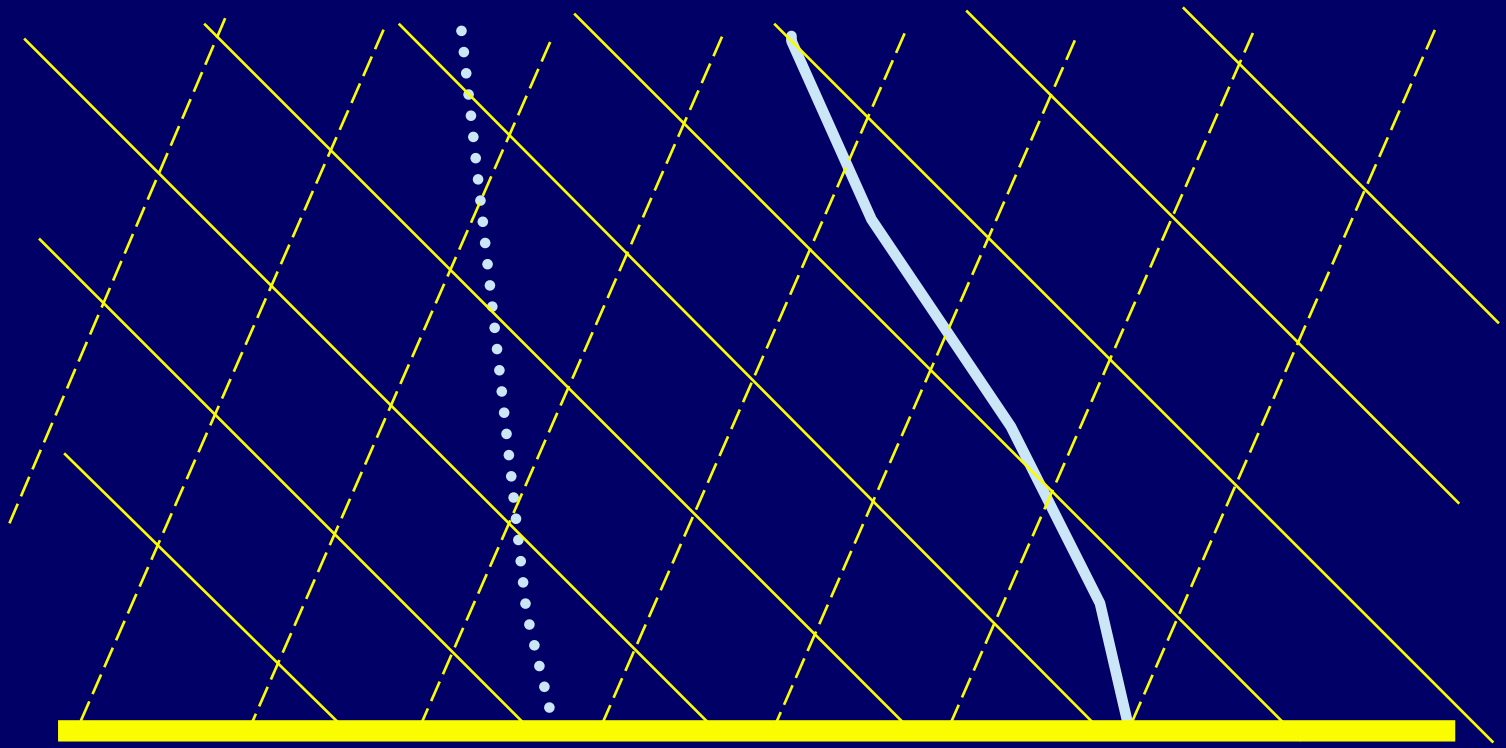
Saunders fog point technique

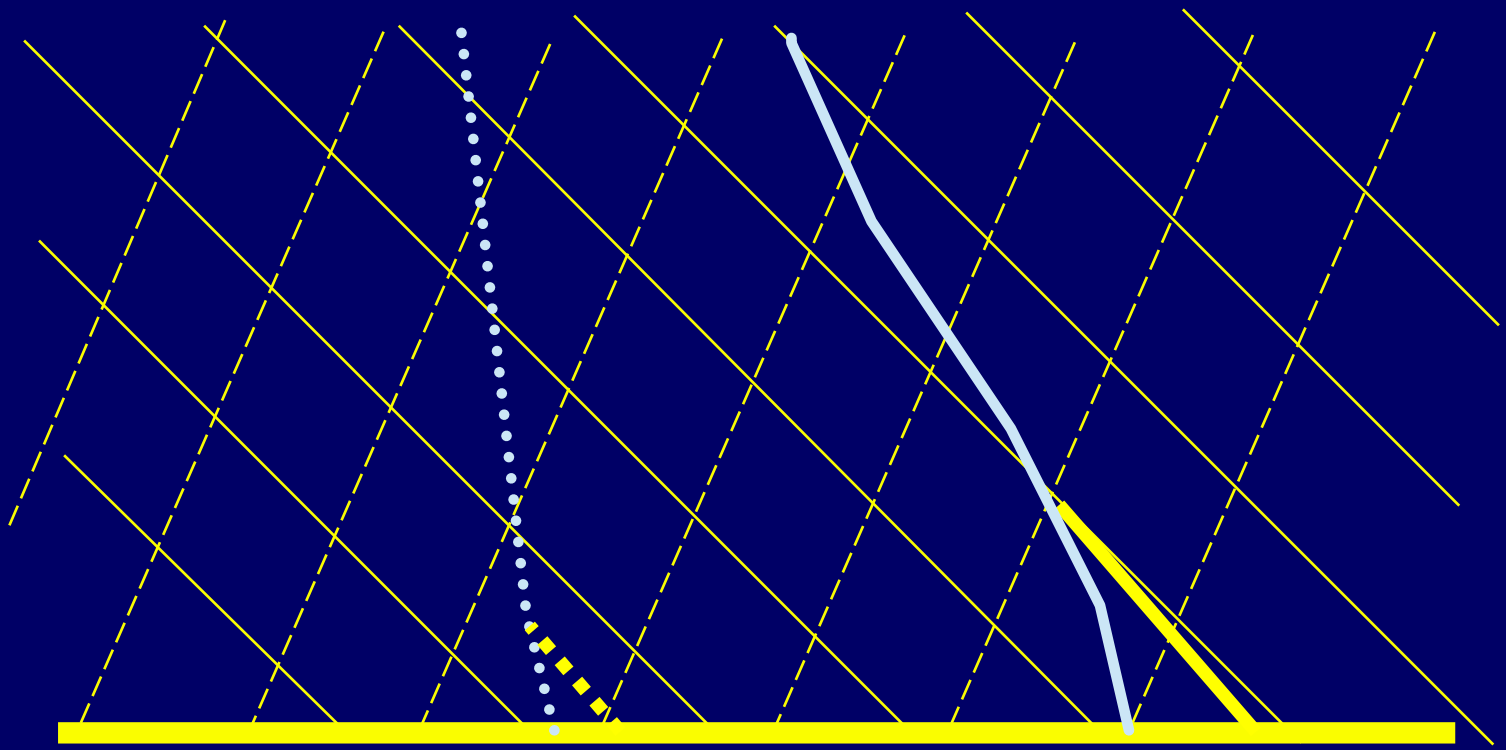
Saunders Technique

- Choose a representative midday temperature sounding (tephigram)
  - Same airmass as your area
  - Ideally upwind
- Amend the tephigram for time of maximum temperature
  - Draw on the station level pressure (QFE)
  - Mark on T_{max} and T_{dew} at time of max temperature
  - Amend tephigram to fit maximum temperatures.

