Met 5533

The heat lows show a radiative loss of energy – what is that statement ??

How would you compute the heat budget of a heat low and demonstrate the need for an import of energy from the surroundings to maintain its thermal stratification.

1. (METR 5533)

This question relates to the growth of African waves in the vicinity of the African 'lower tropospheric easterly jet'.

a) What months is this jet observed?
b) What is the location of this jet?
c) What is the typical amplitude?
d) How would you pose the barotropic, baroclinic and combined instability mechanisms for the growth of African waves using data sets and posing relevant dynamical and computational tools?

2. (METR 5534)

Describe the possible mechanisms for the diurnal change of convective activity over the warm pool regions of the Western Pacific Ocean. Contrast the diurnal cycle of the convective activity with the stratiform rain over this region and the possible role of radiative forcing (short wave versus long wave) in these diurnal signatures.

3. (METR 5541)

Describe the treatments of the constant flux layer and the planetary boundary layer in a numerical weather prediction model.

a) Describe the model formulation.
b) List the assumptions.
c) Describe the solution procedure, i.e., the knowns, unknowns and the closed system in the context of the big model.
d) List the current limitations of this type of modeling.

T. N. KRISHNAMURTI
(ALLOW 60 MINUTES)
all Krish students and those who took MET 5533

The barotropic transfer of energy for a mean zonal flow to eddies on the scale of African waves is considered important. Discuss the following in the context:

(a) Synoptic aspects of African waves and its broad scale environment.

(b) Observed scale (horizontal and vertical) and frequency of these waves.

(c) What computation would you carry out to establish the importance of the barotropic process. Present a detailed framework: e.g. energetics, inflection point instability, growth rate versus scales.

T. N. KRISHNAMURTI
(ALLOW 40 MINUTES)
all Krish students and others as necessary.

In tropical and middle latitude weather system we have to deal with the large scale condensation process.

From first principles formulate the stability, heating and rainfall rate estimates. Use a simple quasi geostrophic omega - equation as a frame work for your discussion. Discuss also in ellipticity of the omega-equation in this context.

Meteorology 5533

a) Describe in sequence the salient features of an El Niño episode and its atmospheric impact.

b) Describe the physical aspects of the initiation of warm water of the El Niño in a coupled ocean-atmosphere context.

c) Sketch the global east west divergent circulation during an El Niño and an Elviejo and its implication on tropical climate.

Meteorology 5533

Write down the basic energy equation for the rotational and divergent winds and those of the available potential energy of the atmospheric motions. Using these as domain averaged equations, discuss the maintenance of a steady state monsoon system. Use inequality arguments to show how differential heating leads to the maintenance of the monsoon. Discuss all salient covariences of this problem.

5533 Question

Sketch a typical vertical cross section of thetae across a mature hurricane , identify regions of high , low and constant thetae in this cross section. Discuss different possible mechanisms that may be important for the maintenance of low thetae lobes using te framework of generation and destruction of moist static stability around a hurricane. (Hint cloud top radiative cooling, evaporation, lateral transports, vertical turbulent mixing, air sea fluxes)

5533
Krishnamurti
1 hour

Given closed domain equations for the rotational and divergent kinetic energy and for the internal plus potential energy. Discuss, using inequality arguments, the maintenance of a statistically steady state monsoon from differential heating.

Explain the role of all the salient covariances. Explain the significance of the orientation of the velocity potential with respect to the stream function in this problem.

MET 5533 Tropical Meteorology

Describe in some detail with sketches the sequence of the elements of a southern oscillation starting from a strong trade wind phase and culminating in the same phase. Describe within it the comings and goings of the cold and warm phases of the El Nino. How would a feature such as an east-African drought be a part of his scenario, discuss.

Meteorology 5533 Krishnamurti

This question asks you to elaborate on the notion that differential heating drives a monsoon. Use the energetic based on streamfunction and velocity potential as your frame of reference and explain the major covariances and the inequality arguments that are needed to support this notion.

