

APPLIED HYDROLOGY

(HI-505)

Self Introduction

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Qualification:

*B.Sc.: Civil Engineering, UET, Lahore
(1991)*

*M.Sc.: Structural Engineering, UET, Lahore
(1996)*

*Ph.D.: Hydrology & WRE, UOT, Japan
(2001)*

Work Experience:

Lecturer: 1991-1996

Assistant Professor: 1996-2001

Associate Professor: 2001-2004

Professor: 2004-To date

Head of Division: 2009-To date

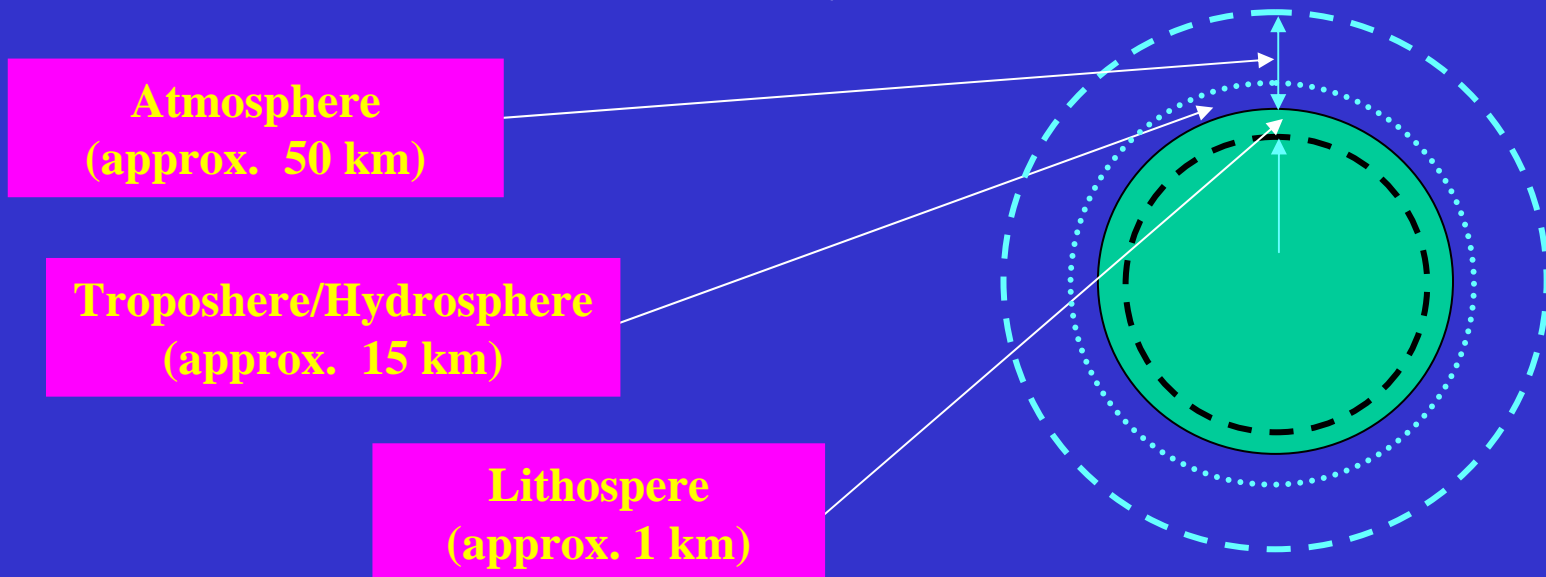
Student's Introduction

Subject Introduction

Hydrology:

(1) Scientific Study of Hydrological Cycle.

(2) Branch of Science which deals with the occurrence, distribution, movement and properties of waters on, under & over the earth's surface with their relations to the environment.



Global Water Volumes

*Atmosphere: 12900 Km³ (0.001 % of T.W.,
0.5% of volume of atmosphere)*

Troposphere: 12900 Km³ (100 % of A.W.)

Lithosphere: 23.4 x 10⁶ Km³ (0.017 % of T.W.)

Rivers: 2120 Km³ (0.0002 % of T.W.)

Oceans: 1338 x 10⁶ Km³ (96.54 % of T.W.)

