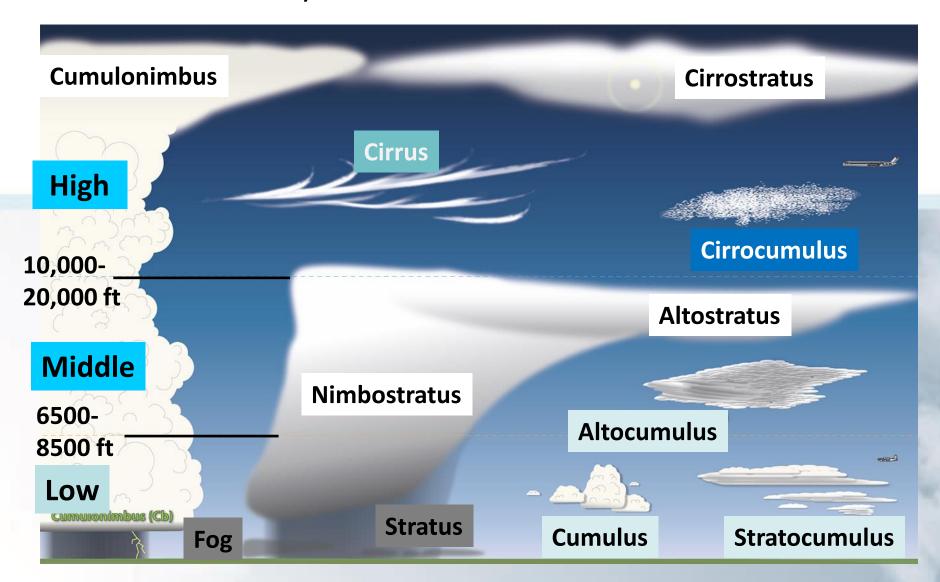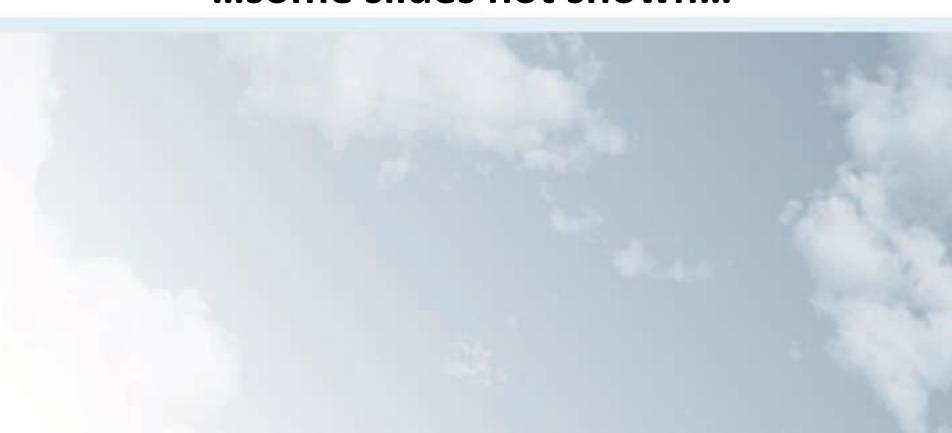# Australian VLab Centre of Excellence Regional Focus Group meeting
30th January 2020

