GEOGRAPHY Revision

Climate and weather
MID-LATITUDE CYCLONES

1. Cold and warm fronts
2. Characteristics
3. Stages
4. Weather
Where do mid-latitude cyclones form?
What are warm and cold fronts?

**COLD FRONT**
- Cold air behind cold front

**WARM FRONT**
- Warm air behind warm front
Mid-latitude cyclones: Characteristics

- Cold front
- Warm front
- Warm sector
- Cold sector

Circulation:
- Clockwise wind circulation

Isobars

Diagram sources:
- Downloaded from Stanmorephysics.com
MIDLATTITUDE CYCLONE: DEVELOPMENT

1 INITIAL STAGE

2 DEVELOPMENT STAGE

3 MATURE STAGE

4 OCCLUSION

FAMILY OF CYCLONES
COLD SECTOR

- Temp: sudden decrease
- Air pressure increases
- Wind changes to SW
- Thick cloud cover
- Heavy rainfall

CROSS SECTION & WEATHER CHANGES

- Temp reaches maximum
- Air pressure: at lowest
- Wind direction: N-NW
- Cloud cover decreases
- Rainfall stops

- Temp: sudden rise
- Air pressure drops
- Wind direction: NE
- Cloud cover increases
- Rainfall: steady
Describe the weather changes associated with the passing of a warm/cold front.

COLD FRONT
- Temp drops
- Air pressure increases
- Wind changes from NW to SW
- Cloud cover increases.
- Heavy rainfall

WARM FRONT
- Temp rises to max
- Air pressure drops to minimum.
- Wind changes from NE to N/NW
- Cloud cover decreases.
- Rainfall stops
WEATHER CHANGES: COLD FRONT

- Movement of cyclone
- NW-wind
- High temp
- Few/no clouds
- No precipitation
- Pressure drops

- SW-wind
- Low temp
- High cloud cover
- Precipitation
- Pressure rises

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Mid-latitude cyclones – Synoptic Weather map

- Cold front
- Clockwise rotation
- Circular isobars
- Low pressure
- Warm sector
- Cold sector
- Occlusion
- Warm front
Tropical cyclones

1. Favourable conditions
2. Characteristics
3. Location
4. Weather patterns
5. Development stages
6. How managed
CONDITIONS FOR TROPICAL CYCLONES TO FORM

- Sea temperature at least 26°C
- High humidity
- Coriolis force
- Air pressure below 950hPa
- Divergence in upper air levels
- Light variable winds
- Little surface friction
- Unstable air
Where do tropical cyclones form?

- Hurricanes: May–Nov. (North America)
- Tropical Cyclones: Oct.–May (South Atlantic)
- Typhoons: April–Jan. (Asia)
- Tropical Cyclones: Apr.–Dec. (Philippines)
- Tropical Cyclones: Oct.–May (Australia)
Equator/Ewenaar

From EAST to WEST

Turns EAST at 30°

DESTRUCTION
- Storm winds
- Torrential rain
- Flooding

TROPICAL CYCLONES
CHARACTERISTICS

DISSIPATES
- No Moisture
- No warm air
- Friction

OCCUR
- Tropics
- Ocean
- Further - 5°

EYE
- No wind, rain & Clouds

Away from equator

From EAST to WEST
TROPICAL CYCLONE: DEVELOPMENT

1. FORMATIVE Pressure ABOVE 1000 hPa
2. IMMATURE Pressure BELOW 1000 hPa
3. MATURE Pressure WELL BELOW 1000 hPa
4. DISSIPATION Pressure RISES

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Tropical Cyclones: Weather patterns

**BEFORE EYE (SH)**
- Wind direction: South
- Wind: Hurricane
- Air pressure decreases
- Very heavy rainfall

**IN EYE**
- No wind
- No rain
- No clouds
- Lowest air pressure
- Temp increases

**AFTER EYE (SH)**
- Wind direction: North
- Wind: storm to hurricane
- Air pressure increases
- Heavy rainfall
- Starts to dissipate
SUBTROPICAL ANTICYCLONES AND ASSOCIATED WEATHER