Krish (Tropical)

The question follows the analysis of Ogura and Chow to describe the bimodality of tropical clouds, i.e. predominantly low and high clouds.

Describe an outline of their analysis method and show how they lead to the above conclusions.

TROPICAL - 5533

2. The Kuo Eliasseu equation can be used to describe the Hadley Cell. Write down the equation and explain the left hand and the right hand sides.
   a) Discuss the ellipticity of the equation.

   b) Show geometrically how internal heat sources and sinks over the tropics drive the Hadley cell in this context.

   c) Describe the role of meridional fluxes of whatever that plays a role in the intensity of the Hadley Cell in this framework.

   d) Discuss plausible relative roles of the above processes in the drive of the Hadley Cell.

TROPICAL – 5534

3. In a simple cloud ensemble model a number of microphysical processes are usually included via simple parameterizations. Discuss the following processes in the context of the first law of thermodynamics, water vapor and liquid water conveyance equations:
   a) auto conversion
   b) accretion
   c) evaporation of rain
   d) evaporation i.e. cloud to vapor
   e) condensation vapor to cloud

Show how the condensation of water substance is assured in such modeling.

Met 5533 - Tropical I

Using the inequality arguments of the PSI-CHI energetics sequentially illustrate how you can show that a differential heating is necessary for the driving of a steady state monsoon. Explain the relevant covariances and the CHI-PSI exchanges very clearly.

Hint:

$$\frac{\partial K_\Psi}{\partial t} = < K_\chi \bullet K_\Psi > + F_\Psi$$

$$\frac{\partial K_\chi}{\partial t} = < APE \bullet K_\chi > - < K_\chi \bullet K_\Psi > + F_\chi$$

$$\frac{\partial APE}{\partial t} = - < APE \bullet K_\chi > + G + F_{APE}$$

Meteorology 5533 T.N. Krishnamurti

This question relates to tropical/subtropical heat lows over deserts.

a) What are the typical vertical distributions of vertical motion, divergence and relative vorticity in these systems.

b) What do the satellite signatures of net incoming minus the net outgoing radiation look like at the top of the atmosphere in these systems.

c) Describe the framework for the heat budget of the heat low emphasizing relative contributions from the role of adiabatic descent, radiative components, lateral import/export of energy and the maintenance of the thermal stratifications.

d) What are the plausible teleconnections of the heat lows with the rain producing systems around it.

Krish 5533

Write down an outline of the salient ψ-χ energetics over a closed domain. Include energy equations for the rotational, divergent and available potential energy. Illustrate using sequential inequality argument that the maintenance of a steady state monsoon (defined by time rate of change of rotational kinetic energy integrated over monsoon domain being nearly zero) requires a differential heating for its maintenance.

Tropical Meteorology 5533

This question pertains to wind-pressure relationships for the near-equatorial latitudes 10 S to 10 N near the earth's surface.

You are given the sea-level pressure field p(x,y). You are to determine the winds (under near steady-state conditions) from the momentum equations that include:

i) Horizontal advection of momentum

ii) Coriolis force

iii) Pressure gradient force

iv) A Rayleigh-type friction

a) Show the solution procedure for the wind components.

b) Describe a typical wind pattern that you would obtain from this system for a given low-pressure area over the central equatorial Pacific Ocean; emphasizing the westerly winds and the Kelvin and Rossby gravity components of the solution.

Met 5533 Tropical

Describe the salient structural features (with some sketches) of the monsoonal Intraseasonal Oscilation: the scale, speed of propagation, amplitude,relationship to weather and mechanisms that are responsible for its generation.

You are given the u,v components of winds on a pressure surface over the globe on a latitude/longitude grid. This question requires you to find the stream function ψ and the velocity potential χ on the same grid. Show the use of spectral transform method and of the desired recurrence relations of the associated Legendre's function to solve this problem.