*Total Global Water: 1385.98 x 10⁶ Km³
(0.02% of Planet Mass)*

Global Water Volumes

S.#	Item	Area, 10 ⁶ (km ²)	Volume (km ³)	Percent of Total Water	Percent of Fresh Water
1	Oceans	361.3	1 338 000 000	96.5	
2	Ground Water:				
	Fresh	134.8	10 530 000	0.76	30.1
	Saline	134.8	12 870 000	0.93	
3	Soil Moisture	82.0	16 500	0.0012	0.05
4	Polar Ice	16.0	24 023 500	1.7	68.6
5	Other Ice and Snow	0.3	340 600	0.025	1.0
6	Lakes:				
	Fresh	1.2	91 000	0.007	0.26
	Saline	0.8	85 400	0.006	
7	Marshes	2.7	11 470	0.0008	0.03
8	Rivers	148.8	2 120	0.0002	0.006
9	Biological Water	510.0	1 120	0.0001	0.003
10	Atmospheric Water	510.0	12 900	0.001	0.04
	Total Water	510.0	1 385 984 610	100	
	Fresh Water	148.8	35 029 210	2.5	100

Source: Applied Hydrology by Ven Te Chow, 1988

Subject Introduction (cond.)

Applied Hydrology:

*Branch or aspect of hydrology pertinent to planning, design and operation of engineering projects for the **control** and **use** of water.*

(application of hydrology for a particular project)

