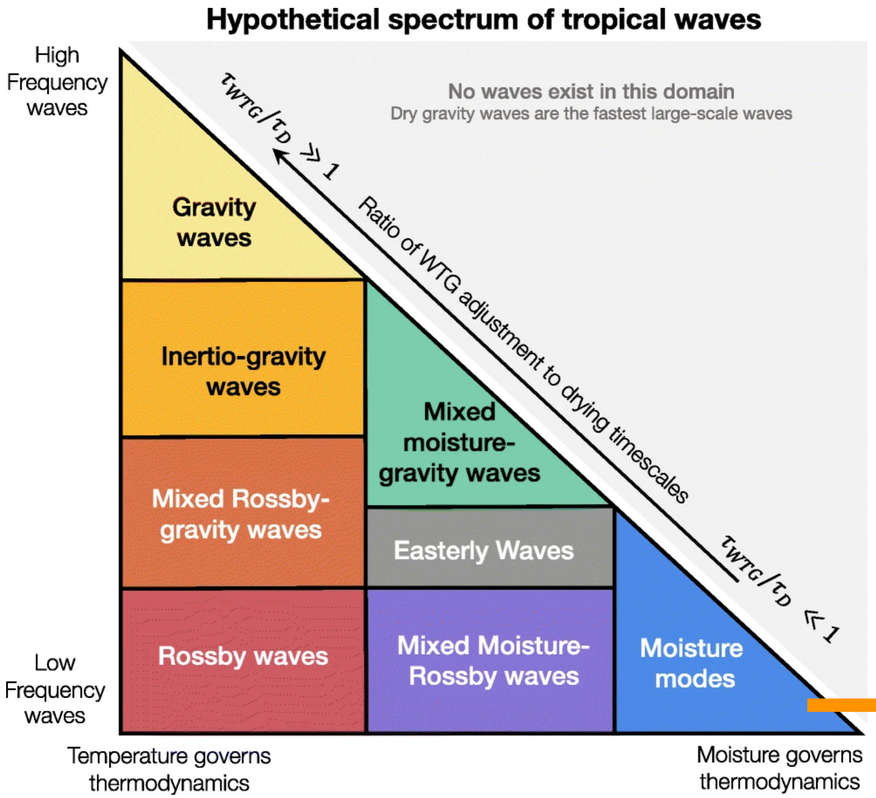


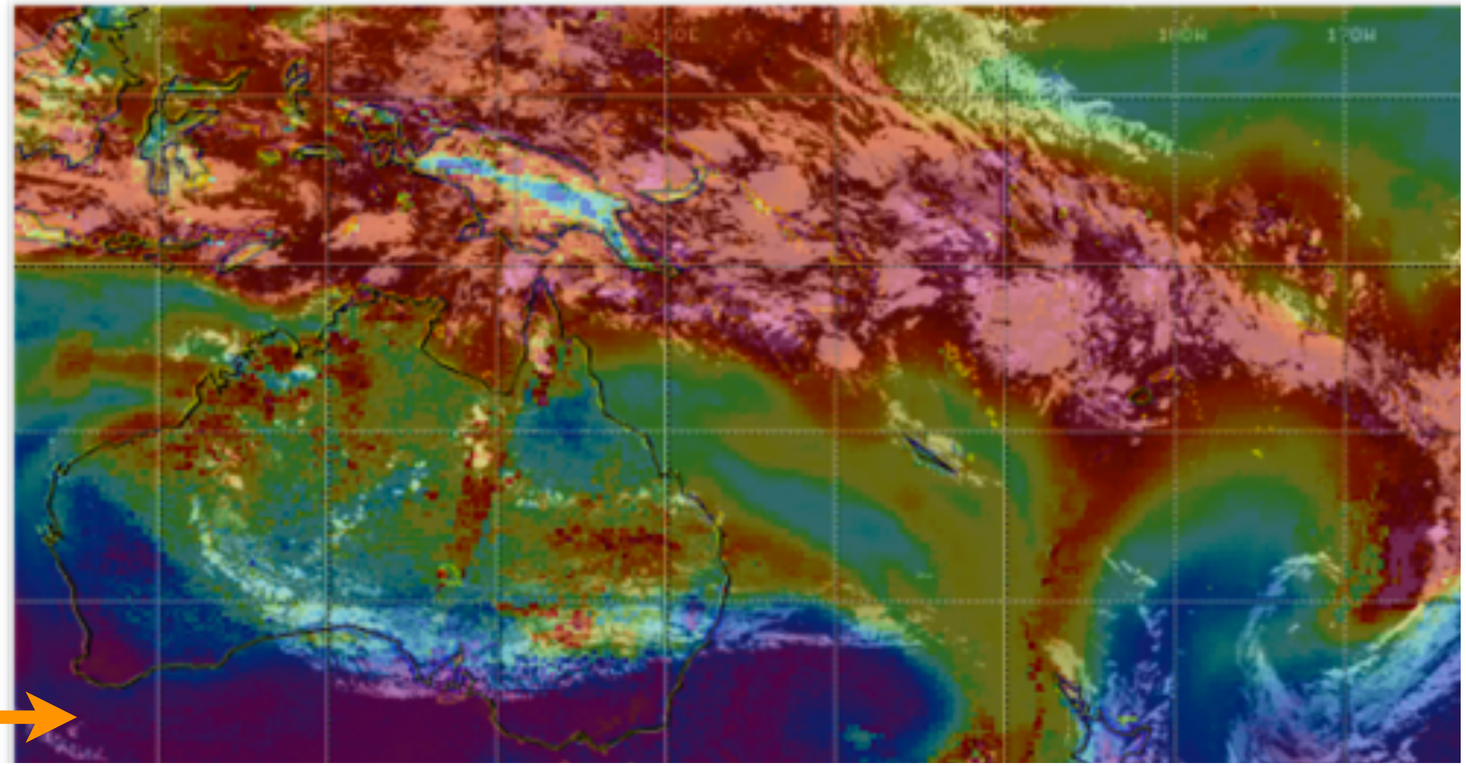
Definition of a moisture mode





Moisture modes are a family of systems, not a single wave





What constitutes a moisture mode?

Mayta et al. (2022) proposed three criteria to identify a moisture mode in observations:

1. Moisture anomalies are highly coherent with the precipitation anomalies.

$$P \propto \langle q \rangle$$

2. The system is in WTG balance.

$$\omega S_p \simeq -Q_1$$

3. Thermodynamic variations in the mode must be dominated by moisture.

$$L_v q \gg C_p T$$