THE FOLLOWING ARE USEFUL NOTES FOR YOU

$$U = \frac{1}{a^2}\left(\frac{\partial \chi}{\partial \lambda} - \cos\theta \frac{\partial \psi}{\partial \theta}\right)$$

$$V = \frac{1}{a^2}\left(\frac{\partial \psi}{\partial \lambda} + \cos\theta \frac{\partial \chi}{\partial \theta}\right)$$

These U,V are Robert functions.

. For our purpose, the following *four recurrence relations* for the normalized associated Legendre functions are most useful:

(1) $\mu P_n^m(\mu) = \in_{n+1}^m P_{n+1}^m(\mu) + \in_n^m P_{n-1}^m(\mu)$, or

$$\sin\theta P_n^m(\sin\theta) = \in_{n+1}^m P_{n+1}^m(\sin\theta) + \in_n^m P_{n-1}^m(\sin\theta), \qquad (6.37)$$

where

$$\in_n^m = \left(\frac{n^2 - m^2}{4n^2 - 1}\right)^{1/2}.$$

(2) $\left(1-\mu^2\right) dP_n^m(\mu)/d\mu = -n \in_{n+1}^m P_{n+1}^m(\mu) + (n+1) \in_n^m P_{n-1}^m(\mu)$, or

$$\cos\theta \frac{dP_n^m(\sin\theta)}{d\theta} = -n \in_{n+1}^m P_{n+1}^m(\sin\theta) + (n+1) \in_n^m P_{n-1}^m(\sin\theta). \qquad (6.38)$$

Eliminating P_{n+1}^m between (6.37) and (6.38), we obtain the following relations:

(3) $\left(1-\mu^2\right) dP_n^m(\mu)/d\mu = (2n+1) \in_n^m P_{n-1}^m(\mu) - n\mu P_n^m(\mu)$, or

$$\cos\theta \frac{dP_n^m(\sin\theta)}{d\theta} = (2n+1) \in_n^m P_{n-1}^m(\sin\theta) - n \sin\theta P_n^m(\sin\theta). \qquad (6.39)$$

(4) $\left(1-\mu^2\right)^{1/2} P_n^m(\mu) = g_n^m P_{n+1}^{m+1}(\mu) - h_n^m P_{n-1}^{m+1}(\mu)$, or

$$\cos\theta P_n^m(\sin\theta) = g_n^m P_{n+1}^{m+1}(\sin\theta) - h_n^m P_{n-1}^{m+1}(\sin\theta), \qquad (6.40)$$

where

$$g_n^m = \left(\frac{(n+m+1)(n+m+2)}{(2n+1)(2n+3)}\right)^{1/2}$$

and

$$h_n^m = \left(\frac{(n-m-1)(n-m)}{(2n+1)(2n-1)}\right)^{1/2}.$$

These are the equations you need to go from U,V to psi ,chi.

$$U_n^m = im\chi_n^m + (n-1)\varepsilon_n^m \varphi_{n-1}^m - (n+2)\varepsilon_{n+1}^m \varphi_{n+1}^m$$

$$V_n^m = im\varphi_n^m - (n-1)\varepsilon_n^m \chi_{n-1}^m + (n+2)\varepsilon_{n+1}^m \chi_{n+1}^m$$

Time : 1 Hour
Ph.D. Exam Question

MET 5534 Tropical (small scale) Meteorology

Hurricane Opel of 1995 exhibited several interesting intensity changes as it moved towards Pensacola. You are to formulate a research problem which is to address possible investigations of these intensity changes. Elaborate on the following:

1) What kind of intensity change are you addressing?

2) What mathematical framework would you need?

3) What hypothesis would you be testing?

4) What data sets do you need?

5) What computations would you be doing?

6) What can you expect to learn from your approach?

Meteorology 5541

One Hour

a) Derive an appropriate stencil for a 4^{th} order accurate Laplacian or describe a procedure for implementing it.

b) Using the above lattice describe in principle how one constructs a fourth order accurate Jacobean which satisfies the quadratic invariance.