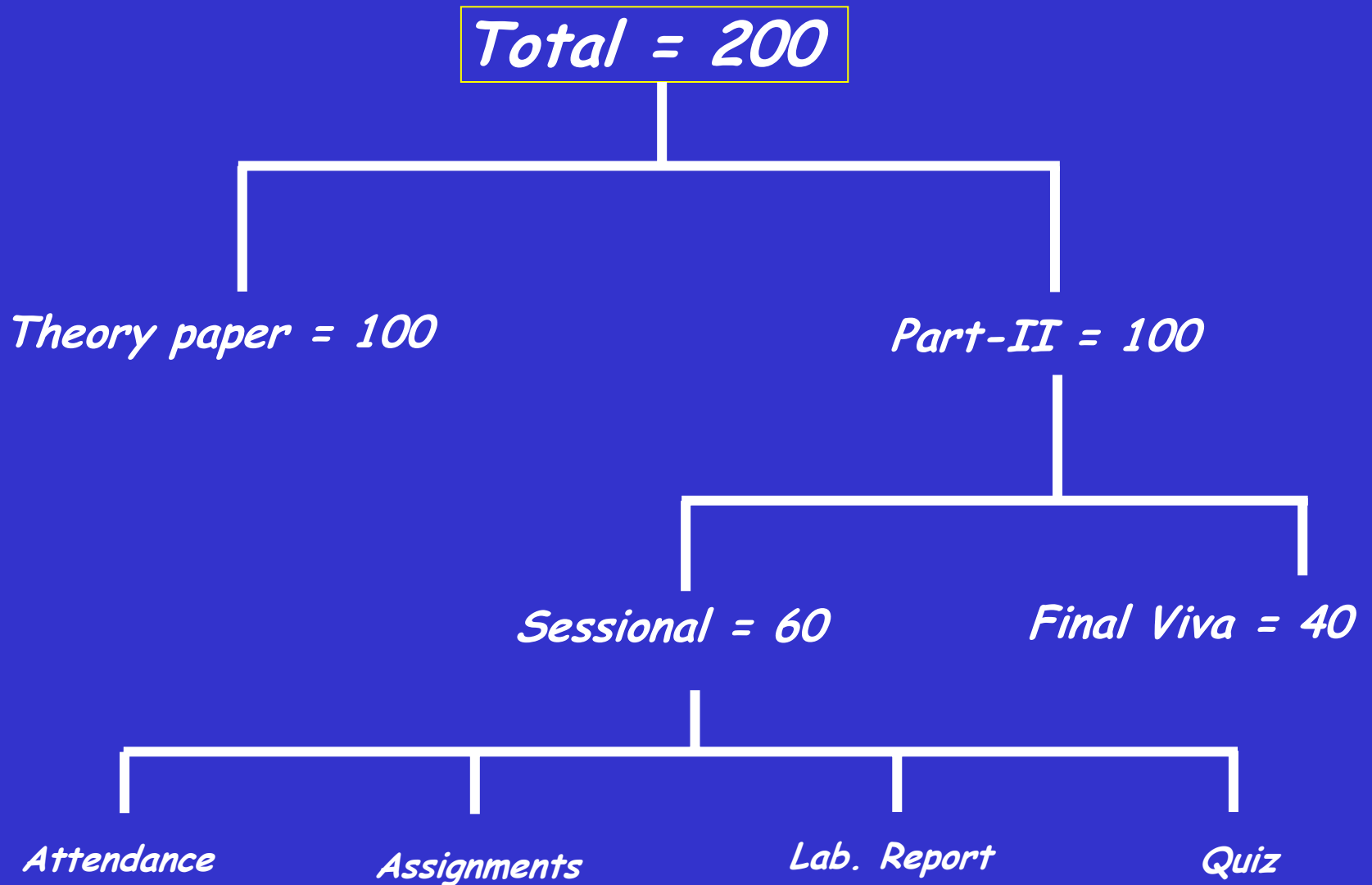
Scope / Significance of Hydrology

- (1) Water, the basic need for the sustenance of human life.
Drinking, agriculture and industry*
- (2) To cope with the extreme hydrological conditions.
Floods & droughts*
- (3) Flow Availability at a site.*
- (4) Input data required for the design of Hydraulic Structures.
Design Flows & Design Floods*
- (5) Food Habits
Rice & Wheat*
- (6) Regional Classification.
Arid, Humid and Semi arid*
- (7) Flood Forecasting*
- (8) Ground Water reserves and its fluctuations etc.*
- (9) Water Resources Planning*
- (10) Impact of Climate Change and land-use change on WRs.*
- (11) To maintain Urban Hydrological Balance.*

Text Books

- (1) Applied Hydrology by Ven Te Chow, David R. Maidment, Larry W. Mays.*
- (2) Hand Book of Hydrology by Maidment.*
- (3) Engineering Hydrology by K. Subramanya.*
- (4) Introduction to Hydrology by Warren Viessman Jr. Gary L. Lewis, John W. Knapp.*