Cloud identification from satellite imagery

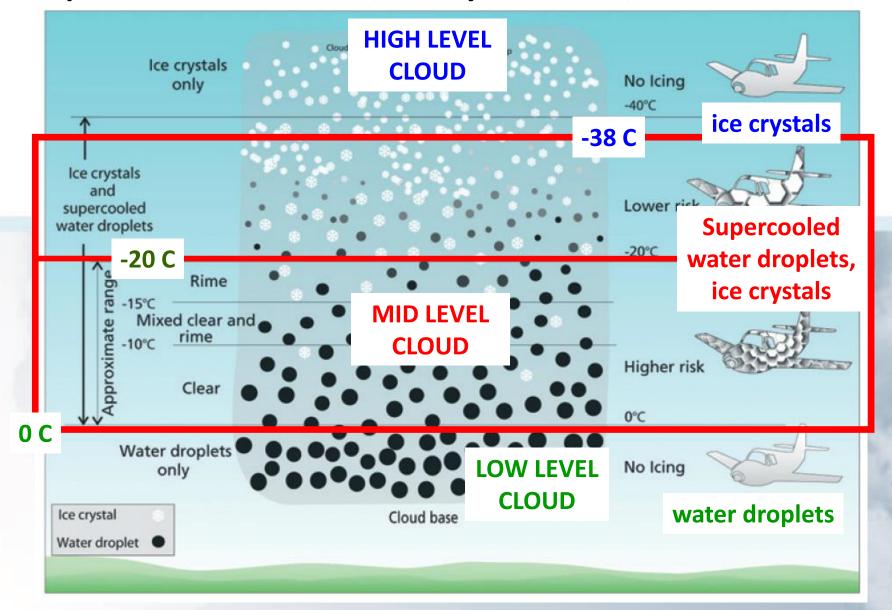**Bodo Zeschke Australian VLab Centre of Excellence Point of Contact**

…some slides not shown…

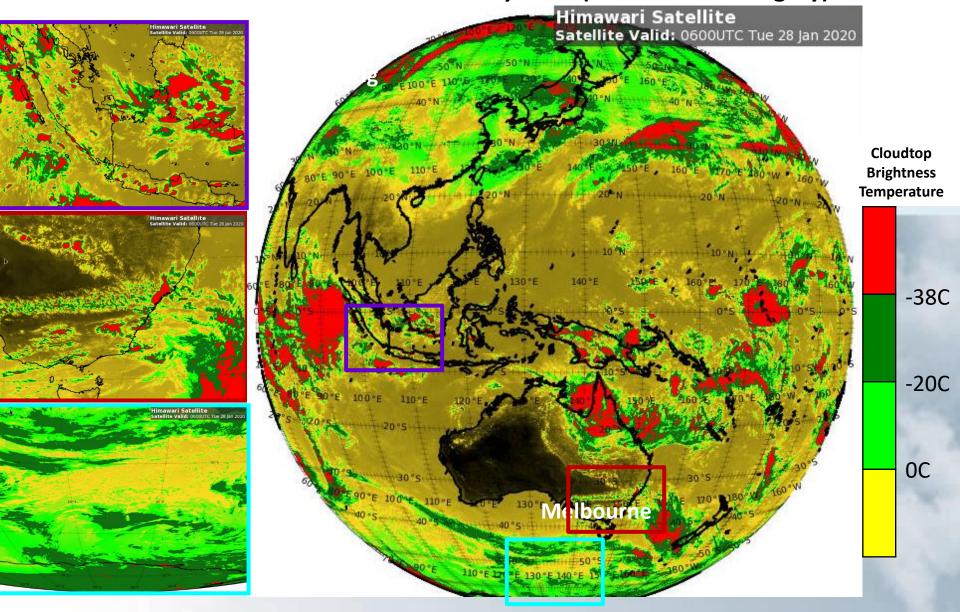# A scheme of classifying clouds according to their usual altitudes.
Question: can you see a limitation in this classification ?

