An Online Tropical Synoptic Meteorology Course Package

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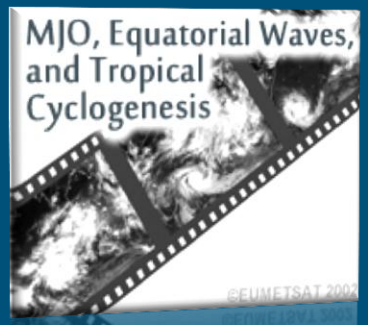
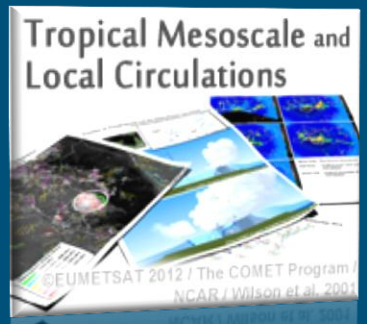
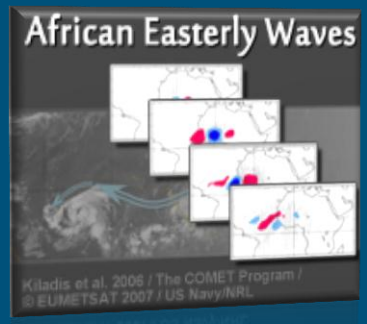