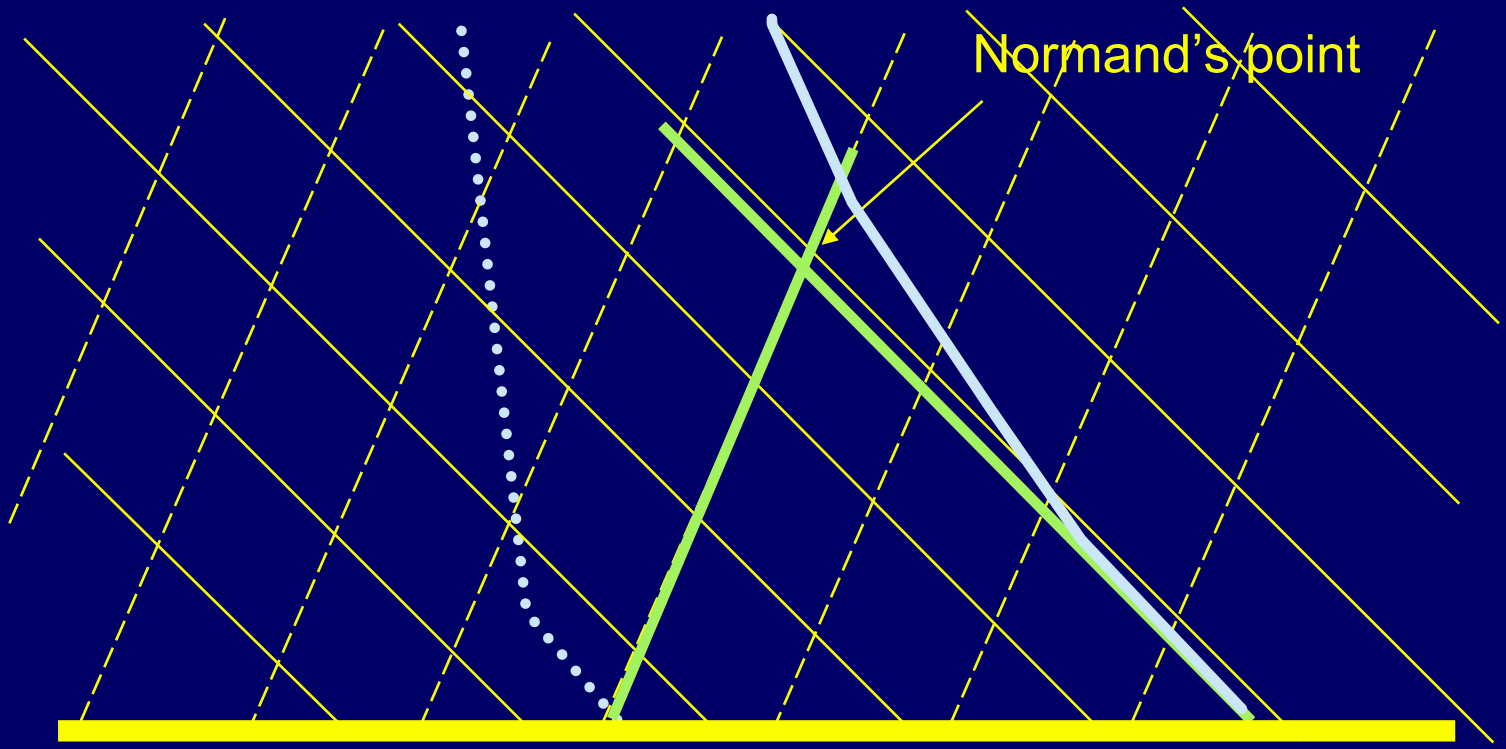
Representative midday radiosonde



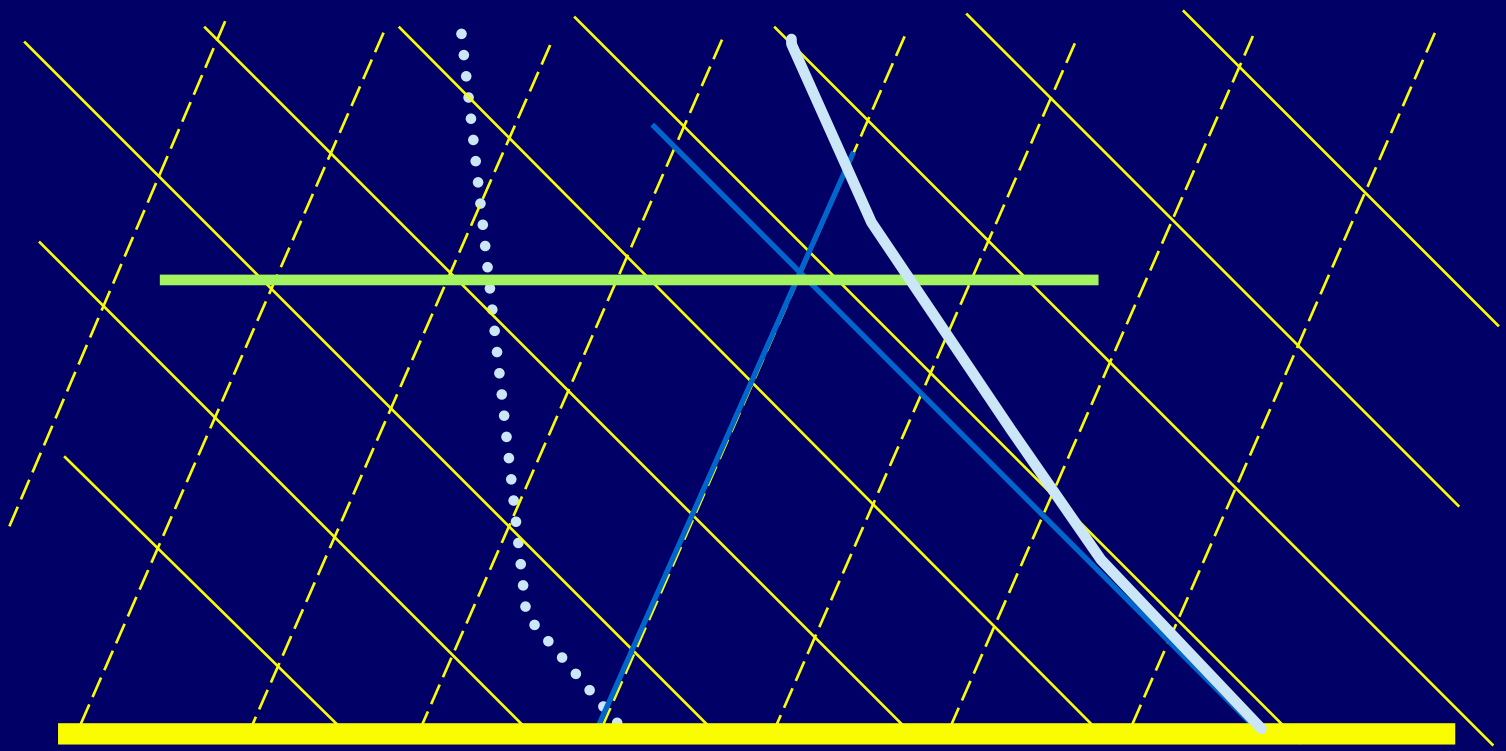
Mark on Tmax and Tdew & modify ascent