Marks Distribution



Watershed & Catchment

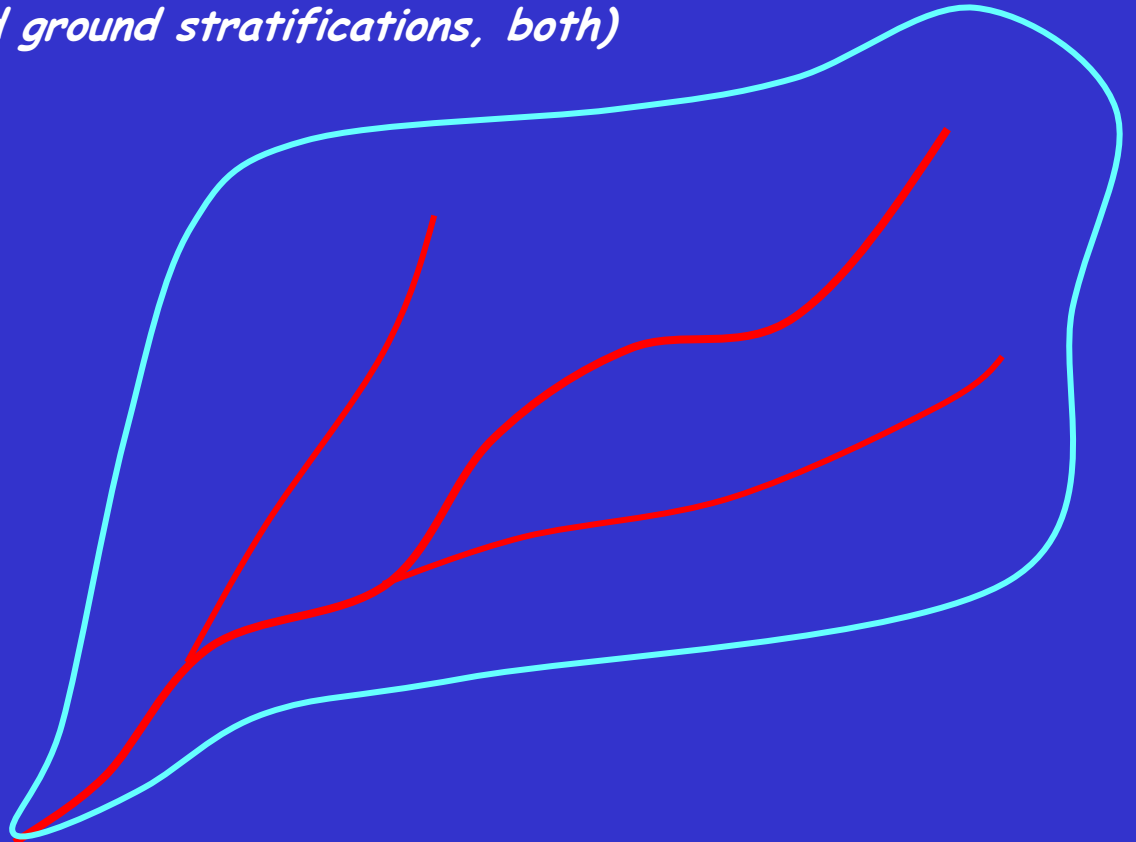
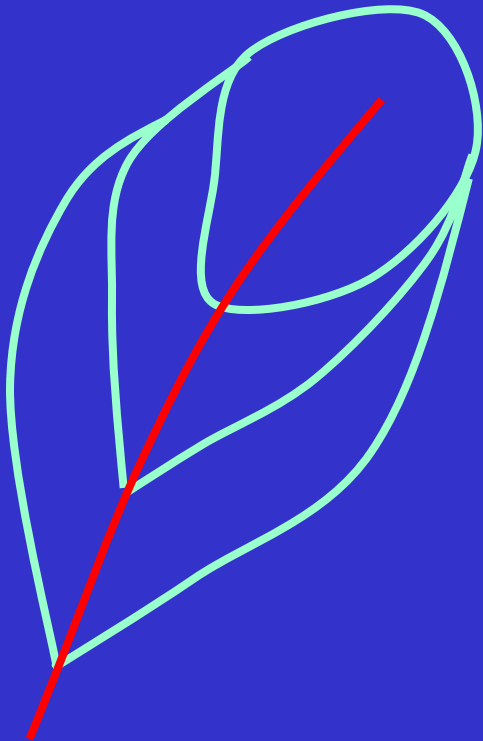
Watershed:

Total area of land draining at a particular section of the stream / river due to surface runoff only. (depends on topography only)

Catchment:

Total area of land draining at a particular section of the stream / river due to surface runoff and sub-surface runoff.

(depends on topography and ground stratifications, both)