image from NOAA

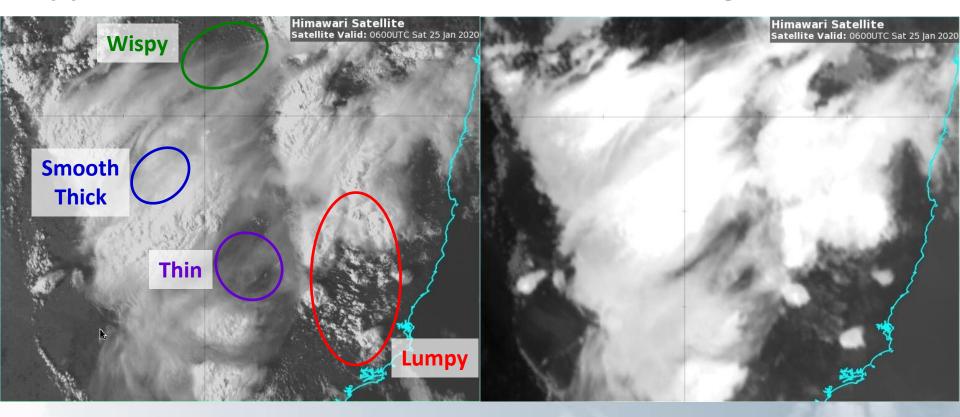# A scheme of classifying clouds according to their particulate composition: water clouds, ice-crystal clouds, and mixed clouds.

HIGH LEVEL CLOUD

Ice crystals only

Cloud

No Icing

-40°C

-38 C

ice crystals

Ice crystals and supercooled water droplets

Lower risk

-20°C

Supercooled water droplets, ice crystals

-20 C

Rime

-15°C

Mixed clear and rime

-10°C

MID LEVEL CLOUD

Clear

Higher risk

Approximate range

0°C

0 C

Water droplets only

LOW LEVEL CLOUD

No Icing

Cloud base

water droplets

Ice crystal

Water droplet

Diagram from the Bureau of Meteorology Aviation Forecaster Handbook

Classification of cloud according to important temperature thresholds 06UTC 28th January 2020 (enhanced IR imagery)

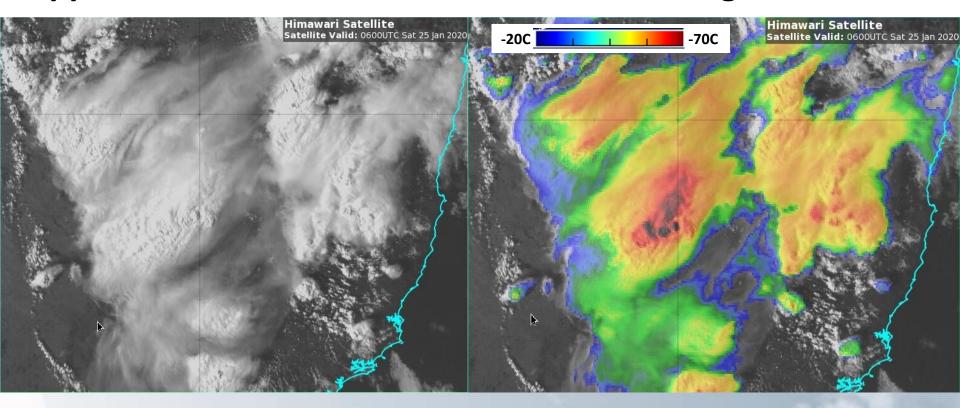# Appearances of cloud in the visible, low vs high level cloud

Visible (0.64 micron) image
Variations in albedo permit easy discrimination between lumpy and smooth cloud, thick and thin cloud. Wispy ice cloud is also revealed.

Infrared (10.4 micron) image
Variations in brightness temperature permits discrimination between low and higher level cloud. However the details of the stormtops is not so good

images courtesy JMA/BOM

Appearances of cloud in the visible, low vs high level cloud

Visible (0.64 micron) image
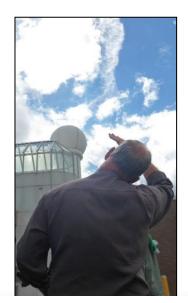Note how the variations in albedo permit easy discrimination between lumpy and smooth cloud

Sandwich product
Note how the variation in brightness temperature in this product permits very good discrimination of stormtop features.

