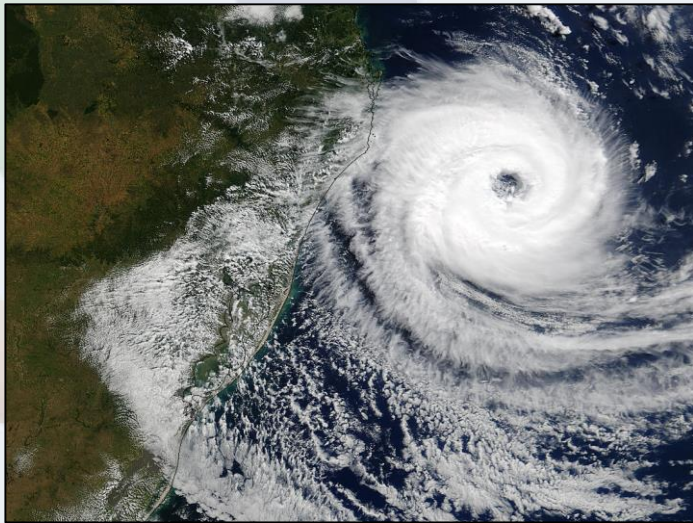


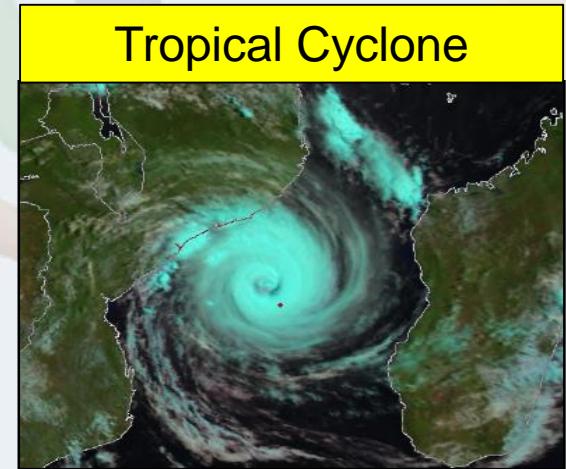
Autumn: Tropical versus Extra-Tropical Cyclones



Jannie Stander
RTC

Objectives of this presentation

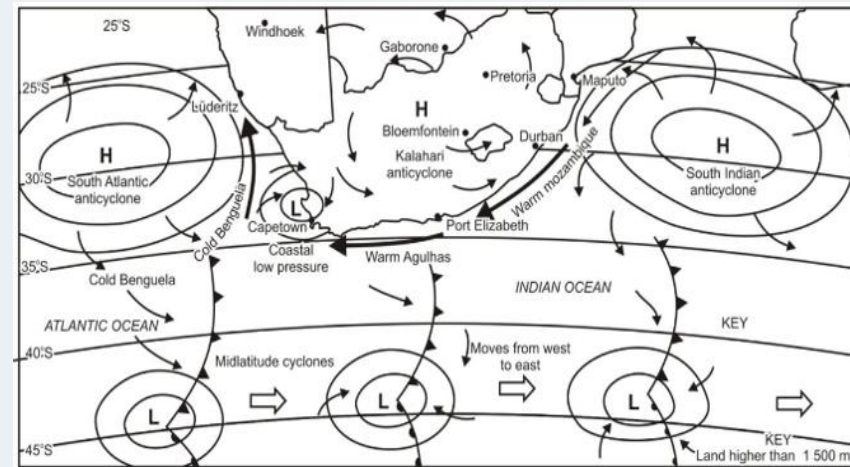
- Autumn
- Where do Tropical and Extra- Tropical Cyclones occur
- Tropical Cyclone structure
- Autumn Tropical Cyclone: Kenneth- 25 April 2019
- Cold front structure
- Characteristic weather changes with the passage of a cold front
- Autumn Cold Front case/s: 12 to 15 April 2019 and 25 May 2020
- Noticeable differences between Tropical Cyclones and Extra-Tropical Cyclones