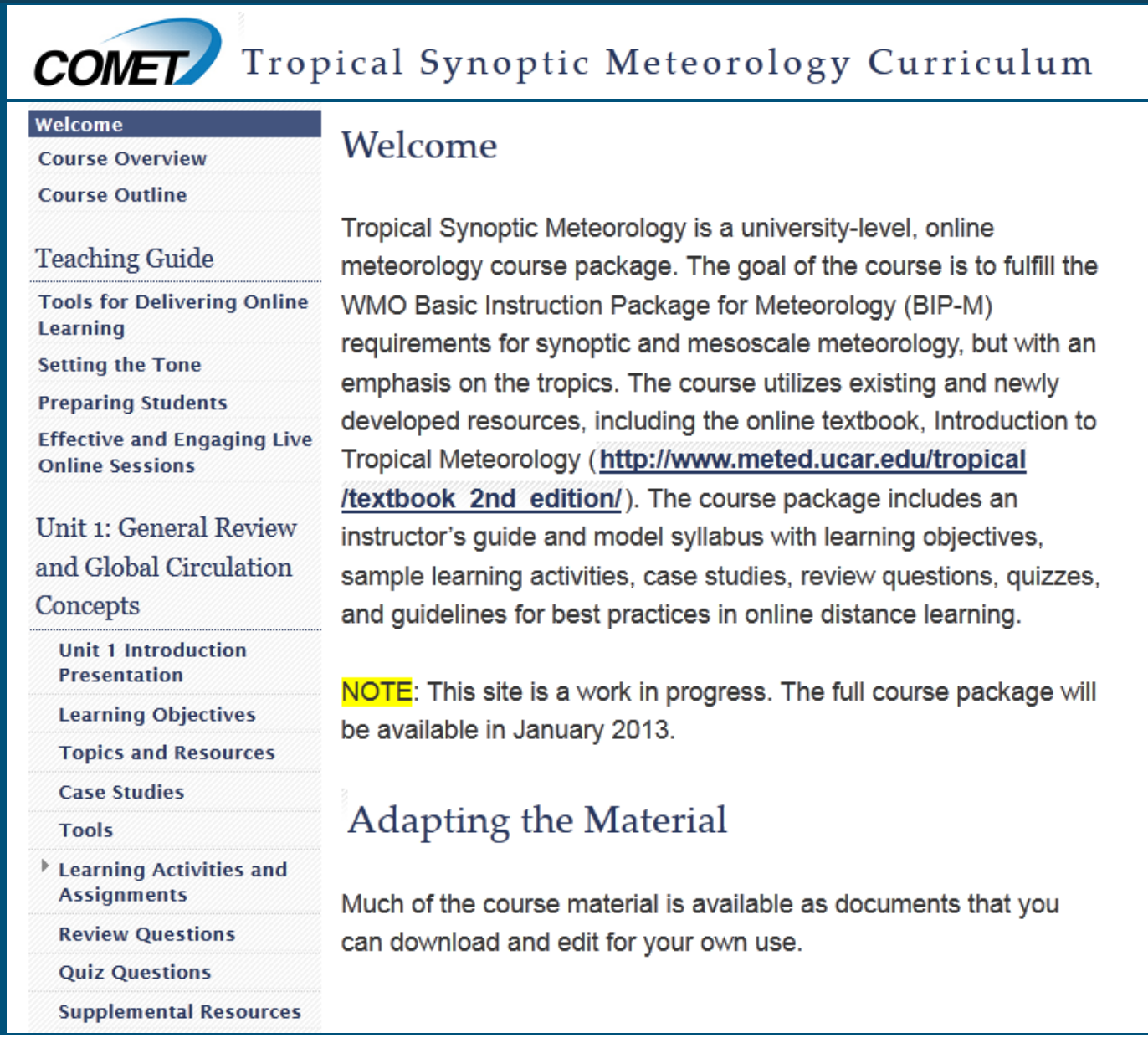


University-level online course to meet WMO BIP-M requirements

Tropical Synoptic Meteorology Online Course Package

- University-level Synoptic course package for the tropics
- Meets substantial portions of WMO BIP-M Synoptic & Mesoscale Met.
- **Package includes *syllabus, teaching guide, online labs, student projects, sample presentation slides, case studies, other media***
- Based on freely available online resources, such as MetEd modules and *Introduction to Tropical Meteorology* Online Textbook

Tropical Synoptic Meteorology Online Course package



https://sites.google.com/a/comet.ucar.edu/tropical-synoptic-meteorology-curriculum/

Teaching Guide

Setting the Tone

Open in Google Docs for downloading or printing.

Tropical Synoptic Meteorology

Setting the Tone: The Online Learning Environmer

A successful course, whether online or in a classroom, calls for a supportive and engaging learning environment. It is up to you as an instructor to foster this environment by providing the students with clear expectations and guidelines for conduct and by being a role model for proper communications. For online courses, providing course support and generating engagement can be particularly challenging.

Establish Expectations and Social Connections Early

With online courses, it's very import
with responses to student inquiries. A