MET 5541 **Dynamical Weather Prediction**

a) Write down the barotropic vorticity equation on a sphere.

b) Using spherical harmonics as a basis function, derive the spectral form of the barotropic vorticity equation.

c) Show the following for the solution procedure for the weather forecast model:

i) Use of the transform method to handle linear and the nonlinear terms.

ii) Provide a flow chart using a simple time differencing scheme for this problem.

MET 5541
T.N. Krishnamurti

Given a linearized system of shallow water equations (linearized about a constant basic flow), show that the frequency equation for wave motions is a cubic. Show that this cubic has two solutions which describe gravity waves moving in opposite directions and a unidirectional Rossby wave. Show furthermore that the use of the geostrophic approximation retains only the Rossby wave and the gravity wave solution vanish.

Hint: Use as a start equations of the type:

$$\left(\frac{\partial}{\partial t} + \bar{u}\frac{\partial}{\partial x}\right)_M u' - fv' + g\frac{\partial h'}{\partial x} = 0$$

$$\left(\frac{\partial}{\partial t} + \bar{u}\frac{\partial}{\partial x}\right)\frac{\partial v'}{\partial x} + \beta v' + f\frac{\partial u'}{\partial x} = 0$$

$$\left(\frac{\partial}{\partial t} + \bar{u}\frac{\partial}{\partial x}\right)h' + v'\frac{d\bar{h}}{dy} + \bar{h}\frac{\partial u'}{\partial x} = 0$$

Meteorology 5541 Krishnamurti

This question is on the handling of nonlinear terms for any equations of the global spectral model. Take one of those equations and illustrate the use of the spectral tranform method. Start from the scalar form of the equation, where the variables are given to you on latitude/longitude grid and express your final nonlinear term in the same latitude/longitude grid.

NWP - 5541

1. In numerical prediction models the treatment of non convective rain require

   a) Some minimal large scale conditions before this is invoked, what are they?

   b) The vertical slope of saturated specific humidity following the condensate (a local moist adiabat) is a key to the computation of this rain. Discuss how this is obtained.

   c) Write down all the steps towards the computation of the non -convective heating and non-convective rain.

   d) Does the release of non-convective heating warm the atmosphere?

Meteorolgy 5541 Dynamical Weather Prediction

What is special about the semi implicit time differencing scheme for time integrations.How does it handle the fast and slow modes, what are those modes. In this system the solution of a Helmholtz equation is necessary for most atmospheric models (use the shallow water equations as your frame of reference). Show the closed system of the model equations in semi implicit form and show in principle how the solution of the Helmholtz paves the way for solving for all other variables of this problem

T. N. KRISHNAMURTI
(ALLOW 60 MINUTES)
all Krishnamurti students & those who took MET5541.

Describe the semi implicit spectral shallow water model. Specifically outline the following.

(a) Spectral closed system

(b) Treatment of the Helmholtz equation for the free surface height.

(c) Treatment of nonlinearity

(d) Treatment of the semi implicit time differencing.

Too many details are not necessary, convince me that you know in principle how one can put these ideas together spectrally.

Meteorology 5541

This question is on the use of the spectral transform method for the computation of the nonlinear dynamics. You are given a contribution to the divergence tendency:

$$\frac{\partial D}{\partial t} = -\nabla^2\left(\frac{U^2+V^2}{2\cos^2\Theta}+\Phi\right)$$

where $\frac{\partial D}{\partial t}$ is the divergence tendency,

U,V are the Robert functions from u,v

Θ is the latitude

and Φ is the geopotential.

Starting from the winds u, v and geopotential Φ on the grid space over a sphere, address the eventual computation of the function $\frac{\partial D}{\partial t}$ on the grid space. Use the following in some sequential manner to address your final answer:

a) Robert function to resolve the pole problem.
b) Use Fourier-Legendre transforms where desired.
c) Use inverse Fourier Legendre transforms where desired.
d) Strategy for the quadratic non-linearity in the grid versus spectral space.
e) Proper handling of the Laplacian in the spectral space over a sphere.