images courtesy JMA/BOM

Identification of main cloud groups from satellite data and surface observations

Looking down on the clouds 0.5 / 2km image resolution

Looking up at the clouds

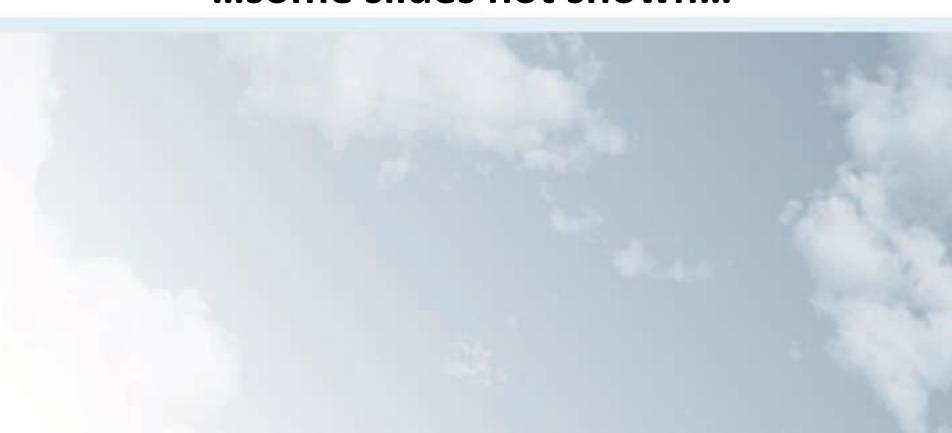image courtesy rammb.cira.colostate.edu Satellite Meteorology

Cloud types that can be identified from meteorological satellite and their symbol

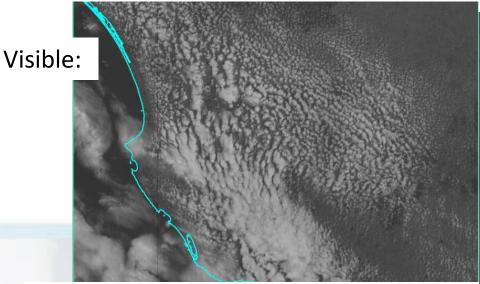| Cloud type identified	Symbols used
High level cloud	Ci *
Middle level cloud	Cm
Stratocumulus	Sc
Stratus/fog	St
Cumulus	Cu
Cumulus congestus	Cg
Cumulonimbus	Cb

*"Cirriform may be the best term to collectively describe high level ice cloud" (P.Toomey BMTC)

Cloud forms observed from ground and their symbol

Level	Cloud forms observed from ground	Symbol
High	Cirrus	Ci
High	Cirrocumulus	Cc
High	Cirrostratus	Cs
Middle	Altocumulus	Ac
Middle	Altostratus	As
Middle	Nimbostratus	Ns
Low	Stratocumulus	Sc
Low	Stratus	St
Low	Cumulus	Cu
Low	Cumulonimbus	Cb

…some slides not shown…

images courtesy JMA/BOM

Cumulus: small individual elements, irregularly shaped
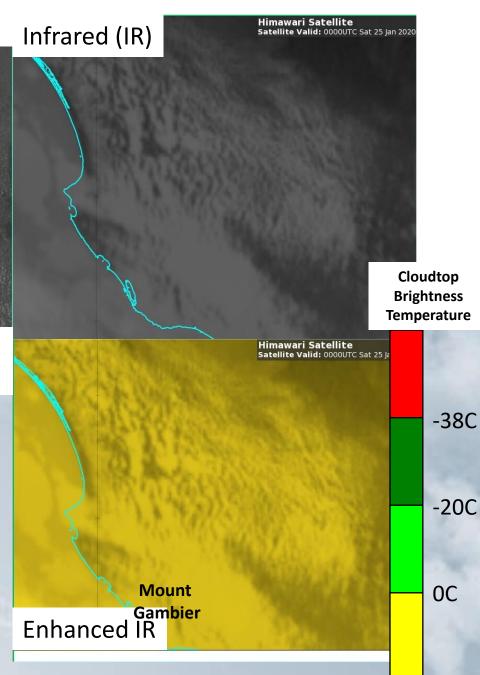
Infrared (IR)