students with an email or posting on t
Discussion Forums" in this Teacher's
something about themselves, their interest in the course, or where they plan to apply
the knowledge learned from the course. You could also set up a forum or a Facebook group that serves as a social venue for students.

Clear and Consistent Expectations

Course websites should contain all the relevant i
situated and to complete assignments. Assignments need to be delivered with detailed instructions, clear expectations, and backed-up with prompt replies to inquiries.

"... supportive and engaging learning environment ..."

"... start communications early ... be prompt with responses "

"... detailed instructions, clear expectations ..."

"... rules of conduct for forum ..."

Developing Course Material

- Determined which parts of BIP-M synoptic and mesoscale requirements are applicable to tropics
- Identified existing training
  (e.g., online tropical textbook)
- Created new content to fill gaps
- Learning activities & Synoptic Laboratory exercises
  - Use of reliable, stable archives such as NOAA, NRL, EUMETSAT
  - Guidelines for activities, e.g., how students should present assignments

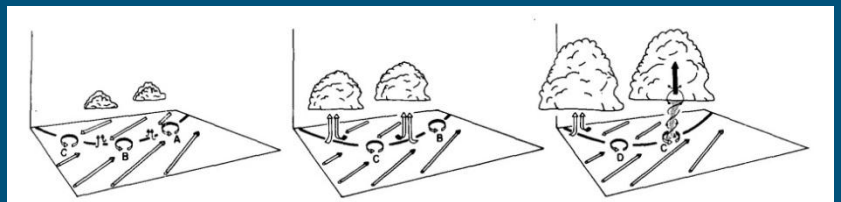


FIG. 20. Schematic model of the life cycle of the non-supercell tornado. The black line is the radar detectable convergence boundary. Low-level vortices are labeled with letters.