Met 5541

This question is on spectral barotropic model. Discuss the following aspects of the model, using spectral transform method.

a) How do you compute J (ψ, ζ). Show a sequence of complete steps.

b) How do you recover ψ from ζ . Show all steps in sequence.

c) How would you compute the Beta term.

T. N. KRISHNAMURTI
(ALLOW 60 MINUTES)

MET 5541: Write down the shallow water equation in semi-implicit form and describe the Helmholtz equation for the free surface height. Discuss the invariants of the problem for a closed domain. What may be appropriate boundary conditions for this problem?

Meteorology 5541

This question relates to spectral modeling (the Gaussian grid):

a) Show how the locations of the transform grid points in the merdional directions are determined in order to have accurate calculations of Legendre functions and their north-south derivatives.

b) For carrying out alias-free non-linear advection computations, it is desirable to have a minimal number of east-west and north-south grid points. How is that determined?

5541 Question

Write down the non linear advective (Jocobean Term) for the barotropic vorticity equation on a sphere , show how you would calculate this term in the spectral form using the spectral transform method. You start with the stream function psi on a latitude/longitude grid.

1a) Derive the adiabatic-inviscid potential vorticity equation,

$$\frac{d}{dt}\left[\zeta_a \frac{\partial\theta}{\partial p}\right] = 0$$

b) Describe the formation of a middle latitude lee trough (in the lee of the Rockies) using this conservation principle.

2. Describe the following in one paragraph each:

a) Ozone hole,
b) Nuclear freeze,
c) Sahelian drought,
d) El Niño
and e) VAS soundings.

Meterology 5534 Krishnamurti

2. This question in on Arnilt's model of the sea breeze. The enclosed nomogram is based on his experimentation. Describe what kind of numerical experimentation is needed to construct these nomograms. What do the closed system of equations for this sea breeze model look like? Explain the use of these nomograms.