Do a Normands point construction

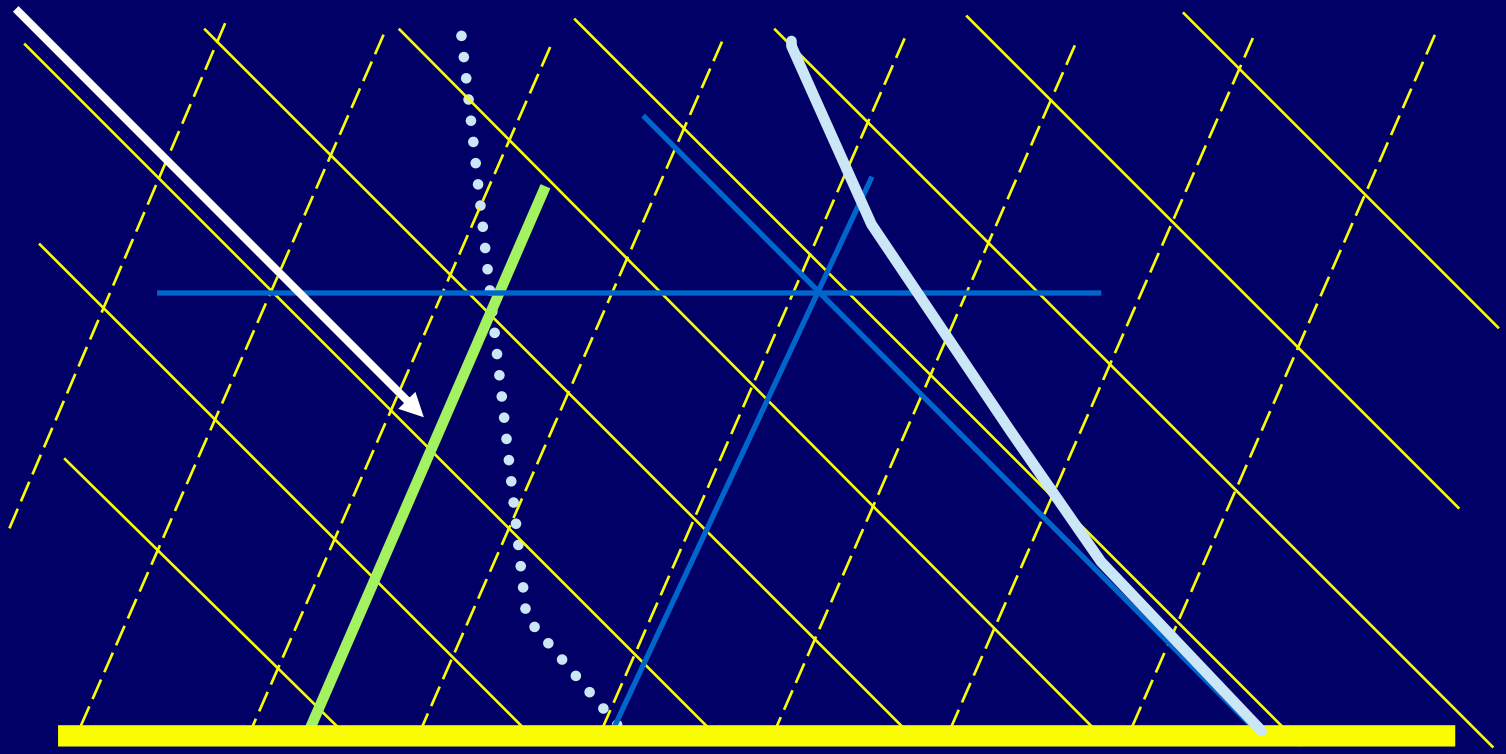


Draw an isobar from Normands Point

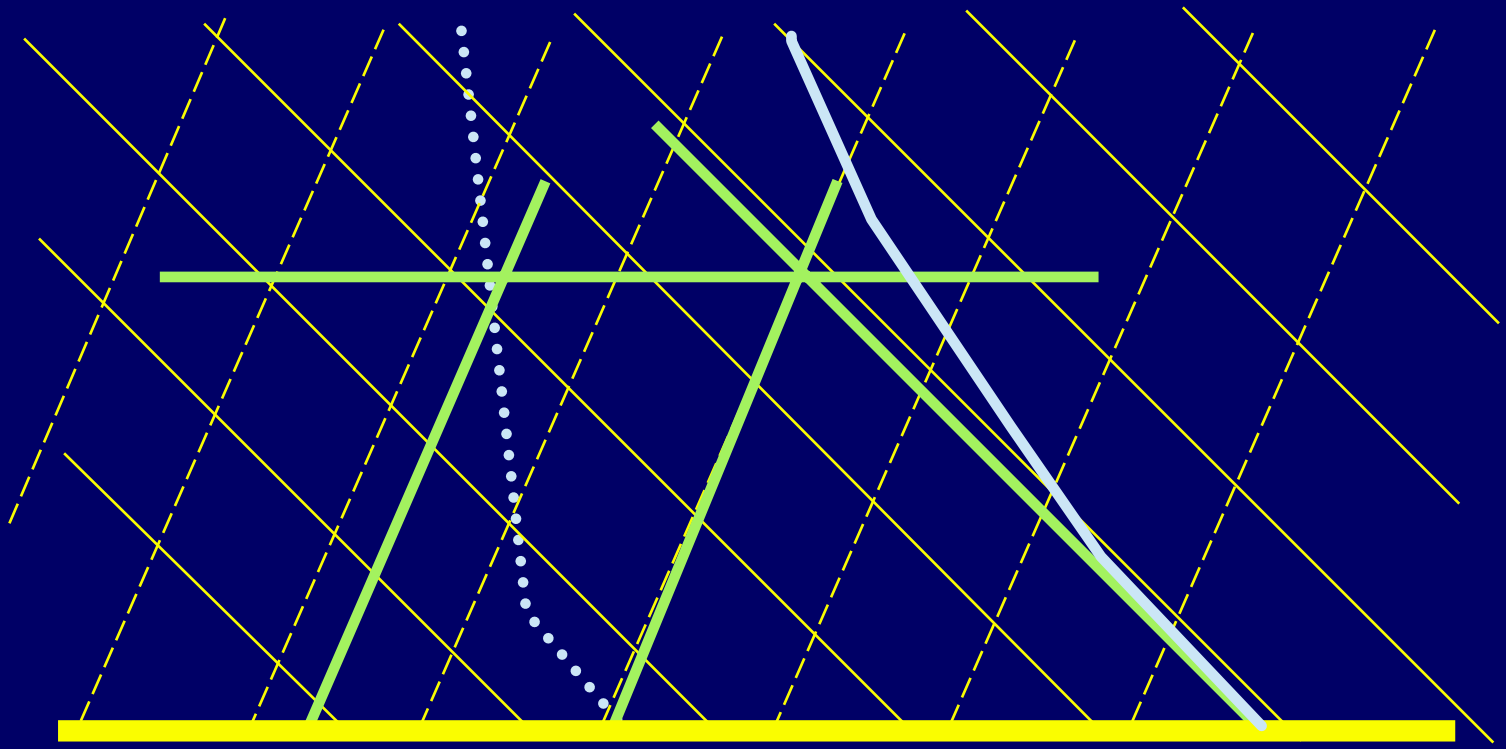