Course Outline

Unit 1: General review and global circulation concepts

Unit 2: Tropical disturbances

Unit 3: General Mesoscale phenomena

- Learning Objectives
- Topics and Resources
- Case Studies
- Tools
- Learning Activities and Assignments
- Review Questions
- Quiz Questions
- Supplemental Resources

Introduction Slides for Each Unit

Unit 1: General Review and Global Circulation Concepts >

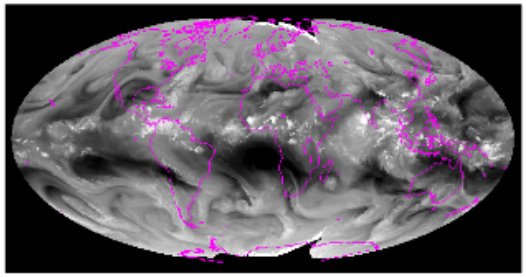
Introduction Presentation

Open in Google Docs for downloading or printing.

COMET

Unit 1: General review and global circulation concepts

- Approximately 3-4 weeks
- Review of basic dynamic and physical meteorology
- Review of midlatitude weather and comparison with tropics
- Exploration of global circulation concepts and tropical circulations

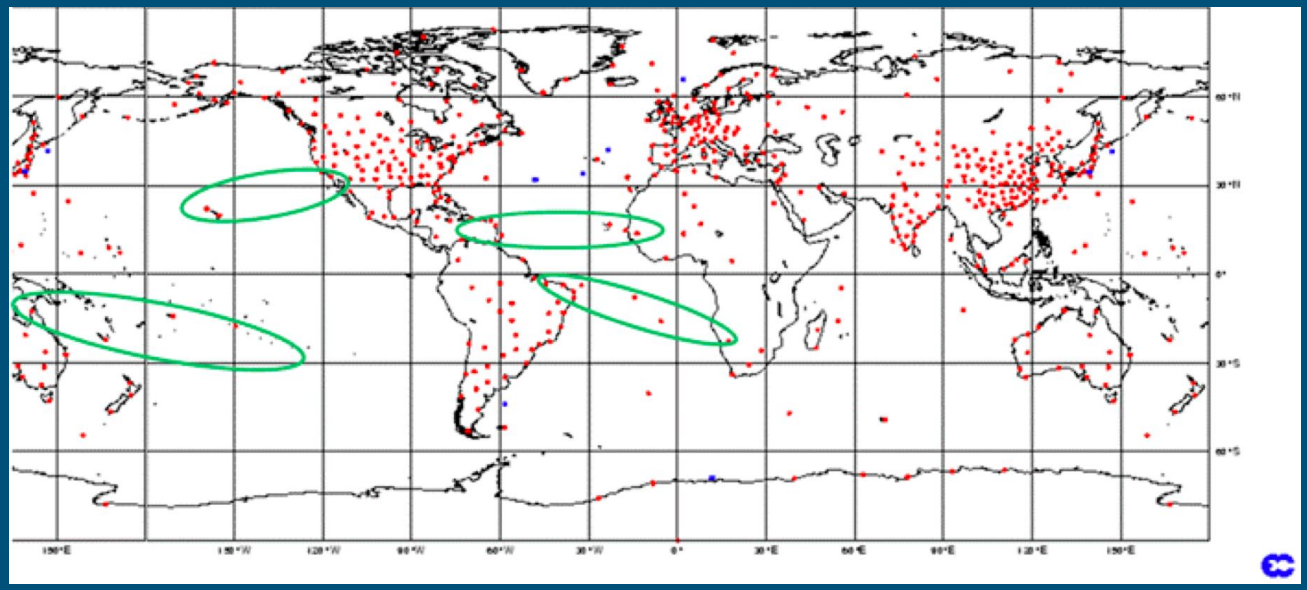


4/10/2012 Produced by The COMET® Program

Slide 2 Google docs

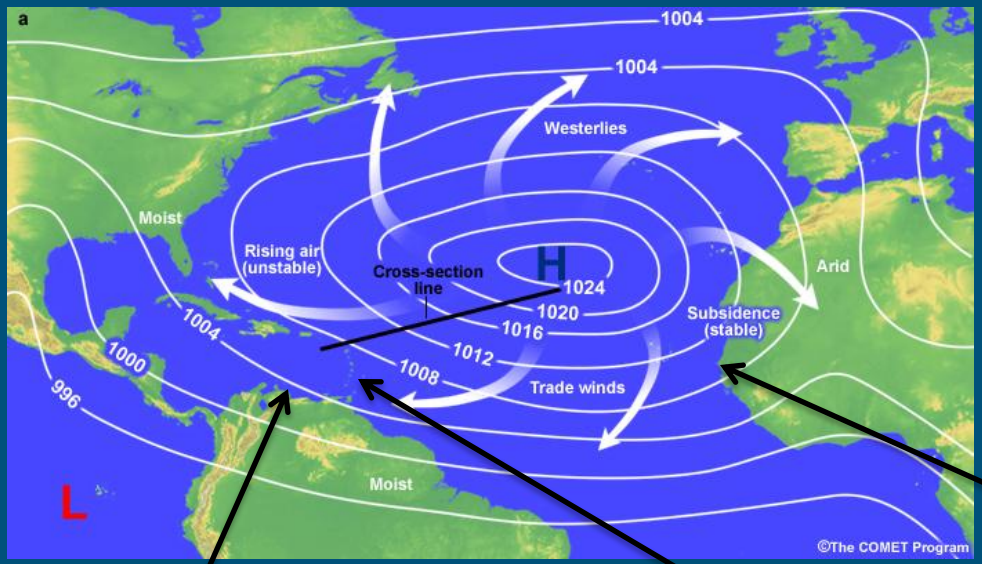
Open *Tropical_Synoptic_Meteorology_Unit1_Introduction.pptx*