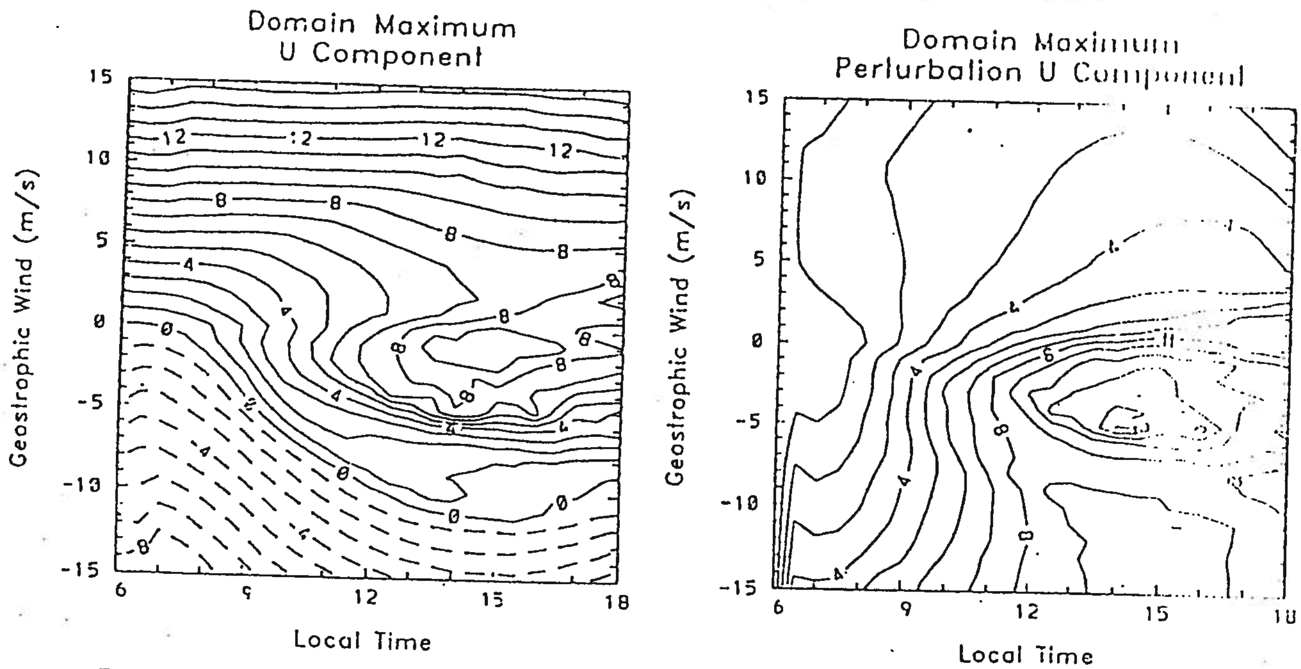

FIG. 1. Maximum predicted u component anywhere in the model domain, as a function of the imposed u_g and time: (a) total u component; (b) perturbation from the model initial u component. Contour interval is 1 m s^{-1}.

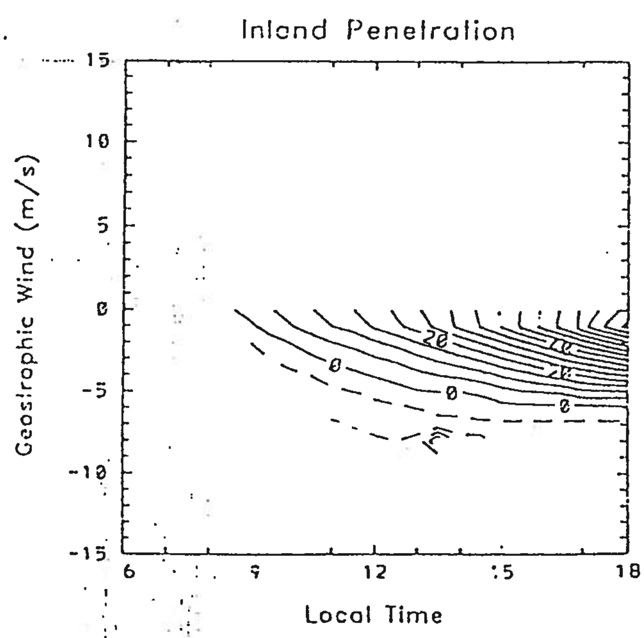

FIG. 2. Inland penetration of the sea breeze, as indicated by the farthest inland location having a positive u component. Contour interval is 5 km, with a value of zero assigned to the coastline.

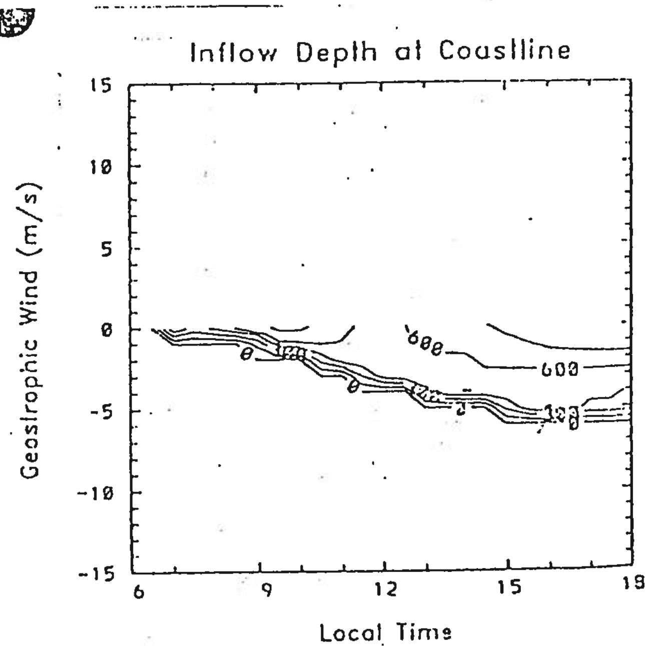

FIG. 3. Depth of the inflow layer at the coastline. Contour interval is 150 m.