1. Factors influencing climate of SA
2. Line Thunderstorms
3. SA Bergwind
FACTORS THAT INFLUENCE THE CLIMATE OF SOUTH AFRICA

1. **INFLUENCE OF OCEANS**
   - South Atlantic HP
   - South Indian HP
   - Cold Benguela
   - Warm Mozambique
   - Warm Agulhas

2. **SUBTROPICAL ANTICYCLONES**
   - High temp, dry cloudless

3. **THE PLATEAU**
   - Lower temp, dry
   - Escarpment
   - Warm and wet
LINE THUNDERSTORMS

Warm Moist Air

Cold Dry Air

Cape Town

Durban

Warm Mozambique

Cold Benguela

MOISTURE FRONT

H

H
Descending air of Kalahari HP

CLOUDLESS DRY CONDITIONS

INVERSION LAYER BELOW ESCARPMENT

Warm, Moist air blocked

Plateau

Cold (winter)

Indian Ocean
SUMMER

Descending air of Kalahari HP

INVERSION LAYER ABOVE ESCARPMENT

LINE THUNDER-STORMS

Warm, moist air can reach plateau

Plateau

Warm (summer) Rising Hot air

Indian Ocean
SOUTH AFRICAN BERGWIND

High pressure in interior

Anti clockwise circulation

Descending air heated

Danger: Veldfires

Warm dry wind at coast

Low pressure over sea
SOUTH AFRICAN BERGWIND

Subsiding air

Surface winds

Escarpment

Subsides warmer

Warm dry wind

Plateau

Ocean

WINTER

HP

LP
Valley Climates

1. Effect of the slope (aspect)
2. Inversions
3. Frost pockets / Smog
INVERSIONS

Warm air rises

Cold air sinks to the valley bottom

Air on slopes cools

Frost pocket

inversion layer

warm air

pollution trapped

cold air
Katabatic winds and Inversions

Inversion: Temperature increases with altitude.
URBAN CLIMATES

1. Reasons for differences
2. Causes of heat islands
3. Pollution domes
4. Effects of heat islands
Differences between city & rural areas

IN CITY
- Artificial surfaces
- High buildings
- Industries
- Many cars

POLLUTION DOME
Mass of polluted air trapped by inversion layer and prevented to rise.

Warm city
Cooler rural area
CAUSES OF URBAN HEAT ISLANDS

Central heating from shops and offices in the CBD can warm the air in the streets.

Warm air from the CBD can rise leading to convection thunderstorms and the release of latent heat.

Dark brick buildings, concrete and tarmac store heat, which is released at night.

Gutters and drains remove rain quickly so less heat is used to evaporate water.

High-rise buildings reduce wind speed at the surface – warm air can build up.

Rivers can provide cool areas as heat is absorbed and used in evaporation.

Cool air comes in from sea.

Industry and offices release large quantities of heat, especially if buildings are poorly insulated.

Large park with grass, trees and bushes, use up heat (evaporation).

Concentrations of people in cities add to heat. Steaming pedestrians.

Traffic pollution creates a dust zone. Adds heat as well as CO₂, SO₂ and diesel particulates.

Suburbs increase urban sprawl, but low density land use, so more limited impact.
EFFECTS OF URBAN HEAT ISLANDS

- Human discomfort
- Heat stroke-deaths
- Reduced visibility (smog)
- Increased energy use
- Air conditioners

- Increase in air pollution
- Increase in greenhouse gasses
- Respiratory discomfort. Asthma
- Increased precipitation
- Reduced insolation (pollution)
Synoptic Weather maps

1. Station Models
2. Features on SA weather maps
3. Satellite images
FEATURES ON A SOUTH AFRICAN SYNOPTIC WEATHER MAP

Isobar
Clockwise movement around LP
Tropical cyclone
Isobar interval 4hPa

Coastal low
HP air descends anti-clockwise
LP air rises clockwise
South Atlantic HP
Cold front
Weather at PE
South Indian HP
HOW TO INTERPRET A SATELLITE IMAGE

LOW PRESSURE CELL
Pivot point of cold front

CLEAR SKIES
Black/grey area

SOLID CLOUD COVER
Grey/white area

COLD FRONT
Curved band of clouds

Via Afrika