

Arba Minch University

Water Technology Institute

Faculty of Meteorology and Hydrology

Course name (code): General Circulation (MHD-0903) **Status:** Compulsory

Section: G2-MHS

Credit hour: 3 ECTS **Academic year:** 2019/20 semester: II

Prerequisite: Tropical Meteorology (co-requisite) **Instructor:** Tewelde B.

COURSE OBJECTIVE:

This course, general circulation, is aimed at introducing the students to the basics of dynamics of global atmospheric flow and its importance, the theoretical models of global circulation, the deriving mechanism related to zonal/meridional global flows, oscillations of the atmosphere and their importance in seasonal weather prediction; and global or/and regional climate modeling, interaction between atmospheric and oceanic circulation, teleconnection (link between sea surface change and climate variability for particular place).

Contents

Part I: Atmospheric Circulation

1. Basic Status of The General Atmospheric Circulation (GAC)
 - 1.1 Atmospheric General Circulation (GAC)
 - 1.2 Driving Force of Atmospheric General circulation (AGC)
 - 1.3 Statistics of Atmospheric Circulation
 - 1.4 Theoretical Models of AGC (uni and tri cellular circulation)
 - 1.5 Baroclinic vs. Barotropic
 - 1.6 Measurement of Rotation
2. Atmospheric Radiation process and Atmospheric Energetics
 - 2.1 Incoming and outgoing radiation
 - 2.2 Latitudinal distribution of earth radiation
 - 2.3 North-South Temperature Gradient
 - 2.4 Energy type: internal, potential, kinetic and available
 - 2.5 Meridional heat exchanges
3. Observed Global Circulation
 - 3.1 Global surface pressure

- 3.2 Global wind pattern
- 3.3 Actual global surface circulation
- 3.4 Persistent features of the atmospheric circulation
- 3.5 Climate Models (General Circulation Models)
- 4. General Circulation Upper Atmospheric and Flow Patterns
 - 4.1 Tropospheric and Stratospheric temperature
 - 4.2 Tropospheric and Stratospheric wind
 - 4.3 Principal Tropospheric Jet Streams
 - 4.4 Formation of Upper-Tropospheric Cyclones and Anticyclones
 - 4.5 Balanced Wind Flow

Part II: Ocean Circulation

- 5. Ocean Processes and Climate Phenomena
 - 5.1 Pressure, temperature, salinity, and some thermohaline dynamics
 - 5.2 Dynamics of the THC
 - 5.3 Theory of gyre-scale circulation
 - 5.4 The abyssal circulation
 - 5.5 Tropical Ocean Circulation
 - 5.6 Equatorial phenomena in the Pacific Ocean
 - 5.7 Tropical–Extratropical Oceanic Exchange Pathways
 - 5.8 The Southern Ocean and the global overturning circulations
 - 5.9 Link of Ocean process and Ethiopian climate and climate variability

Part III; Ocean-Atmosphere Interaction

- 6. Oscillation and Teleconnection
 - 6.1 Introduction: Sound wave, Gravity wave and Rossby wave
 - 6.2 The El Niño–Southern Oscillation Phenomenon
 - 6.3 Physical ENSO processes
 - 6.4 The Atlantic Multidecadal Oscillation
 - 6.5 Quasi-biennial oscillation(QBO)
 - 6.6 .Madden-Julian oscillation (MJO)
 - 6.7 Pacific/North American Pattern
 - 6.8 Pacific Decadal Oscillation
 - 6.9 Quasi-Biennial Oscillation
 - 6.10 Indian Ocean Dipole
 - 6.11 West Pacific Pattern
 - 6.12 Impact of ENSO on Ethiopia rainfall

Methods of Assessment:

- ✓ Quiz /Tests/Attendance, assignment/: 50 %

✓ Final examination: 50%

References

Newell, R.E., Kidson, J.W. and Vincent, D.G., (1972) The General Circulation of the tropical Atmosphere and Interactions with Extra tropical latitudes (The Massachusetts Institute of Technology

Ramage, C.S. (1995): Forecasters Guide to Tropical Meteorology, AWSTR 240, updated by Ramage. (Address Air weather service, 102 West Losey Street, Scott Air Force Base, Illinois 62225-5206-U.S.A).

Wallace, J.M. & Hobbs, P.V. (1977). Atmospheric Science: An Introductory Survey, (Chapter 9), Academic press

James R.Holton (2004): An Introduction to Dynamic Meteorology 4th edition Department of Atmospheric Sciences, University of Washington, Seattle, Washington, Elsevier