Meteorology 5534
Ph.D. question

You are to make use of angular momentum budget using a local cylindrical coordinate (centered on a hurricane) as a frame of reference. Show how such a budget, based on real data, can be used to find the variation of surface drag (of a hurricane) as a function of radial distance for the storms center. Show how the same data sets can be used to find a relationship between the surface drag coefficient and the wind speed. Present a sequential use of data, identifying such, for the entire stream of above computations. What do the final results typically look like for a hurricane.

Meteorology 5534

Describe the construction of a simple non-precipitating shallow stratocumulus cloud model (such as those of Frank Murray) where you have dynamical and water substance equations. Show how such a framework is used to study the lifecycle of a buoyant cloud. Specifically discuss the feedback processes among the thermodynamic energy equation and the water substance equations, i.e. evaporation, precipitation and condensation heating and cooling, etc. Describe the initial state and the evolution of equivalent potential temperature.

(1 Hour)

Write down the equation for the time rate of change of angular momentum of a parcel for a local cylindrical coordinate. Discuss the various torques. Describe how you might interpret the maximum intensity of a hurricane taking into account the sources, sinks and the boundary valves of a parcel's angular momentum.

MET 5534 PhD Preliminary Examination Question – Dr. Krish

In the design of a cloud ensemble model several microphysical processes are always included. In the water substance equation for vapor, water and ice, there are several features such as: accretion, autoconversion, evaporation, condensation, sublimation, etc.

i) Explain each of these features of a model and show in principle how they are interlinked among the water substance equation and the first law of thermodynamics.

ii) If such a model is to be used to partition the convective and nonconvective rain, how in principle might you try to do that?

(1 Hour)

Derive the spectral form of the barotropic nondivergent vorticity equation. Discuss in detail how the transform method is used to handle a linear and the nonlinear terms. Finally show how you would make a one time step forecast starting from the wind components u, v over the globe at 500 mb.

(1 Hour)

Describe the zonally and meridionally propagating waves on the Madden-Julian time scale of 30 to 50 days. The passage of these waves have been related to the occurrence of intra seasonal climate variability. Describe that clearly in terms of motion field, cloud and weather. What are the horizontal and vertical scales of these waves.

One Hour

a) In the context of the planetary boundary dynamics show the scale analysis for the balance of forces for the Ekman, Advective and the Stokes types. Derive appropriate frequency equations.

b) Sketch the wind and pressure fields for the Somali jet over the Arabian Sea during summer at the 1 km level, and discuss the balance of forces from south to north following the jet.

Dr. Krishnamurti

Describe the modelling of Non Convective rain for a numerical prediction model, describe the conditions you may need to invoke to model this rain, how do you handle the condensation details, and how would you estimate the surface rain and the heating arising from this method.

Hint:

$$e_s = 6.11\exp\left(\frac{a(T-273.16)}{T-b}\right)$$

$$q_s = \frac{0.622e_s}{p}$$

$$H_{NC} = L\omega\frac{\partial q_s}{\partial p}$$

(30 minutes)

Kelvin's circulation theorem states that, under certain conditions the circulation is conserved following the motion of material particles. State these conditions, then consider an atmosphere starting at rest, with no vorticity. Explain how vorticity can be generated in this atmosphere.

What is a semi implicit time differencing scheme? How does it distinguish between the handling of slow and fast modes? Take the shallow water system as a frame of reference and show how you would
set up this model of three equations for three unknowns in the semi-implicit form and solve one time step for all variables.