Autumn

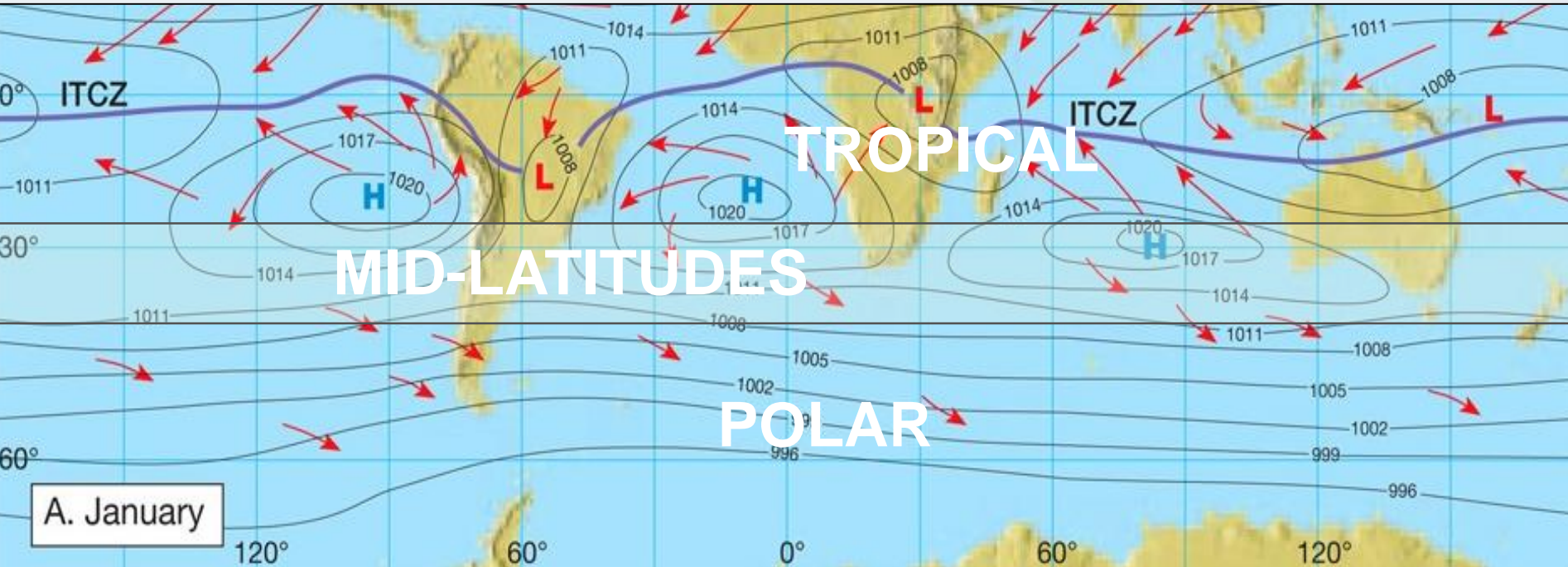
- The brief for this presentation is to look at autumn related weather systems
- March, April and May is defined as the Autumn season.
- In March and April the oceans tend to loose their heat less rapidly than the land making conditions still favourable for the formation of Tropical cyclones in the Mozambique Channel.
- Officially the **Southwest Indian Ocean Cyclone** season ends 30 April although 80% occur before end of March. Recent examples are TC **Idai March 2019** and **Kenneth April 2019**.
- In March to May colder air starts affecting the SW Cape and southern coastal belt of the country with the invasion of cold fronts which become stronger in the month of May in terms of their intensity and northward progression across the country.

March	April	May
Tropical Cyclones	Tropical Cyclones	Strong cold Fronts
Cold Fronts	Cold Fronts	



**South African
Weather Service**

Where do Tropical and Extra-Tropical Cyclones develop?



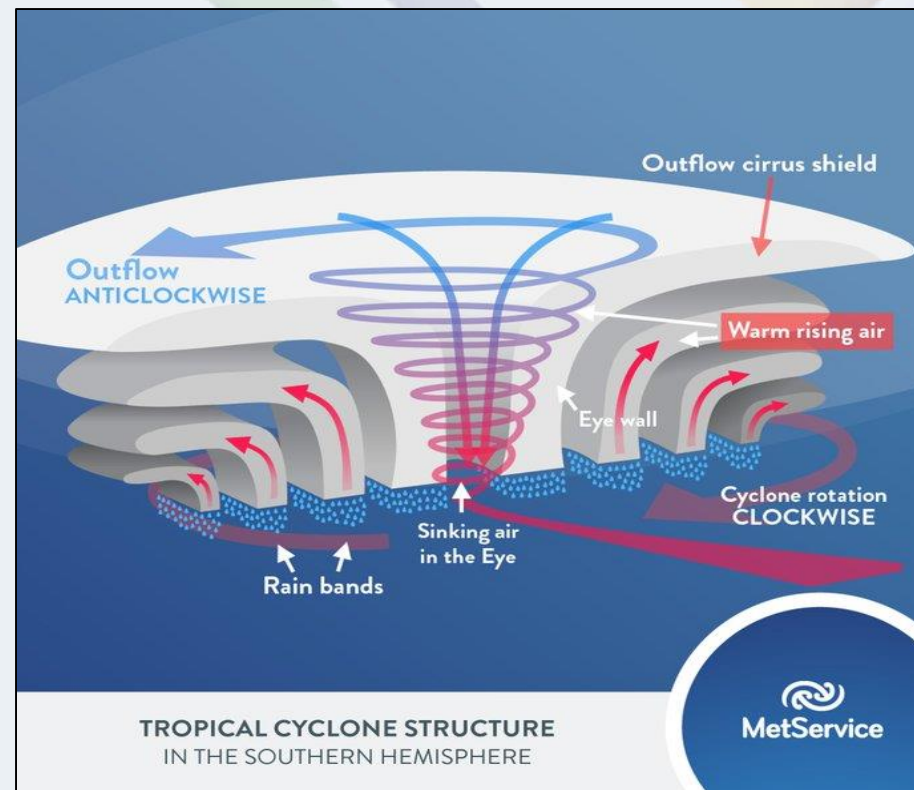
Tropical Cyclone Structure

Favourable conditions for their development

- tropical atmosphere needs a pre-existing disturbance with sufficient rotation (vorticity) and inflow (convergence) such as thunderstorm
- SST > 26,5°C
- An unstable atmosphere
- A moist mid-troposphere
- At least 500 km away from the equator (Coriolis force important)
- Substantial amount of large-scale spin available (either through the monsoon trough or easterly waves)

Structural Elements:

- Boundary layer inflow
- Eyewall- organized band of thundershowers and strongest winds
- Cirrus shield
- Rain bands
- Upper tropospheric outflow
- Clear central eye- subsidence
- In a TC, the wind flows inward cyclonically at lower levels, spiraling upwards in the zone of deep convection, spiraling outwards aloft, just below the tropopause