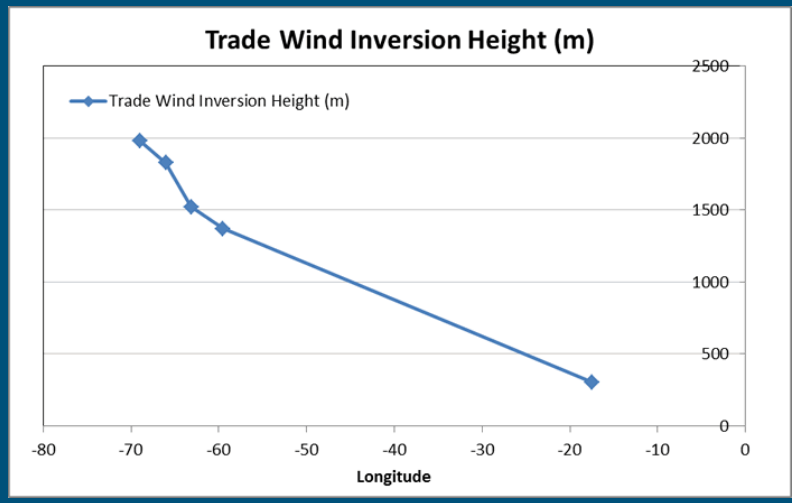
Unit 1: Example Assignment

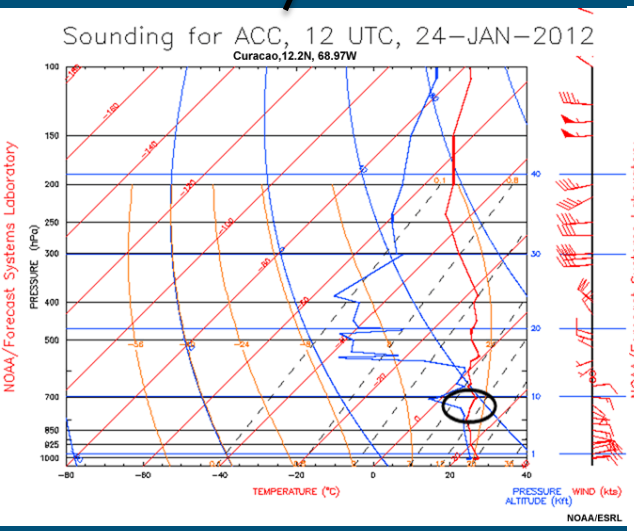


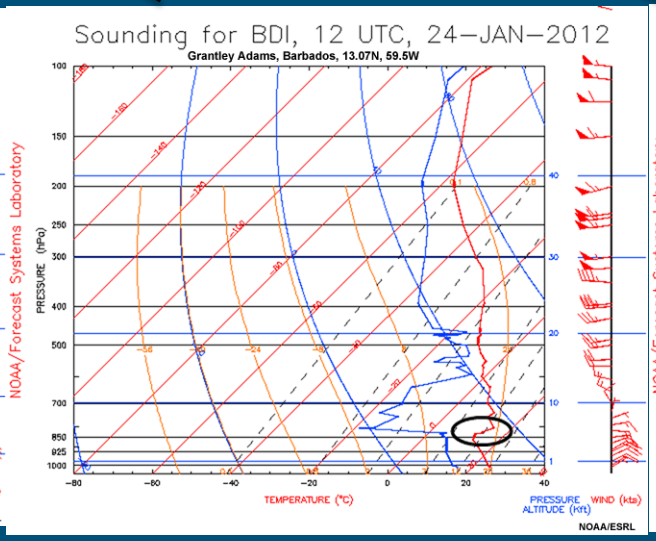
- Understand relationship between **semi-permanent surface pressure systems and trade wind inversion**
- Understand how that relationship influences **east-west variation in cloud layer height across tropical oceans**.
- Estimate inversion base from soundings, graph height across ocean basin, compare reality and conceptual model, explain similarities and differences based on synoptic conditions

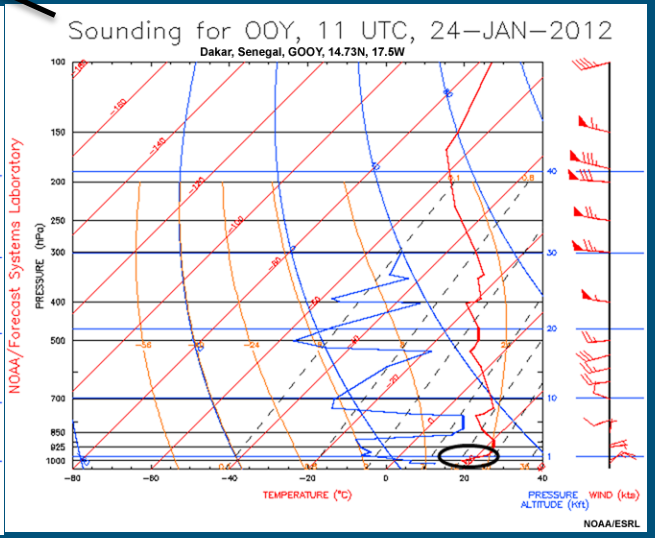
Unit 1 Assignment: Trade Wind Inversion











Unit 2: Topics and Resources

Unit 2: Tropical Disturbances >

Topics and Resources

Open in Google Docs for downloading or printing.