Isobar intercepts dewpoint curve

Follow SHMR from intercept down to surface



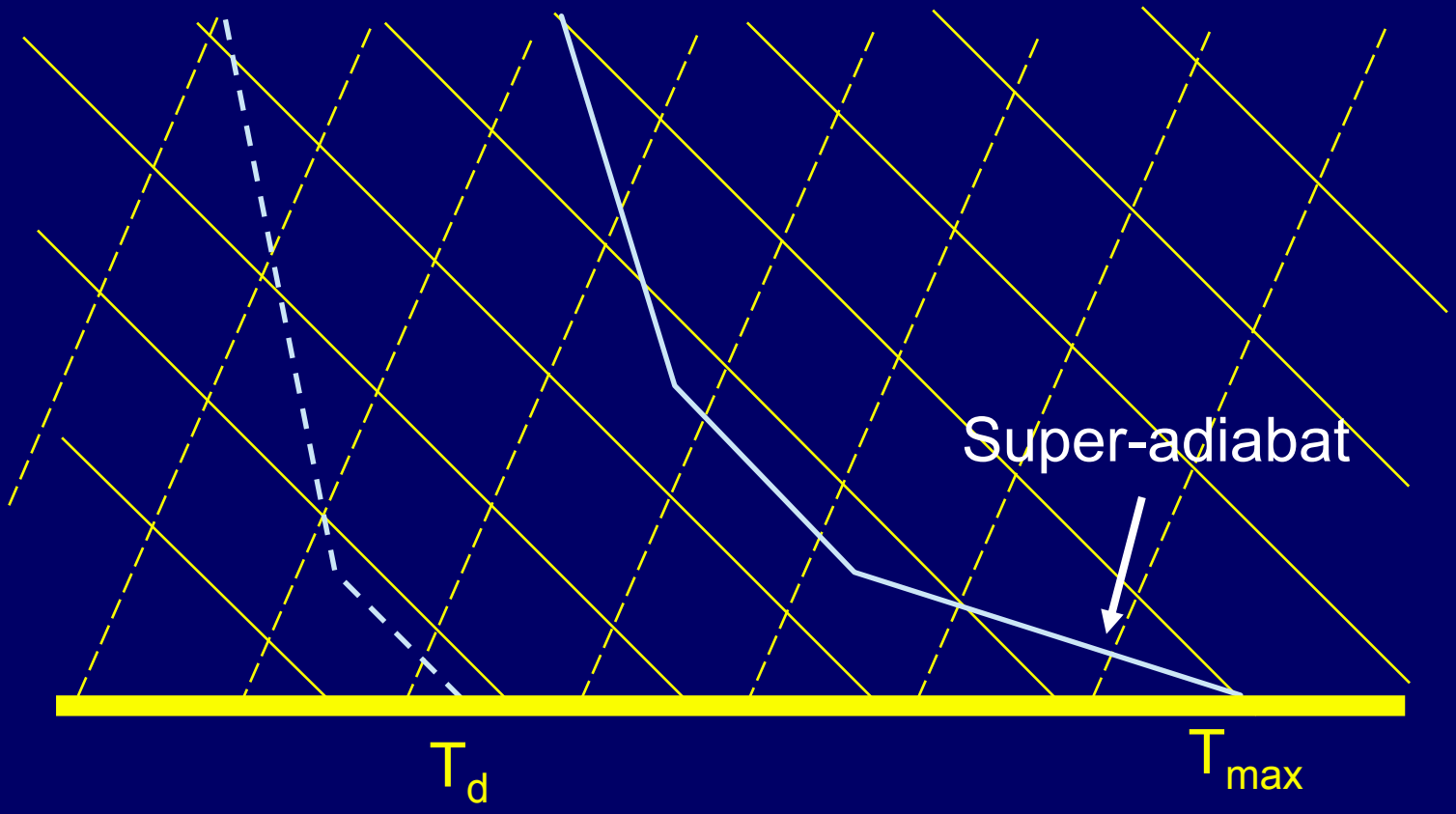
Saunders Fog point



