# Dvorak Enhanced Infrared (EIR) Analysis Diagram

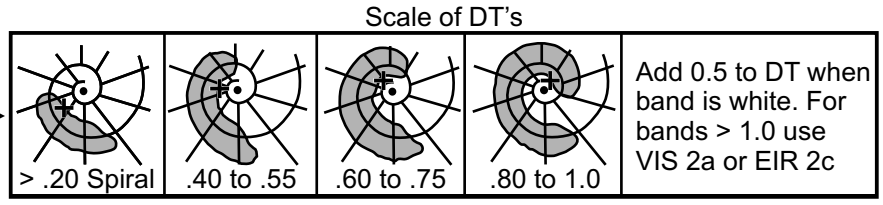
| Abbrev-iation | Grey Shade BD Curve | Temperature Range (°C) | Temperature Range (°K) |
|---|---|---|---|
| WMG | Warm Medium Grey | > +9°C | > 282 |
| OW | Off White | +9 to -30°C | 243 - 282 |
| DG | Dark Grey | -30 to -41°C | 232 - 242 |
| MG | Medium Grey | -42 to -53°C | 220 - 231 |
| LG | Light 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.

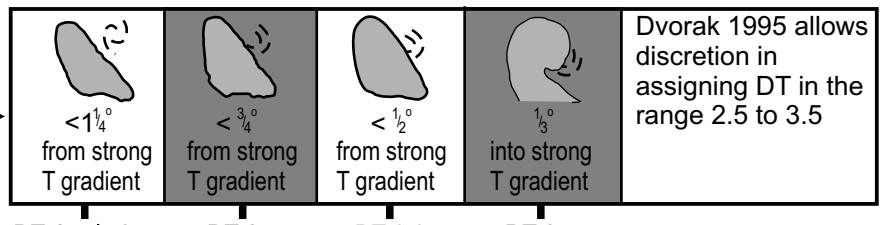
**2a.** **"Curved Band" Pattern** (Use spiral arc distance along 10" long spiral) Always use tightest inner curve →

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

**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

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

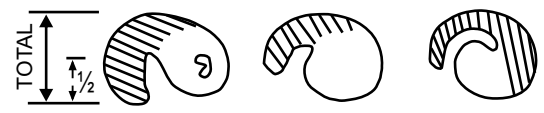
| | 30nm | 30 | 30 | 24 | 24 | 18 | 18 | Nautical Miles |
|---|---|---|---|---|---|---|---|---|
| Narrowest Width | ⩾0.5 | ⩾0.5 | ⩾0.5 | ⩾0.4 | ⩾0.4 | ⩾0.3 | ⩾0.3 | Degrees Latitude |
| Surrounding grey shade | CMG | W | B | LG | MG | DG | OW | EIR Colour (BD Curve) |
| | E6.5 | E6.0 | E5.5 | E5.0 |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

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

**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 | |

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

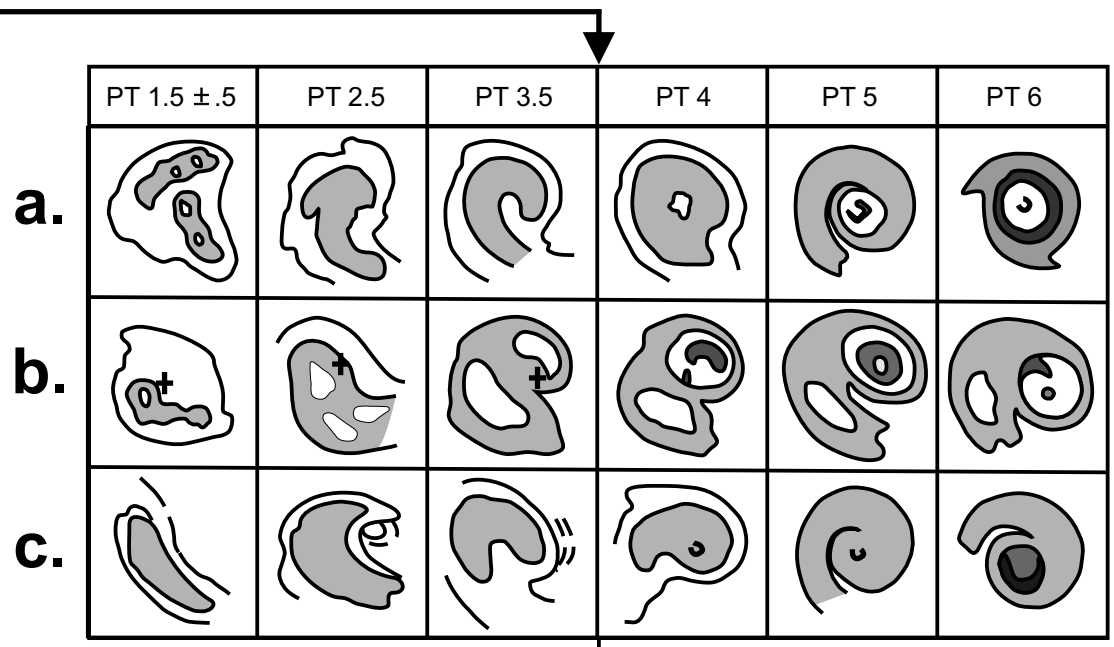
Note: Add BF to CF only when DT < MET.

**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.




* 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 2.5* over 18 hrs
     - change of 3.0* over 24 hrs
5. Final T-no. must = MET ±1

* Ref: Sangster&Landsea, 2020.

**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 Tropical Cyclone Warning Centre, Bureau of Meteorology, tcwc@bom.gov.au. Date: 10 July 2020.*