Visible:

Stratocumulus: Globular or cellular pattern. Edge of clouds often touch each other
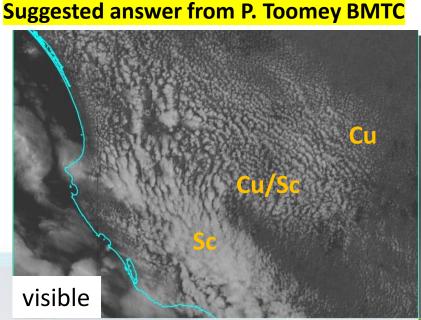
Low level clouds.

Cumulus and stratocumulus

(SA and VIC 00UTC 25th Jan 2020)

Question: highlight where the Cumulus is located "**C**"
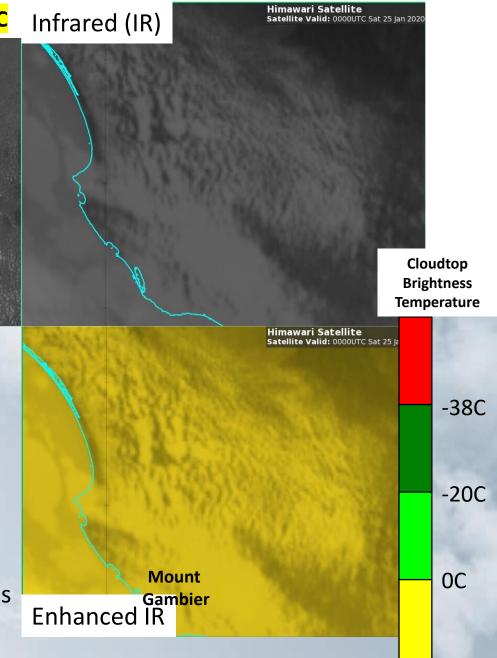
Question: highlight where the Stratocumulus is located "**S**"

Mount Gambier

Enhanced IR

Himawari Satellite
Satellite Valid: 0000UTC Sat 25 Jan 2020

Himawari Satellite
Satellite Valid: 0000UTC Sat 25 Ja

Cloudtop Brightness Temperature

-38C

-20C

0C

Suggested answer from P. Toomey BMTC

Infrared (IR)

Himawari Satellite
Satellite Valid: 0000UTC Sat 25 Jan 2020

Cu

Cu/Sc

Sc

visible

Cloudtop Brightness Temperature

Himawari Satellite
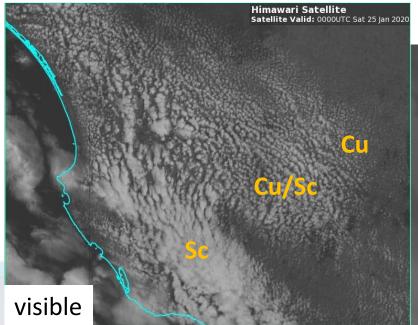Satellite Valid: 0000UTC Sat 25 Ja

Low level clouds.
Cumulus and stratocumulus
(SA and VIC 00UTC 25th Jan 2020)

- Specked cumulus grading into "marbled" stratocumulus, esp. in visible imagery

- Mount Gambier station observations as BKN025 BKN030 VIS:9999
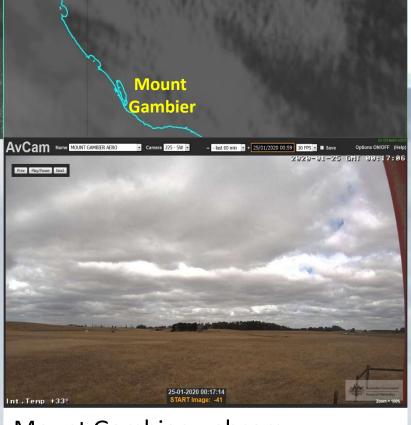
Mount Gambier