Saunders Technique - 2 special cases

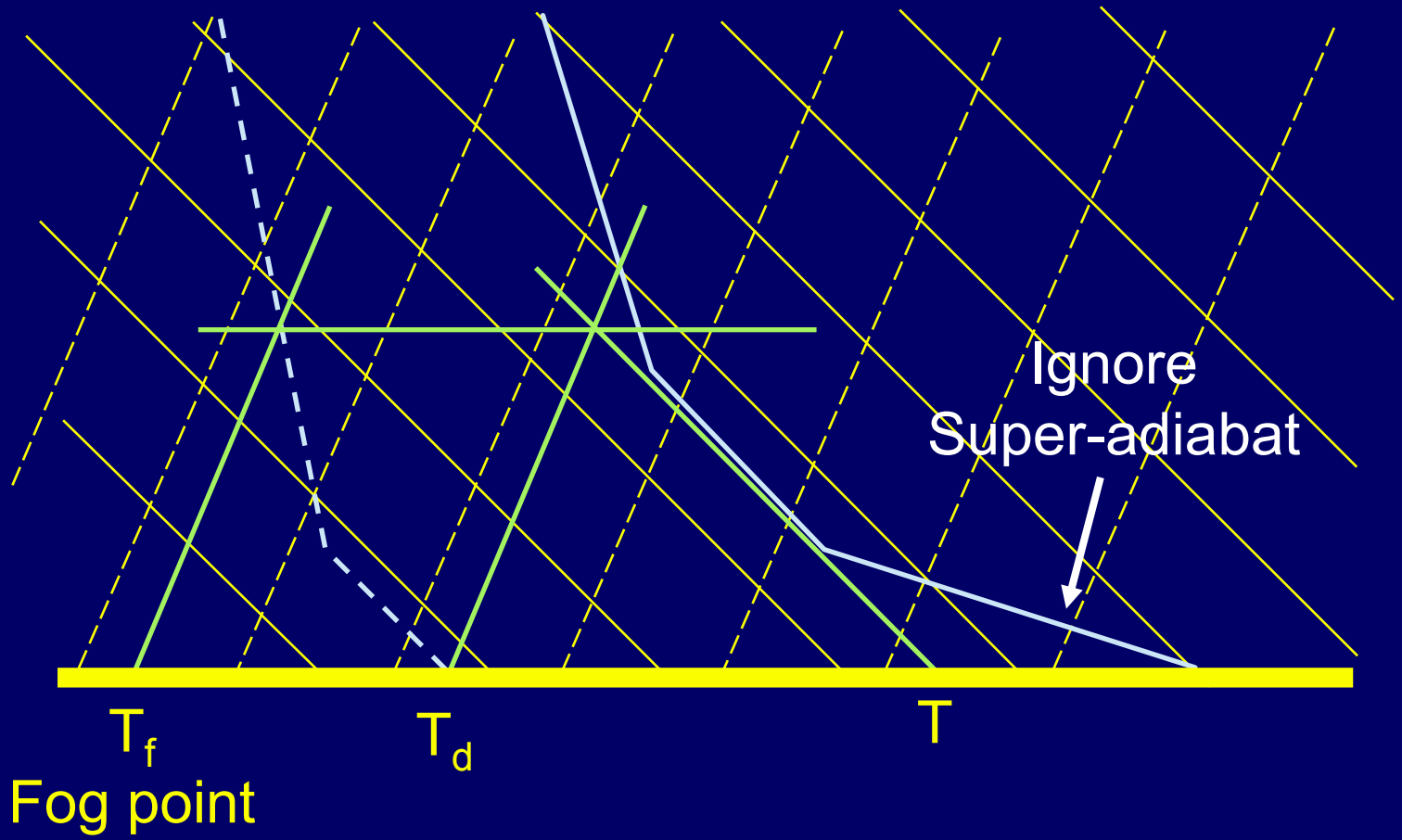
- Type I
  - Super-adiabat at surface
- Type II
  - Dry air aloft
  - Moist air near surface

