Dvorak Enhanced Infrared (EIR) Analysis Diagram

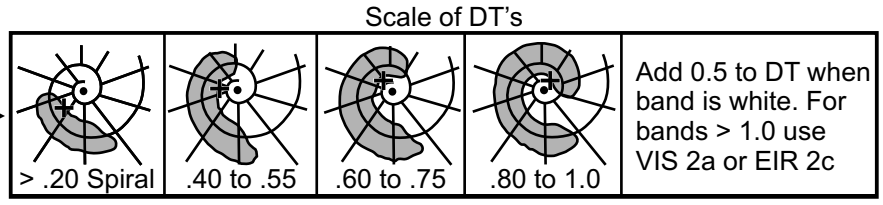
Abbrev-iation	Grey Shade BD Curve	Temperature Range (°C)	Temperature Range (°K)
WMG	Warm Medium Grey	> +9°C	> 282
OW	Off White	+9 to -30°C	243 - 282
DG	Dark Grey	-30 to -41°C	232 - 242
MG	Medium Grey	-42 to -53°C	220 - 231
LG	Light Grey	-54 to -63°C	210 - 219
B	Black	-64 to -69°C	204 - 209
W	White	-70 to -75°C	198 - 203
CMG	Cold Medium Grey	-76 to -80°C	193 - 197
CDG	Cold Dark Grey	⩽ -81°C	⩽192

1. **START** Locate cloud system center. → Locate the Cloud System Centre ("CSC") at the focal point of all the curved cloud lines or bands. For initial development (T1), see Step 1a

2. Analyze using pattern below when possible; then go to Step 3 → When your storm pattern does not fit the description of any of Steps 2a thru d, do Steps 3, 4, 5, and 6; then return to Step 2 if indicated.

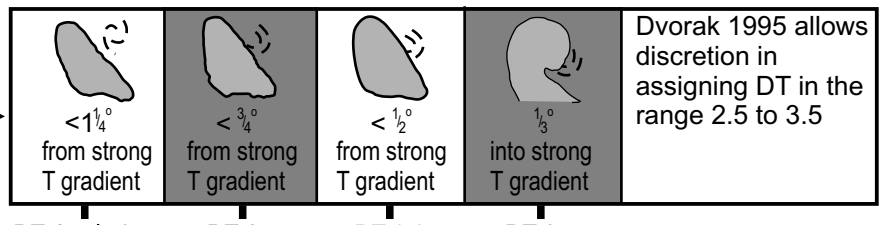
2a. **"Curved Band" Pattern** (Use spiral arc distance along 10" long spiral) Always use tightest inner curve →

Scale of DT's



Add 0.5 to DT when band is white. For bands > 1.0 use VIS 2a or EIR 2c

2b. **"Shear" Pattern** Use center definition and center's distance to dense overcast. →



Dvorak 1995 allows discretion in assigning DT in the range 2.5 to 3.5

DT 1.5 ± 0.5 | DT 2.5 | DT 3.0 | DT 3.5

2c. **"Eye" Pattern** → Was 24-hr T-no ⩾ T2.0? YES → NO → Step 2a or 4

	30nm	30	30	24	24	18	18	Nautical Miles
Narrowest Width	⩾0.5	⩾0.5	⩾0.5	⩾0.4	⩾0.4	⩾0.3	⩾0.3	Degrees Latitude
Surrounding grey shade	CMG	W	B	LG	MG	DG	OW	EIR Colour (BD Curve)
	E6.5	E6.0	E5.5	E5.0	E4.5	E4.5	E4.0	

2d. **"Embedded Center" Pattern** (Center within cold ⊕ by ⩾ 0.4) Use technique with caution weight FT to MET for this pattern type → Was 12-hr old T-no ⩾ T3.5? YES → NO → Step 2a or 4

	36	36	30	30	24	24	Nautical Miles
Embedded Distance	⩾0.6	⩾0.6	0.5	⩾0.5	⩾0.4	⩾0.4	Degrees Latitude
Surrounding grey shade	White or colder	B	LG	MG	DG	OW	
	CF5.0	CF5.0	CF4.5	CF4.0	CF4.0	CF3.5	

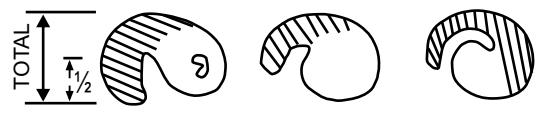
Eye Temperature

No Minimum width Surrounding Ring Temperature	WMG	OW	DG	MG	LG	B	W
OW	0	-0.5					
DG	0	0	-0.5				
MG	0	0	-0.5	-0.5			
LG	+0.5	0	0	-0.5	-0.5		
B	+1.0	+0.5	0	0	-0.5	-0.5	
W	+1.0	+0.5	+0.5	0	0	-1.0	-1.0
CMG	+1.0	+0.5	+0.5	0	0	-0.5	-1.0

Not for large (⩾ 45 n ml) or elongated (short axis 2/3 long) eyes
Elongated eyes when E no. ⩾ 4.5
subtract 0.5 if no previous subtraction made

Eye Adjustment? E-No. + Eye Adj. = CF

Banding Feature (BF)? CF + BF = DT



Rules (Banding Features)
- Band curves 1/4 distance around
- Band is MG or colder
- Warm wedge DG or warmer

Note: Add BF to CF only when DT < MET.