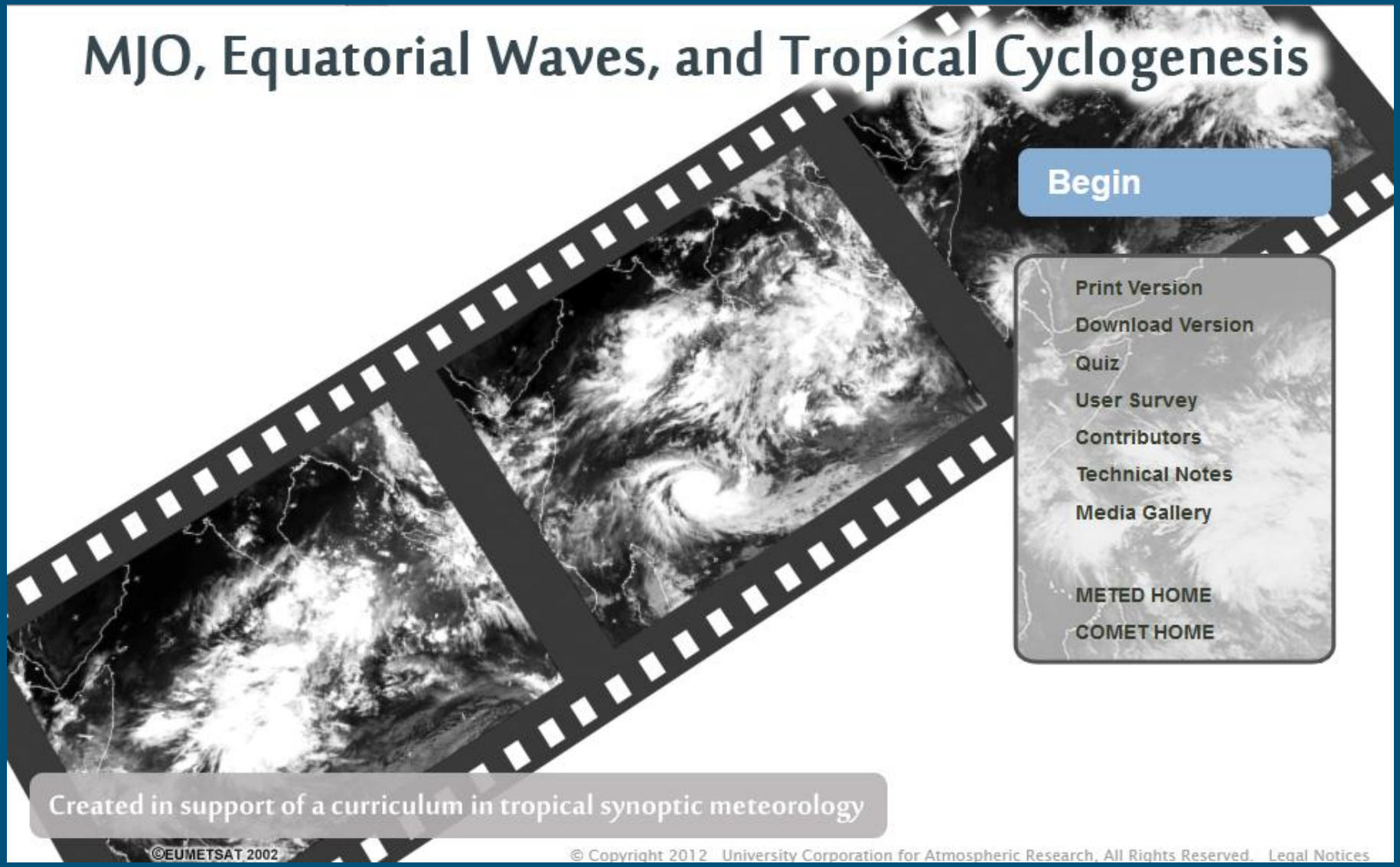
1. *Tropical waves*
   a. African Easterly Waves
      http://www.meted.ucar.edu/tropical/synoptic/Afr_E_Waves/
      This section describes characteristics of African easterly waves including horizontal and vertical structure, evolution, speed, frequency, methods of tracking, and their downstream transformation over the Atlantic, Caribbean, and East Pacific. Mechanisms for wave formation are presented. Also explored are differences between waves that develop into tropical cyclones and those that do not. Extratropical interactions are also examined.

   b. Equatorial Waves
      Introduction to Tropical Meteorology, Section 4.1.2,
      http://www.meted.ucar.edu/tropical/textbook_2nd_edition/navmenu.php?tab=5&page=1.2.0
      This section describes the space and time scales, speed, and cloud and precipitation patterns of equatorial waves. Examine Kelvin waves (Section 4.1.2.1), equatorial Rossby waves (Section 4.1.2.2), mixed Rossby-gravity waves (Section 4.1.2.3), areas where equatorial waves have greatest impact including on tropical cyclone genesis (Section 4.1.5.1), how to monitor and forecast equatorial waves (Section 4.1.5.2). An operational focus section has links to other examples of equatorial waves,
      http://www.meted.ucar.edu/tropical/textbook_2nd_edition/navmenu.php?tab=5&page=4.0.0

   c. Synoptic analysis of equatorial waves
      Introduction to Tropical Meteorology, Section 9.3.3
      http://www.meted.ucar.edu/tropical/textbook_2nd_edition/navmenu.php?tab=10&page=3.3.0
      The second part of this section describes how to identify equatorial Rossby waves and mixed Rossby-gravity waves using 850 hPa synoptic charts and satellite images.