TYPE 1 – super-adiabat at surface

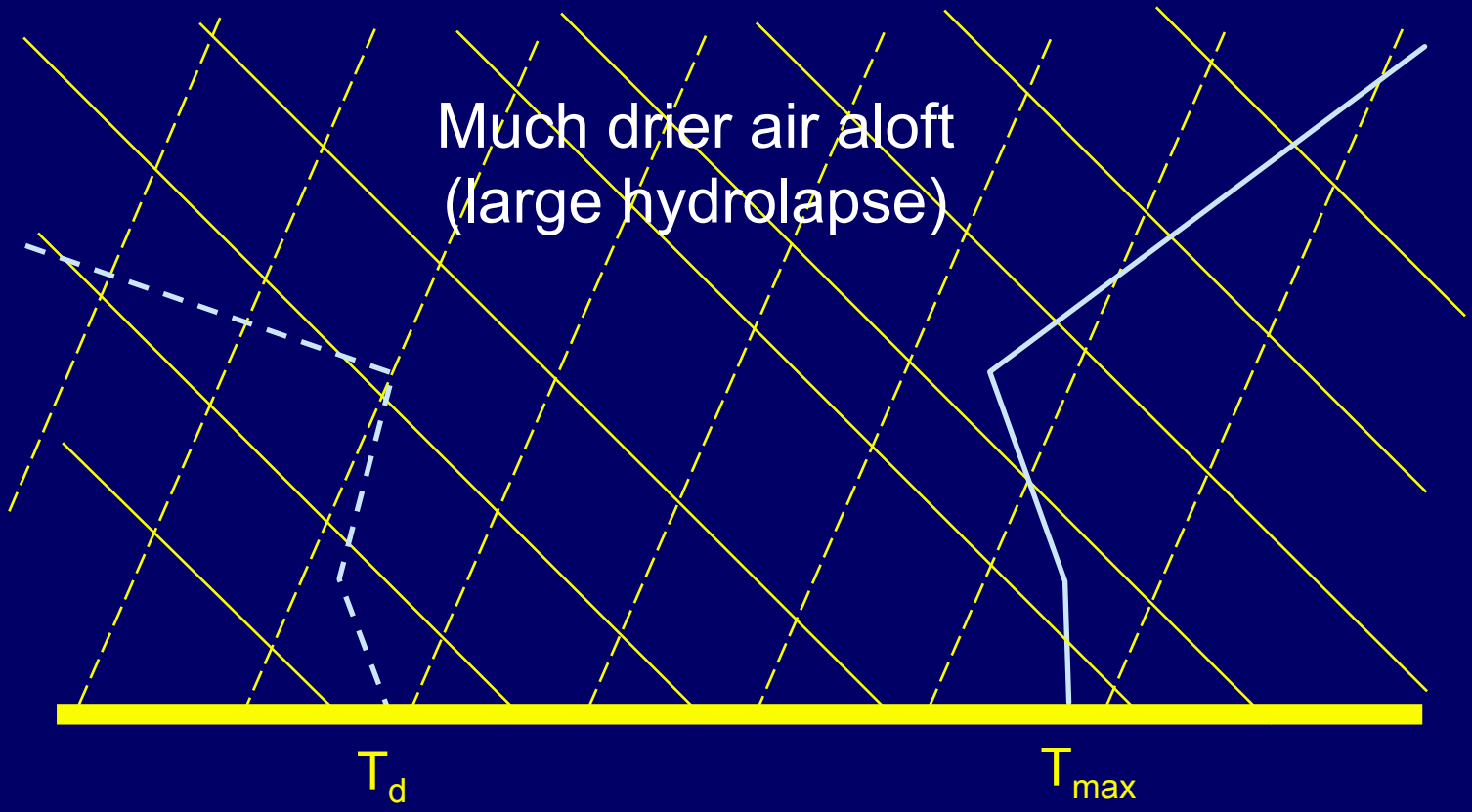


Ignore surface super-adiabat

Type 1

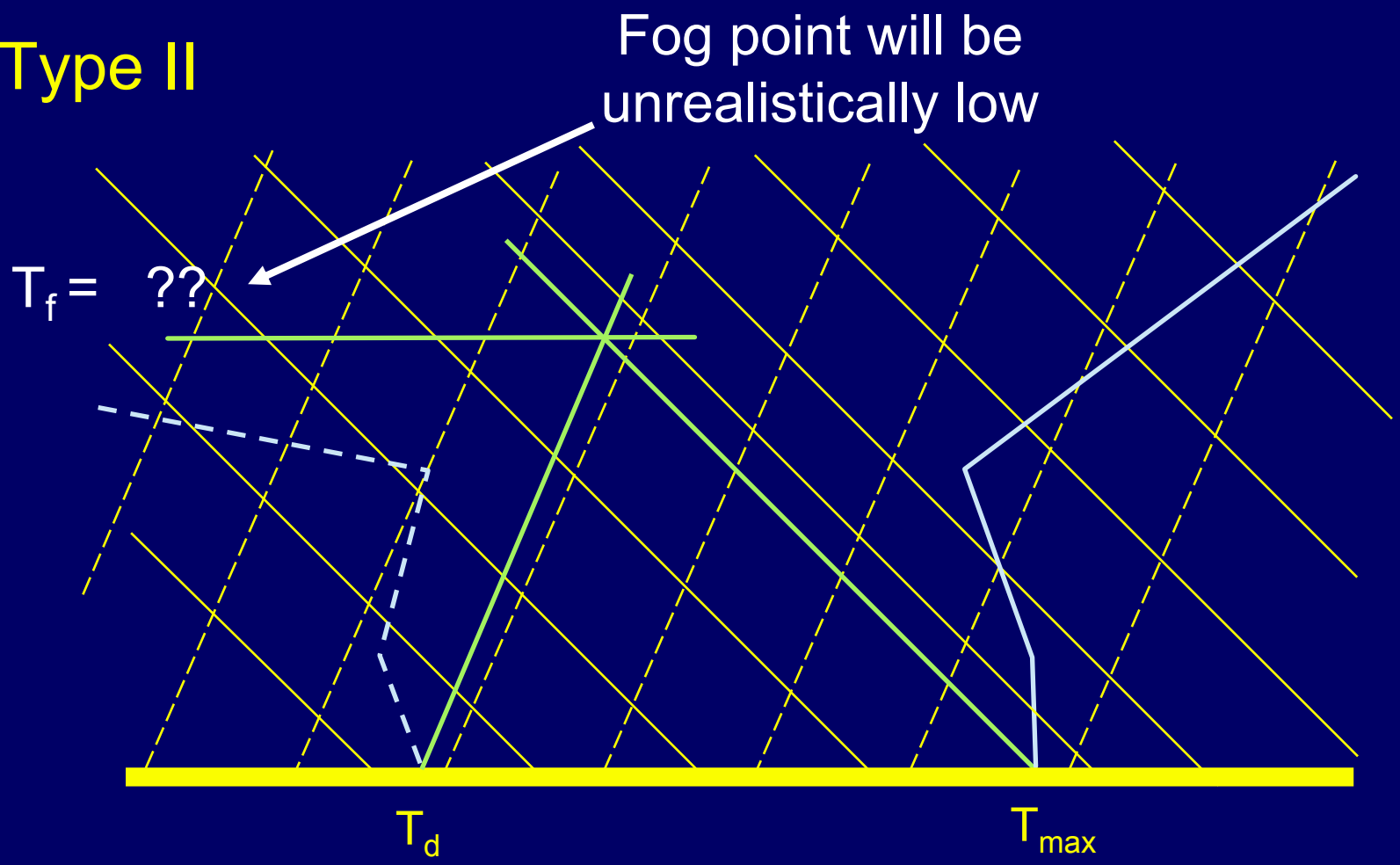


TYPE 2 – Much drier air aloft



Normands construction and isobar

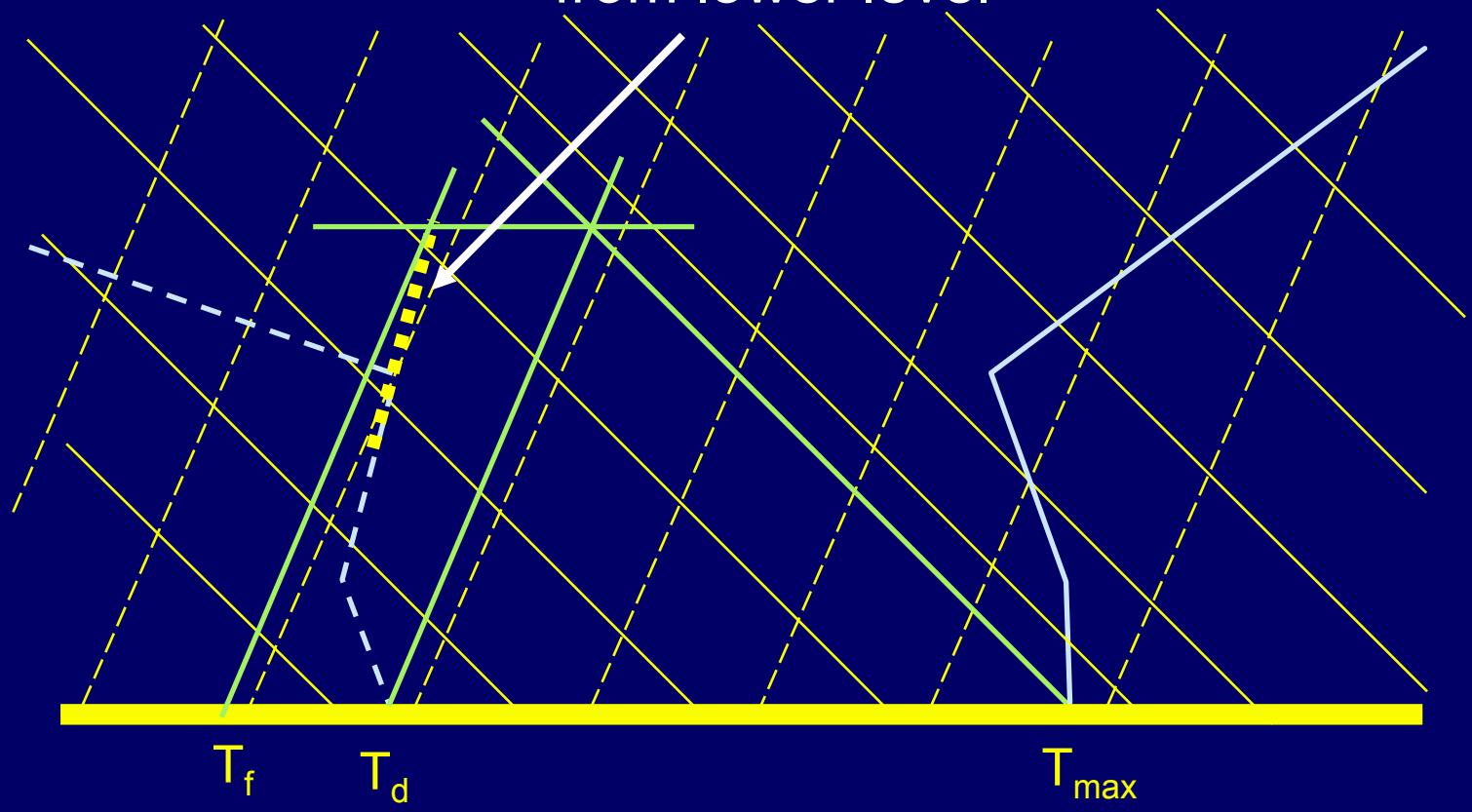
Type II



Extend ‘moister’ low level hydrolapse

Type II

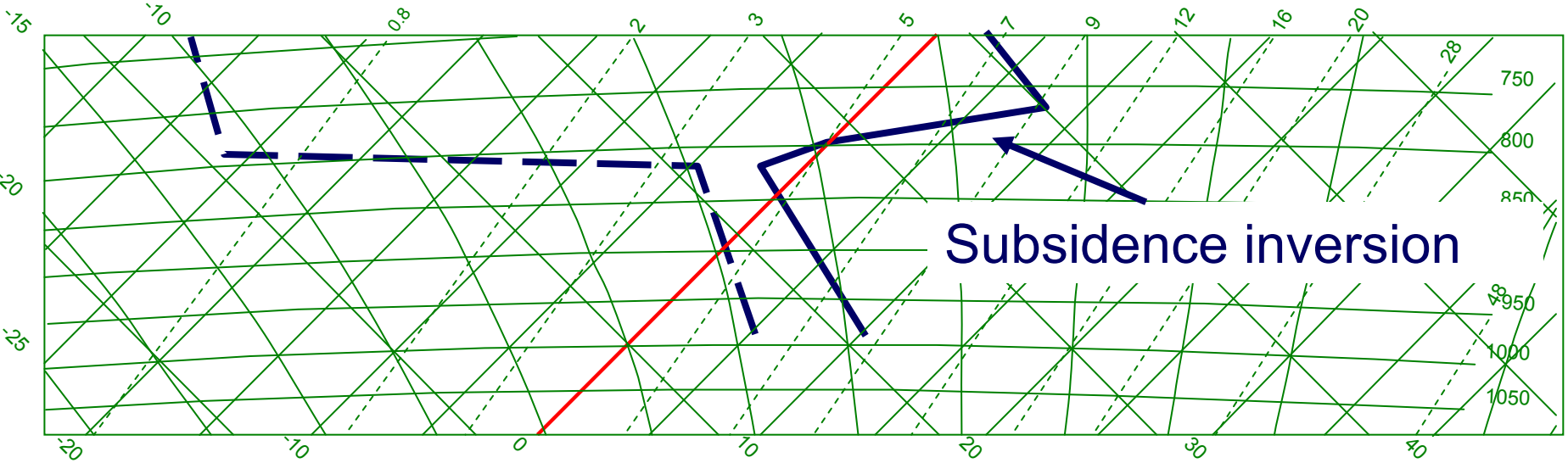