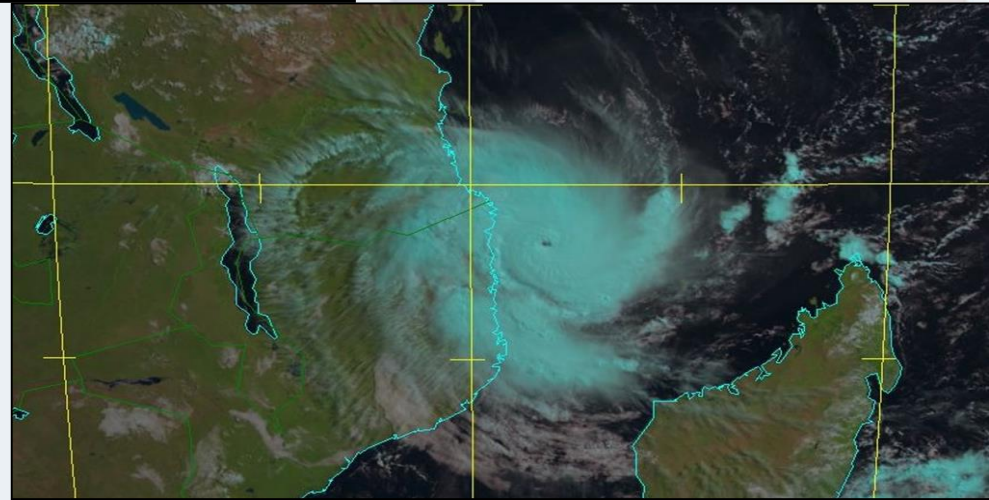
Tropical cyclone structure

**South African
Weather Service**

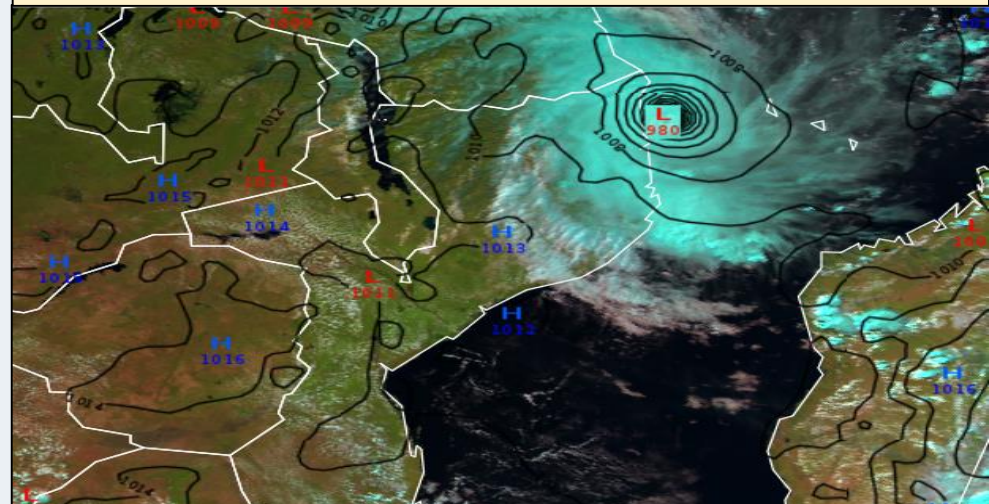
Autumn: Tropical Cyclone Kenneth

25 April 2019

- Tropical Cyclone is an intense circular storm that originates over warm tropical oceans and is characterized by low atmospheric pressure, high wind, storm surge and heavy rain.
- It draws energy from the sea surface and maintains its strength as long as it remains over warm water.
- Kenneth made landfall on the northern province of Cabo Delgado on Thursday evening, with wind speeds of 220km/h (140mph) - equivalent to a category four hurricane.
- Winds eased on Friday, but France's meteorological agency said up to 800mm of rain was expected - nearly double the 10-day accumulated rainfall that flooded the port city of Beira during Cyclone Idai.