   d. Madden Julian Oscillation (MJO)

Unit 2: Case Exercise



Unit 2: Case Exercise (Indian Ocean)

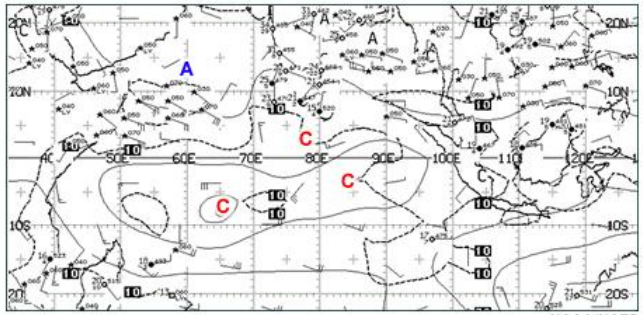
MJO, Equatorial Waves, and Tropical Cyclogenesis

Equatorial Wave Evolution: 1 - 4 May 2002

How did the equatorial waves evolve over the next few days? Below you'll find two animations: one a set of 4 analyses at 850-hPa at 12 UTC on 1 through 4 May 2002, and the other a set of four IR satellite pictures from 18 UTC on the same days. Watch how the tropical flow evolves over the three-day period using both observing methods. You can look at the sequence for each, or at satellite and 850-hPa analysis on the same day. After completing your examination of the 850-hPa wind and height analyses for 1 May to 4 May 2002, answer the question below.

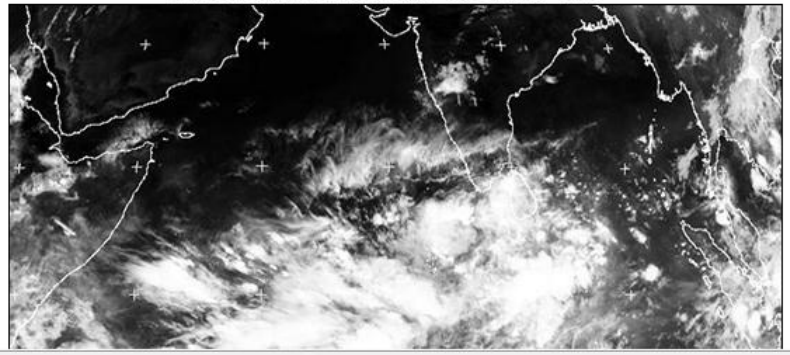
1 May | 2 May | 3 May | 4 May | IR Loop | 850 Analysis Loop

850-hPa Analysis: 1 May 2002 1200 UTC



NOAA/NCEP

Satellite Infrared Image, 18 UTC 1 May 2002



Unit 3: Suggested Learning Activities and Guidelines

Unit 3: General Mesoscale Phenomena

Learning Activities and Assignments

- Explore triggers of convection in the tropics. Mountain peaks, easterly waves, diurnal heating, and island tails. Identify the areas of the tropics that will be typically affected by each and show the differences in areal extent.

  Flip the exercise and make it into a discussion using a satellite animation, where student identify examples, then ask what the differences are. Pinpoint areas where it is hard to identify the source and discuss them.

  Useful sites for imagery
  - US Navy NRL Real-time and archive images, http://www.nrlmry.navy.mil/sat_products.html
  - US Navy NRL Archive Directories, http://www.nrlmry.navy.mil/archdat/ (three weeks)
  - NOAA RAMSDIS Tropical Images, http://rammb.cira.colostate.edu/ramsdis/online/tropical.asp
  - CIMSS, http://www.ssec.wisc.edu/data/
  - EUMETSAT Real-time and archive, topical images, case studies, http://www.eumetsat.int/Home/Main/Image_Gallery/index.htm?l=en (one week)