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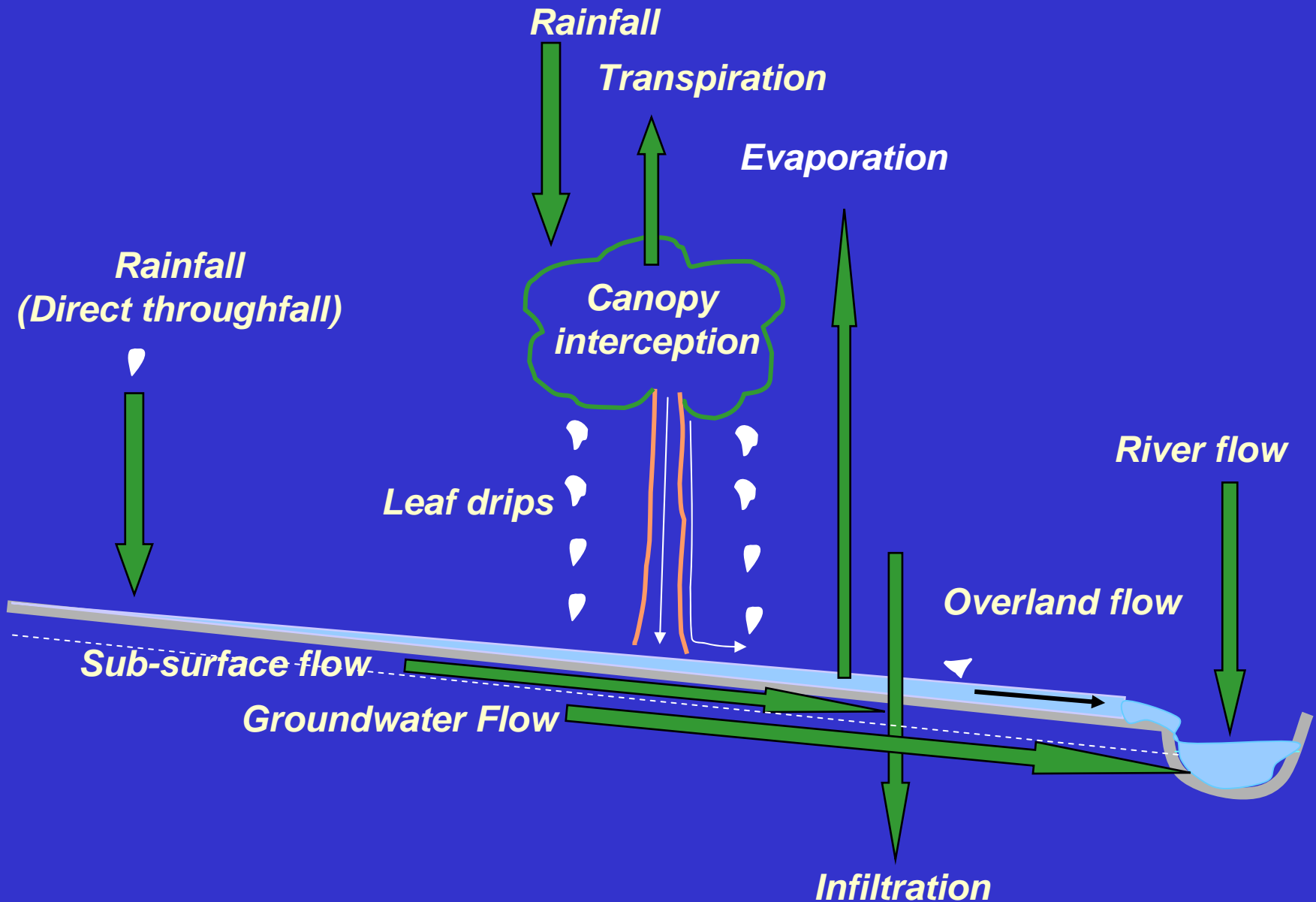
What Is a Watershed?



Hydrological Processes

- (1) Precipitation*
- (2) Canopy Interception*
- (3) Evaporation*
- (4) Infiltration*
- (5) Transpiration*
- (6) Depression Storage*
- (7) Surface Runoff*
- (8) Glacier melting*
- (9) Snow melting*
- (10) Sub-surface Flow*
(Flow in unsaturated zone)
- (11) Ground Water Flow*
(Flow in saturated zone)
- (12) River Flow*

Hydrological Processes



Course Outlines

Lecture No.	Topics	Seminar
1	Introduction, Hydrological Cycle	
2	Global Hydrology (Water & Heat Balance)	
3	Precipitation	
4	-do-	
5	Evapotranspiration	
6	-do-	
7	Canopy Interception, Infiltration	
8	-do-	
9	Experiment on Infiltrometer	

Course Outlines (cond.)

Lecture No.	Topics	Seminar
10	Ground Water Flow	
11	-do-	
12	Hydrological Modelling	
13	Hyd. Modelling, Governing equations	
14	Experiment of Rainfall - Runoff	
15	Introduction to HEC-HMS	
16	Flood Frequency Analysis & PMF	
17	-do-	
18	Practice for HYFA + Quiz	

Hydrological Cycle

- ❑ *No beginning, no end*
- ❑ *Continuous Cycle*
- ❑ *Law of conservation of mass*
- ❑ *For Civil Engineers, most useful is runoff*
- ❑ *Sun is the main source of energy*
- ❑ *Winds are the main source of cloud transportation*
- ❑ *Ocean is the main source of water*

Flow Chart for Hydrological Cycle