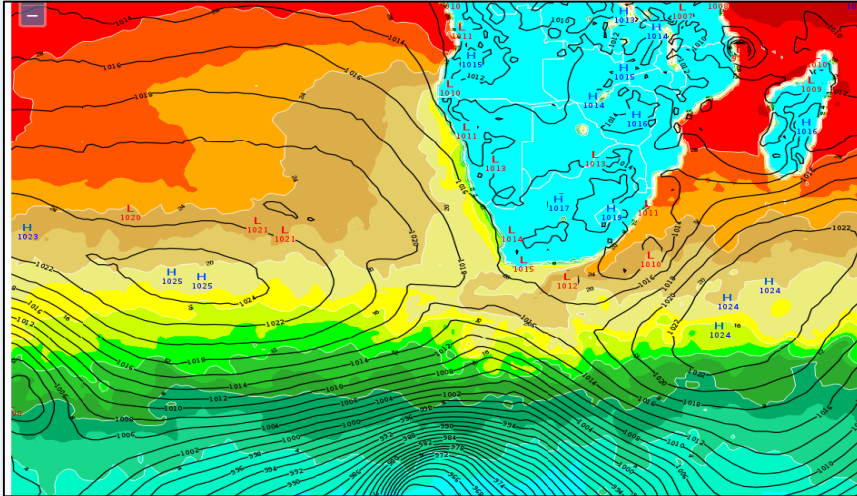


Tropical cyclone Eye visible

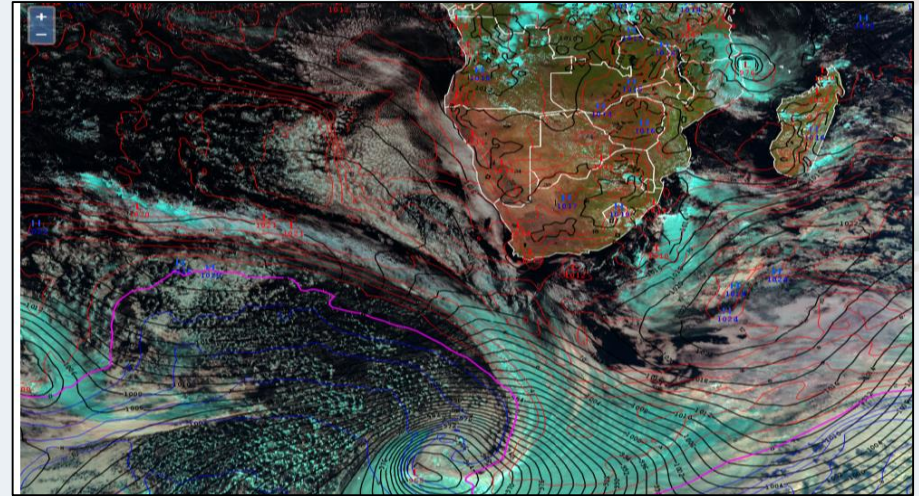


MSLP of below 980 hPa

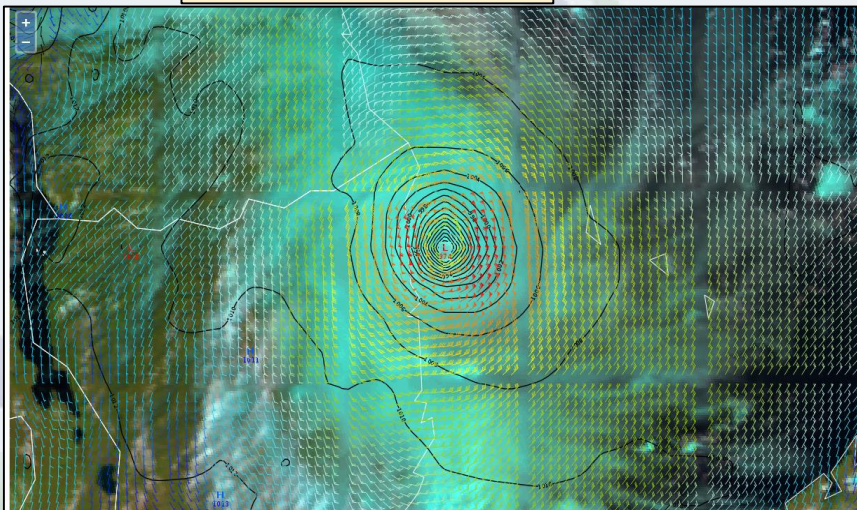
Autumn: Tropical Cyclone Kenneth 25 April 2019 12Z