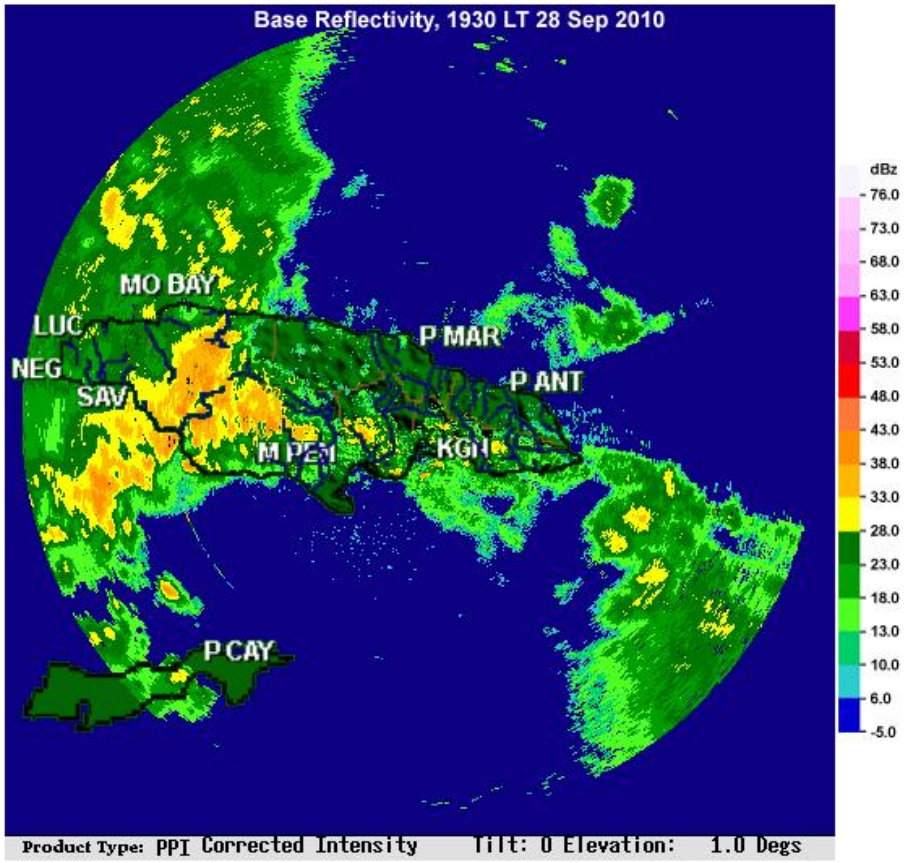
- Have students identify the causes of/conditions that produce local scale winds in their area, by constructing a wind rose for their city or town (or by finding one in a local climatology). What effects do these local winds have on the local weather?

  Guidelines for activity
  Global climate data is available from the US National Climatic Data Center (NCDC) website (http://www.ncdc.noaa.gov/), which is searchable by WMO Station ID, by country, and region, or using their interactive map, http://gis.ncdc.noaa.gov/map/cdo/
  Students submit powerpoint presentation with their wind rose and explanation for the effects on their local weather.

Unit 3: Case Study

Severe Weather and Flooding in Jamaica

1930 UTC 28 Sep | 1950 UTC 28 Sep | 2010 UTC 28 Sep



Question 4 of 4

How would you describe the evolution of the radar reflectivity pattern? (Select all that apply.)

- [ ] **a)** Reflectivity decreased as the line of convection moved eastward
- [ ] **b)** Areas of maximum reflectivity became more organized along a leading line

New Course Resources

- MJO, Equatorial Waves, and Tropical Cyclogenesis
- Jet Streams
- Tropical Mesoscale and Local Circulations
- African Easterly Waves
- Tropical Mesoscale Convective Systems
- Tropical Severe Local Storms
- Tropical-Extratropical air mass interactions

Institutions Planning to Adopt Course

- University of South Pacific (Feb 2013)
- University of the West Indies (2013 academic year)
- University of Costa Rica

Thanks!

Questions?

Contact:

laing@ucar.edu

https://sites.google.com/a/comet.ucar.edu/tropical-synoptic-meteorology-curriculum/