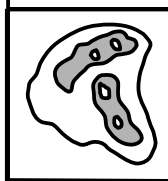
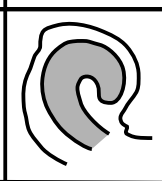
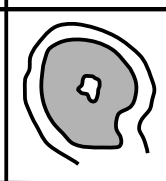
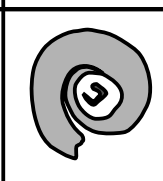
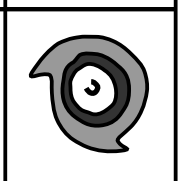
3. "Central Cold Cover" Pattern This pattern indicates arrested development → Rules: When past T-no. ⩽ T3, maintain model trend for 12 hours; then hold same. When past T-no. ⩾ T3.5 hold T-no. same. Use as final T-no.; then go to Step 9.

4. Determine past 24 hour trend. Is Development, Weakening, or Same indicated in a change of:
(a) centre or eye characteristics
or
(b) centre's involvement with the cold overcast

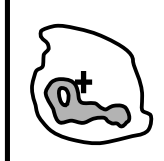
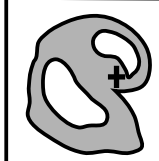
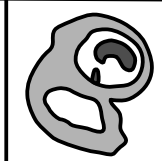
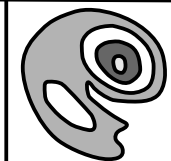
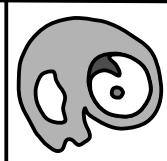
5. Determine Model Expected T-no. (MET). 0.5, 1.0, 1.5 (as determined by step 4) to 24 hr old FT

6. Determine pattern T-no. Select pattern in diagram that best matches your storm picture within one column of the MET. Adjust MET ±.5 when indicated.

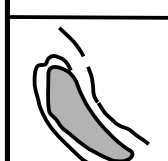
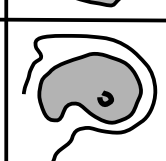
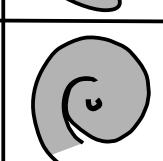
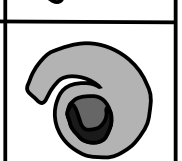
a.

PT 1.5 ±.5	PT 2.5	PT 3.5	PT 4	PT 5	PT 6
					

b.

c.

* When grey part of these patterns white or colder, consider adding 0.5 to pattern number

7. **T-no Determination:**
1. Use data T-no. from Step 2 when cloud features are clear-cut.
2. Use Pattern T-no. when DT is not clear and adjustment to MET is made.
3. For all other cases, use the MET.

8. **Final T-no Constraints:**
1. Initial classification must be T1.0 or T1.5.
2. During the first 48 hours of development, T-no. cannot be lowered at night.
3. 24 hrs after initial T1.0, storm's T-no, must be ⩽ T2.5
4. Final T-no. limits:
   - <T4.0: change of 0.5 over 6 hrs,
   - >T4.0: - change of 1.0 over 6 hrs
     - change of 1.5 over 12 hrs
     - change of 2.0 over 18 hrs
     - change of 2.5 over 24 hrs.
5. Final T-no. must = MET ± 1

9. **Current Intensity (CI) Number Rules:**
1. Use CI = Final T-no.(FT) except when Final T-no. shows change to weakening trend, or when redevelopment is indicated.
2. For initial weakening, hold CI same for 6* hours, then hold CI 0.5 or 1.0 higher than Final T-no, as storm weakens until the FT has plateaued for >6h.

* ref Brown and Franklin (2004) paper

10. **24 Hr Forecast** Extrapolate past trend unless one of the five rules in the instructions applies

Source: *Dvorak, V.F. 1995 Tropical clouds and cloud systems observed in satellite imagery: Tropical cyclones. Workbook Vol. 2. Modified by Perth Tropical Cyclone Warning Centre, Bureau of Meteorology, tcwcwa@bom.gov.au.*
Artwork held: *Publication Section, Bureau of Meteorology. Date: 3 October 2011.*