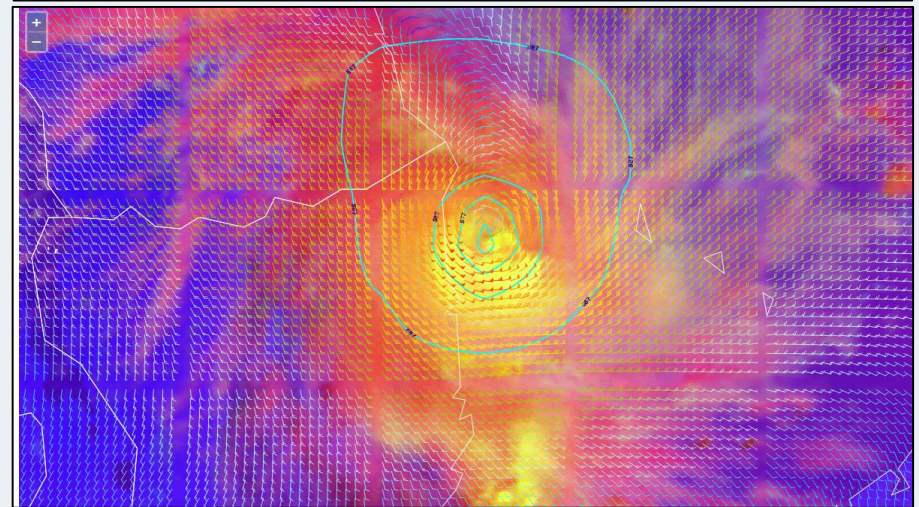
SST and MSLP



Temp@850 hPa, MSLP and DNC

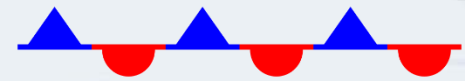


Winds@850 hPa, MSLP and DNC RGB

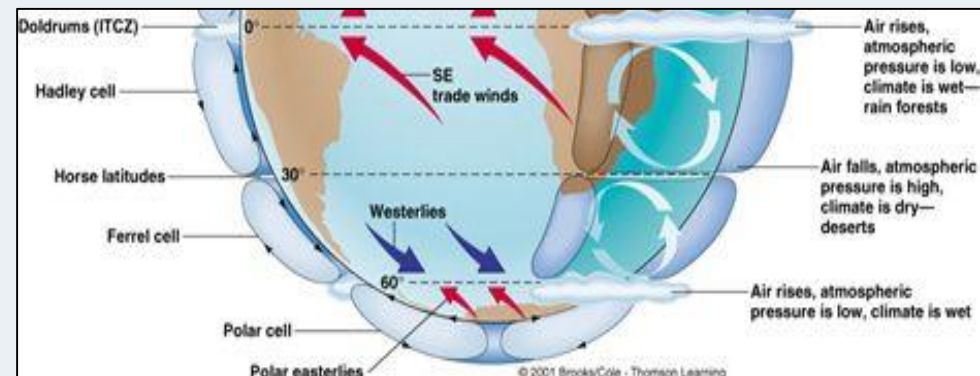
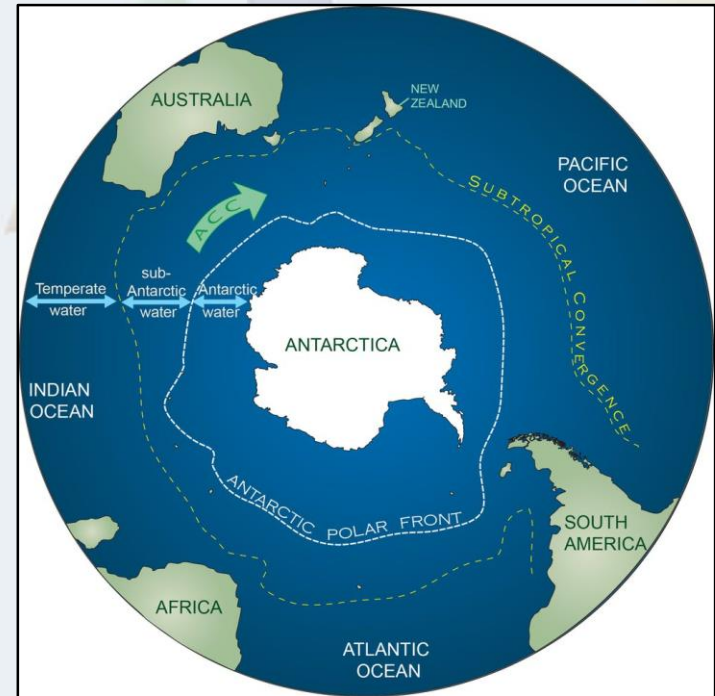


Winds@300 hPa, GPM@300 hPa and WW

Cold fronts



- Cold front - a front in which cold air is replacing warm air at the surface
- Main temperature gradient in the mid-latitudes is concentrated in the “polar front” which separates warmer mid-latitude air mass from cold polar air mass
- Cyclone families/Extra-Tropical Cyclones/mid latitude Cyclones form and intensify along this temperature contrast throughout the year but effect South Africa in autumn, winter and spring
- The Cyclone centers usually situated well to the south of Gough and Marion Island – South Africa affected by the cold front troughs
- A cold front is attached to an Extra-Tropical Cyclone and is a mass of cold air advancing towards warm air.
- Associated with low pressure centers (low pressure troughs):