Enhanced IR

-38C

-20C

0C

Low level clouds.
Cumulus and stratocumulus
(SA and VIC 00UTC 25th Jan 2020)

- Can use webcam to give additional information

- However, satellite observations are not always compatible with surface observations.
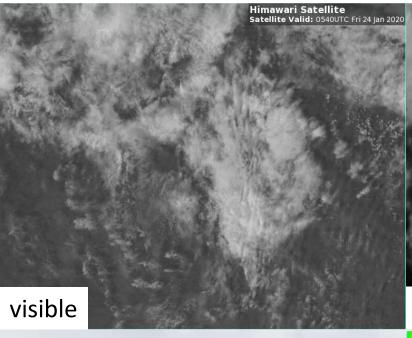
Mount Gambier webcam (stratocumulus)

visible

Infrared (IR)

Halls Creek

Enhanced IR

Cloudtop Brightness Temperature

-38C

-20C

0C

Mid Level Cloud
(WA 0540UTC 24th Jan 2020)

- Variations in albedo in the visible imagery due to mixed water / ice phase and variations in the size of the condensate particles

- Medium grey in infrared image.

images courtesy JMA/BOM

Himawari Satellite
Satellite Valid: 0540UTC Fri 24 Jan 2020
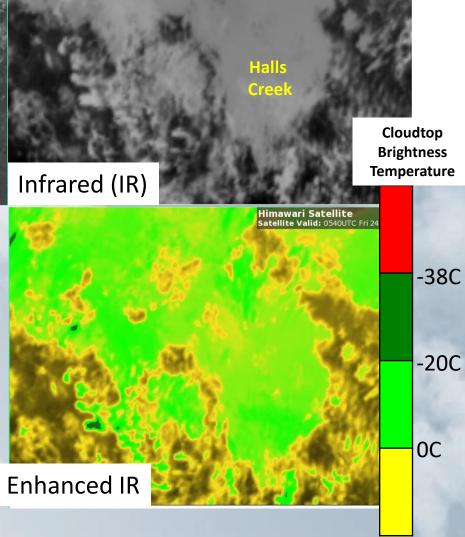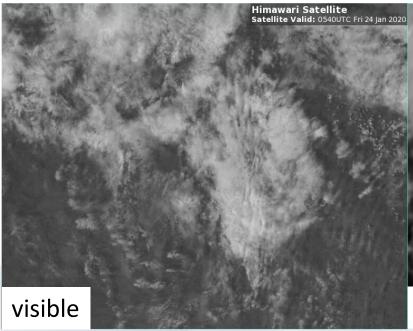
Himawari Satellite
Satellite Valid: 0540UTC Fri 24 Jan 2020

X

IR spectra **-5.81 C**
[IR]

Halls Creek

visible

Infrared (IR)

Mid Level Cloud
(WA 0540UTC 24th Jan 2020)

- Comparison with station or NWP model sounding is useful.

- Note that if the mid level cloud is very thick and if the RADAR shows precipitation then this is likely to be nimbostratus

550-700hPa

0C

Zoom to low area
Point info

CAPE   Normand Point   Fog Point

Type   From Model

Location **17°42'S 127°25'E**
Validity **24.01.2020 06:00 [+6:00h]**
Model **Access R/(default)**
Run **24.01.2020 00:00**

ACCESS R sounding

…some slides not shown…

It is important to relate the cloud viewed in the satellite data to the synoptic environment

Cb
(in areas of deep atmospheric instability)

Ci Cs
(outflow from deep convection, defining upper jets, associated with fronts)

AcAs
(upslope transport of condensate, also associated with fronts)

St Fg
(radiative cooling, post rain event)

Sc
(subsidence and low level moisture)

Cu
(strong surface to atmosphere temperature contrasts – also over land during the day)

image courtesy JMA/BOM

...some slides not shown...