Hint:

The shallow-water equations:

$$\frac{\partial u}{\partial t}+\frac{\partial \phi'}{\partial x} = -\left(u\frac{\partial u}{\partial x}+v\frac{\partial u}{\partial y}-fv\right) = N_u,$$

$$\frac{\partial v}{\partial t}+\frac{\partial \phi'}{\partial y} = -\left(u\frac{\partial v}{\partial x}+v\frac{\partial v}{\partial y}+fu\right) = N_v,$$

$$\frac{\partial \phi'}{\partial t}+\bar{\phi}\left(\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}\right) = -\left(\frac{\partial u\phi'}{\partial x}+\frac{\partial v\phi'}{\partial y}\right) = N_h$$

1 hour

Using appropriate length and time scales, nondimensionalise the zonal equation of motion in the planetary boundary layer, and discuss under what conditions you expect Ekman, Advective and Stokes boundary layers. Give an example of the balance of forces for the advective boundary layer and explain its role in the cross equatorial flows of the Somali jet.

(30 minutes)

The statements of conservation of mass, momentum, energy, and the equation of state for a perfect gas, respectively, may be written as follows:

$$\frac{1}{\rho}\frac{D\rho}{Dt} + \frac{\partial u_j}{\partial x_j} = 0$$

$$\rho\frac{Du_i}{Dt} = -\frac{\partial p}{\partial x_i} - g\rho\lambda_i + \mu\left[\nabla^2 u_i + \frac{1}{3}\frac{\partial}{\partial x_i}\left(\frac{\partial u_j}{\partial x_j}\right)\right]$$

$$\rho C_p\frac{DT}{Dt} - T\alpha\frac{Dp}{Dt} = k\nabla^2 T$$

$$p = RT\rho \qquad i = 1, 2, 3 \qquad \lambda_i = (0, 0, 1)$$

α = thermal expansion coefficient
k = thermal conductivity

In a layer of air of depth d there is a vertical temperature gradient $\beta = \Delta T/d$.

Rewrite these equations making the Boussinesq approximation, and explain the conditions under which this approximation is valid.

You have attended several seminars at fsu during the last two years. Pick one seminar, provide the rough title of this seminar. Then write a statement of the problem the seminar addressed. Write down a couple of pages on the contents of this seminar. Then list any assumptions or limitations of this seminar. Finally summarize what you think were the conclusions. Also add if you think this area of research has some future potential.

T. N. KRISHNAMURTI
(ALLOW 60 MINUTES)
all students.

Try to write a small paragraph, e.g. for the Glossary of Meteorology, for the following:

(a) Equational Kelvin waves

(b) Rossby gravity waves

(c) Wave Cisk

(d) PNA pattern

(e) Madden Julian wave

(f) Heat Low.

1. Define the following terms and describe them as well:

a) Conditional instability
b) Combined barotropic - baroclinic instability
c) PNA pattern
d) Equatorial Kelvin wave
e) Mixed Rossby gravity wave
f) Madden-Julian oscillation

(Krish) a. Discuss the computational stability of a semi-implicit time differencing scheme applied to a simple linear wave equation. Discuss its advantage over an explicit method.

b. In its application to shallow water show the separation of the terms for the fast and the slow modes. Briefly indicate how a Helmholtz equation pops up in this formulation.

a) Define the Hadley Cell. b) If you are to map the Hadley Cell from real data, show the sequence of steps (including equations for a stream function) you would need to map it.
c) Explain how the Hadley Cell transports momentum and moisture across the equator from the winter to the summer hemisphere, however it transports kinetic energy the opposite ways.
d) How do transports of heat and moisture typically vary among El Niño and La Niña years.

Tropical Meteorology (Krishnamurti)

Describe the MJO phenomenon in the atmosphere (i.e., its space and time scales and its relationship to weather). Describe the variables that show the phenomenon most clearly and its seasonal geographical disturbances and amplitudes. Describe briefly the wave-CISK theory for the MJO proposed by Dr. William K. M. Lau of NASA.

Advanced Topics in Hurricanes (Krishnamurti)

Describe the angular momentum principle applied to hurricanes. Include the various torques that modify the angular momentum. You have looked at radar-based data sets that enable you to examine the cloud torques in the inner core of a hurricane. Describe how those observations fit in with the overall angular momentum picture for assessing hurricane intensity.