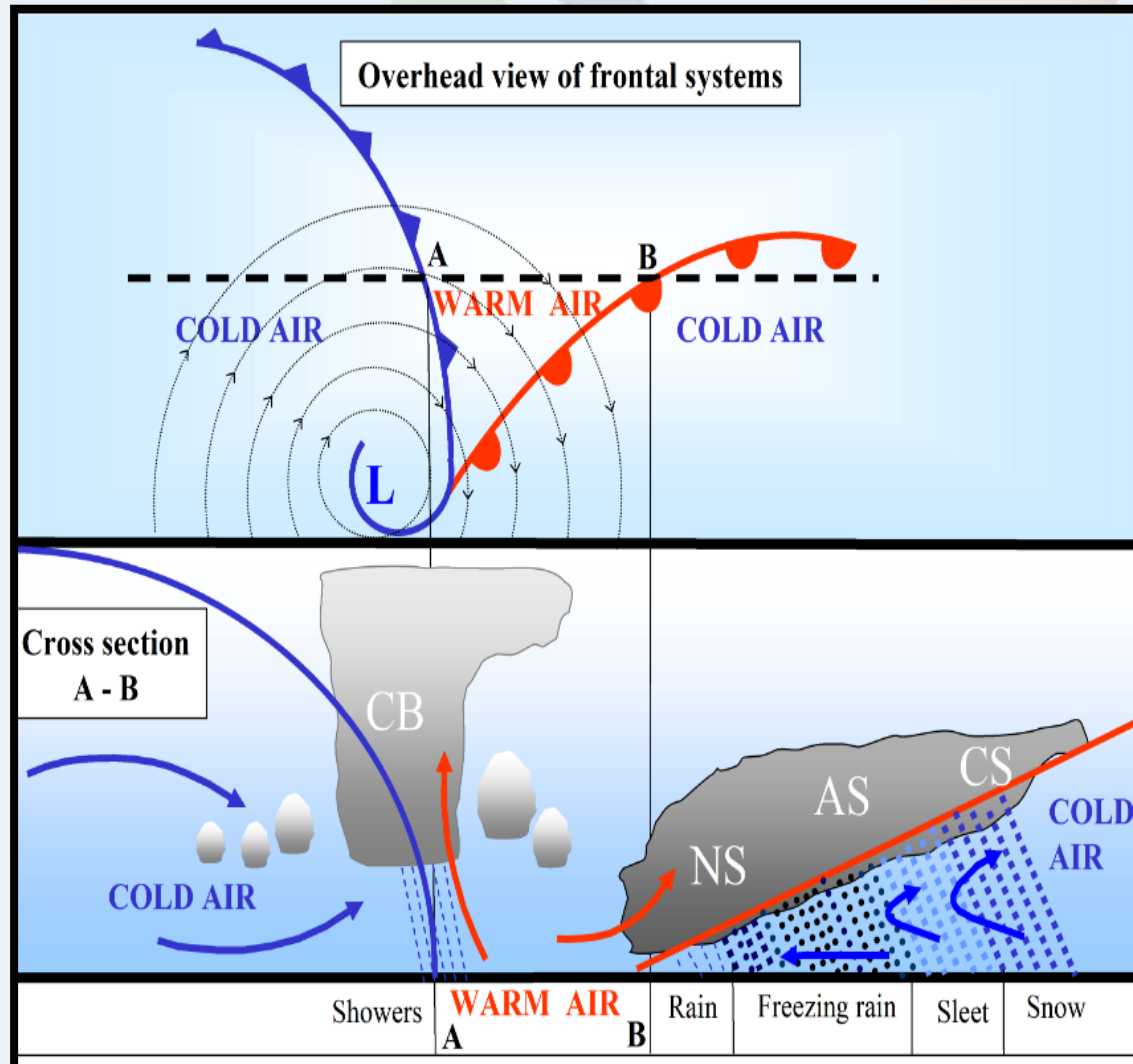


Characteristic weather changes with the passage of a cold front

Surface variables	Pre frontal	Post frontal
Wind direction	NW	SW
Pressure tendency	falling	rising
Temperature	warm	cold
Dew point	dry	moist
Equivalent Potential temperature (Θ_e)	high	low
Cloud	clear becoming stratiform	convective

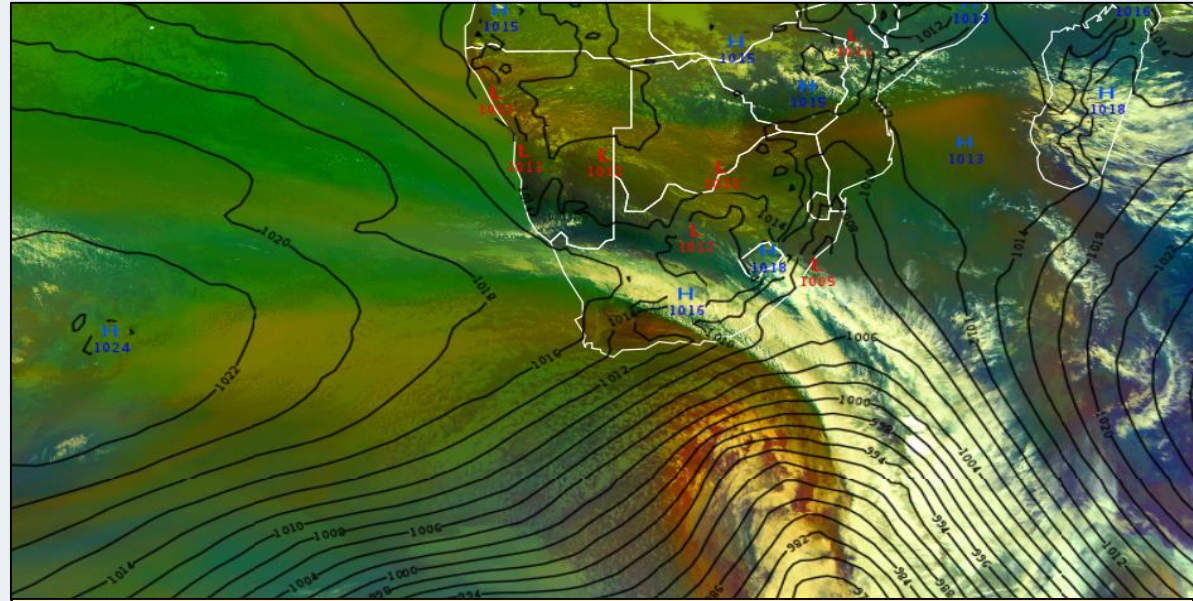
Cold front: Structure

- The location of the front is not always very obvious! Even meteorologists sometimes disagree...
- The pressure is minimum as the front passes (first decreases as the front approaches and then increases behind the front)
- Typically associated with heavy precipitation, rain or snow, combined with rapid temperature drops.



Autumn Cold Front: 12-15 April 2020

- Normally in April around Easter we expect the first snowfall producing cold front over South Africa
- The period, 12 to 15 April saw a cold front affect us – SAWS media release was sent out
- Cold temps
- Strong winds
- Heavy rain
- Rough seas



12 April 2020 at 12UTC – AIRMASS RGB and MSLP

Sani Mountain Lodge, Sani Top, Sani Pass

(c) www.snowreport.co.za

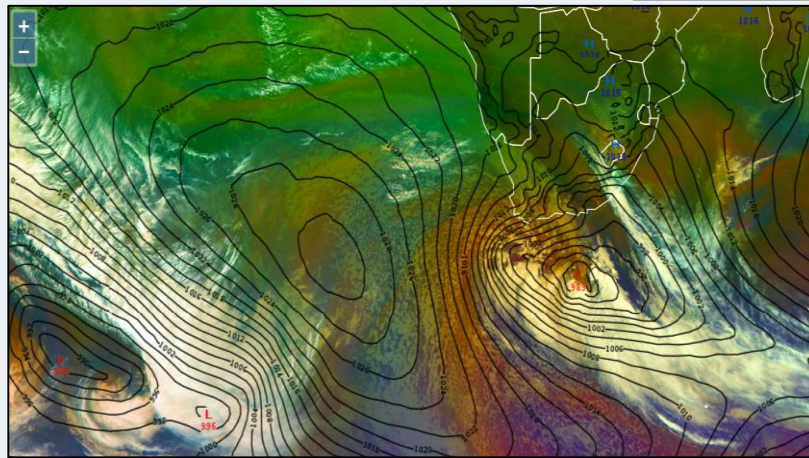


Battery 059% 11.6

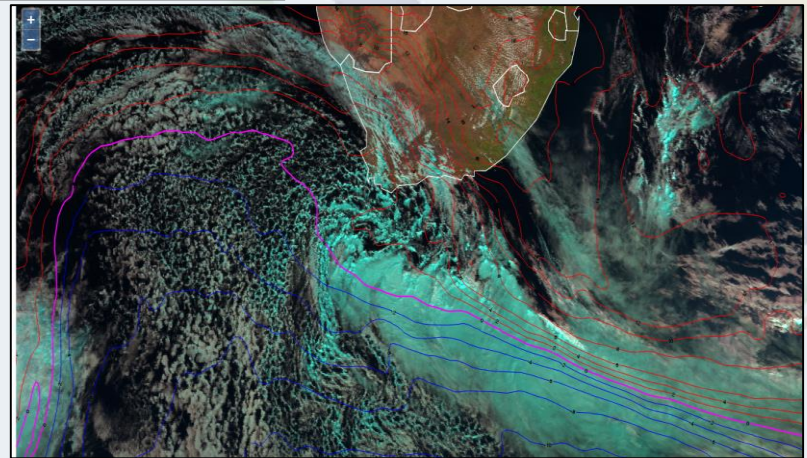
2020/04/15 07:01:35

Sani-pass - Snowfall

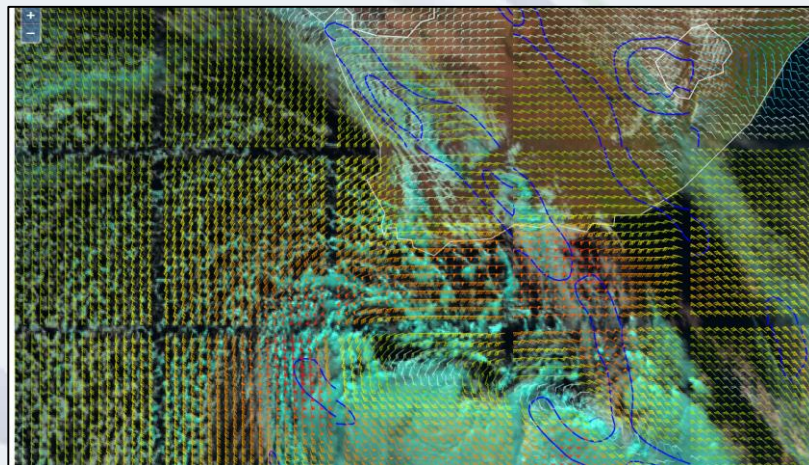
Late Autumn strong cold front 25 May 2020



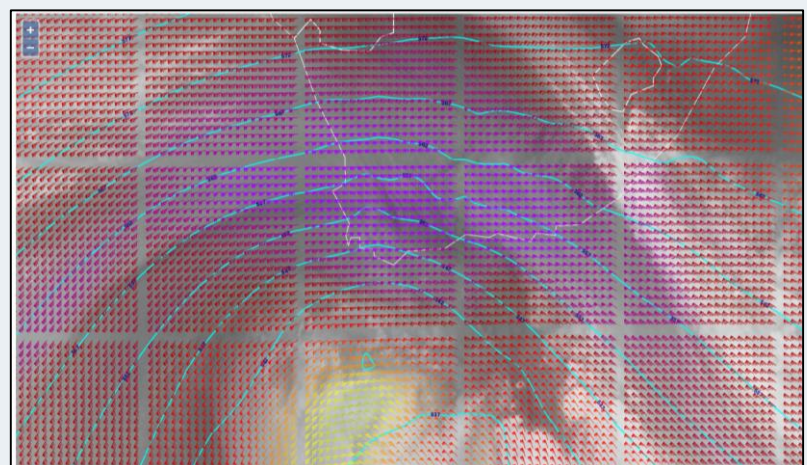
MSLP+Airmass RGB



TEMP 850+DNC RGB



Frontal parameter, wind 850 and
DNC RGB



Wind 300 hPa, GPM 300 hPa and
WV

In Summary: Noticeable differences between Extra-Tropical and Tropical Cyclones

- Although Tropical Cyclones and Extra- Tropical Cyclones can occur in a similar season they are inherently different

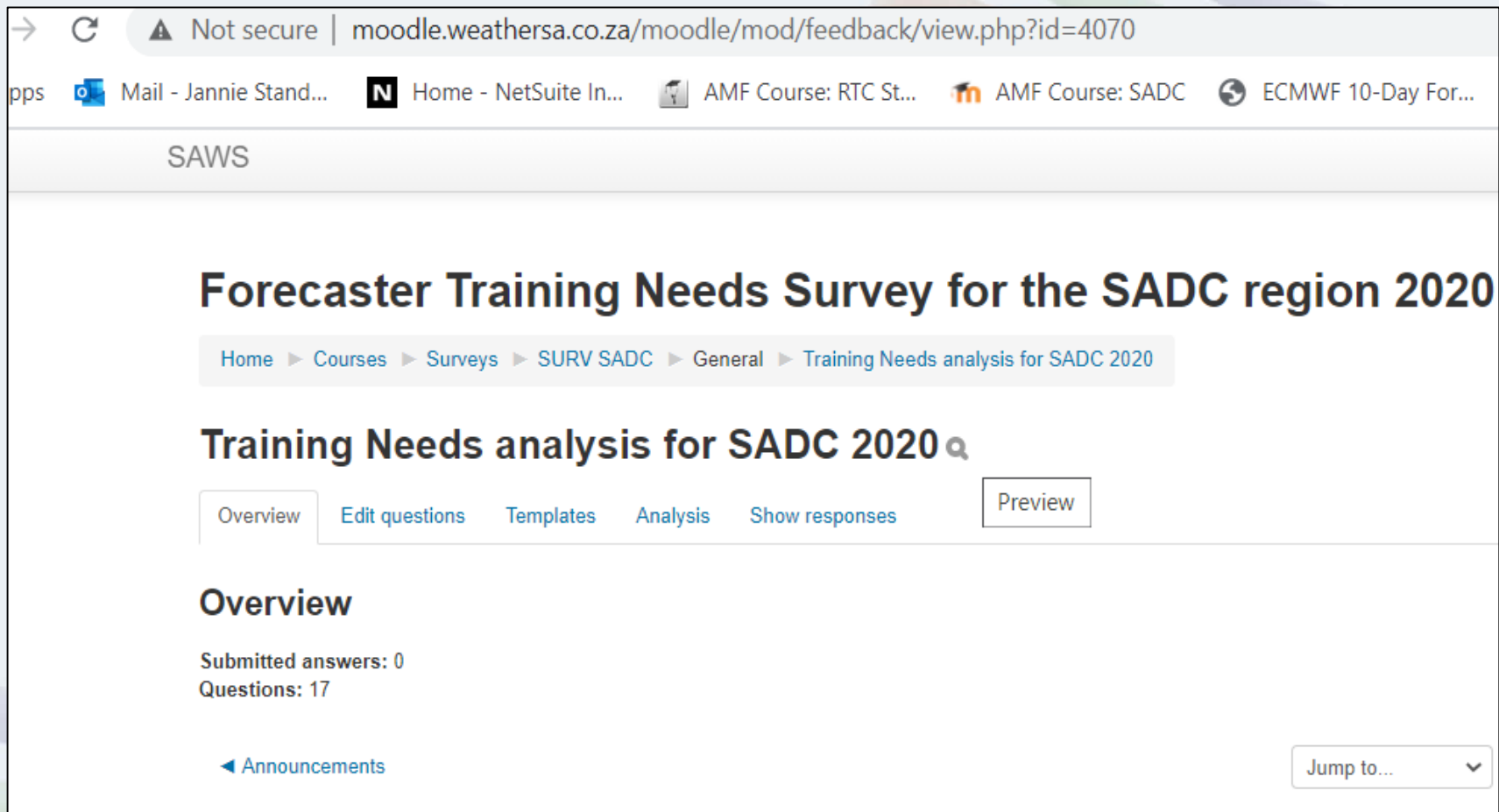
<u>Extra Tropical Cyclone</u>	<u>Tropical Cyclone</u>
In the NH Extra - Tropical Cyclones also have names but they are not named over the SH.	Tropical Cyclones have names once they develop.
SST is not a requirement for the development of an Extra - Tropical Cyclone although a gradient of SST can assist.	For Tropical Cyclones SST of at least 26°C (through a depth of at least 50m) is needed for their development.
Strong vertical wind shear	Very little vertical wind shear
Move from west to east and form in the westerly wind belt – westerly waves	Move from east to west and form in the easterly wind belt – easterly waves
Extra - Tropical Cyclones affects a much larger area	A Tropical Cyclones has an effect on a comparatively smaller area
The velocity of air is comparatively lower	The velocity of wind in a tropical Cyclone is much higher and it is more damaging.
They can be formed on both land and sea	Tropical Cyclone forms only on seas with temperature more than 26 – 27 °C and dissipate on reaching the land.

Noticeable differences between Extra-Tropical and Tropical Cyclones

<u>Extra - Tropical Cyclone</u>	<u>Tropical Cyclone</u>
Extra-Tropical Cyclone can last for a duration of 15 to 20 days	A Tropical Cyclones doesn't last for more than 7 days
Size: > 1000 km	Size: 100's of km
Wind max well removed from center	Wind max close to Cyclone center
Wind max in upper troposphere	Wind max in lower troposphere
Baroclinic (cold) vortex	Warm core vortex
Precipitation right of track	Symmetry of precipitation
Driven by baroclinic instability	Driven by latent heat release
An Extra -Tropical Cyclone is a low pressure system that primarily gets its energy from the horizontal temperature gradient. Extra-Tropical Cyclones have frontal features, i.e. they are associated with cold fronts, warm fronts, and occluded fronts.	Their energy are derived from the release of heat due to cloud/rain formation from the warm moist air of the tropics. Vertical processes.
Structurally, Extra-Tropical Cyclone are "cold-core". "Cold-core" means that the center is colder than the surroundings at the same height in the troposphere.	Structurally, Tropical Cyclones are "warm-core" have little or no significant temperature differences across the storm.

Training needs Survey for SADC

- <http://moodle.weathersa.co.za/moodle/mod/feedback/view.php?id=4070>



The screenshot shows a web browser window displaying a Moodle course page. The address bar shows the URL: moodle.weathersa.co.za/moodle/mod/feedback/view.php?id=4070. The page title is "SAWS". The main heading is "Forecaster Training Needs Survey for the SADC region 2020". Below the heading is a breadcrumb trail: Home > Courses > Surveys > SURV SADC > General > Training Needs analysis for SADC 2020. The page content includes a search bar with the text "Training Needs analysis for SADC 2020" and a magnifying glass icon. Below the search bar are several tabs: "Overview", "Edit questions", "Templates", "Analysis", "Show responses", and "Preview". The "Overview" tab is selected. Under the "Overview" tab, it shows "Submitted answers: 0" and "Questions: 17". At the bottom left, there is a link for "Announcements" with a left-pointing arrow. At the bottom right, there is a "Jump to..." dropdown menu.

Training needs Surveys for SAWS

Marine

- <http://moodle.weathersa.co.za/moodle/mod/feedback/view.php?id=5147>

Aviation

- <http://moodle.weathersa.co.za/moodle/mod/feedback/view.php?id=5117>

PWS

- <http://moodle.weathersa.co.za/moodle/mod/feedback/view.php?id=3972>

The End