Extend dew point curve from lower level

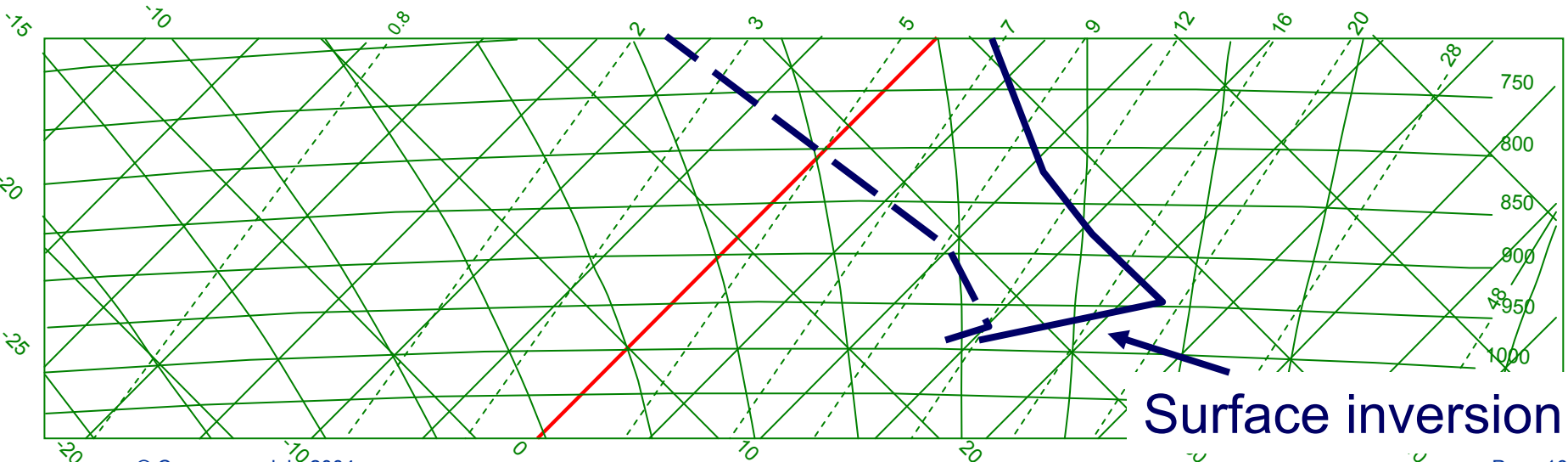


General fog points

- If a subsidence inversion is within 30hPa of the surface then $T_f = T_{dew}$

Inversion types





General fog points

- If a subsidence inversion is within 30hPa of the surface then $T_f = T_d$
- If it rains in the afternoon the fog point will be higher than the calculation
- If the radiosonde ascended through rain then the fog point will be lower
- If a sea breeze reaches your area after Tmax then use the coastal dew point as your fog point
- If your calculated fog point temperature is < 0C then the actual fog point will be lower due to hoar frost

Fog or mist or nothing?

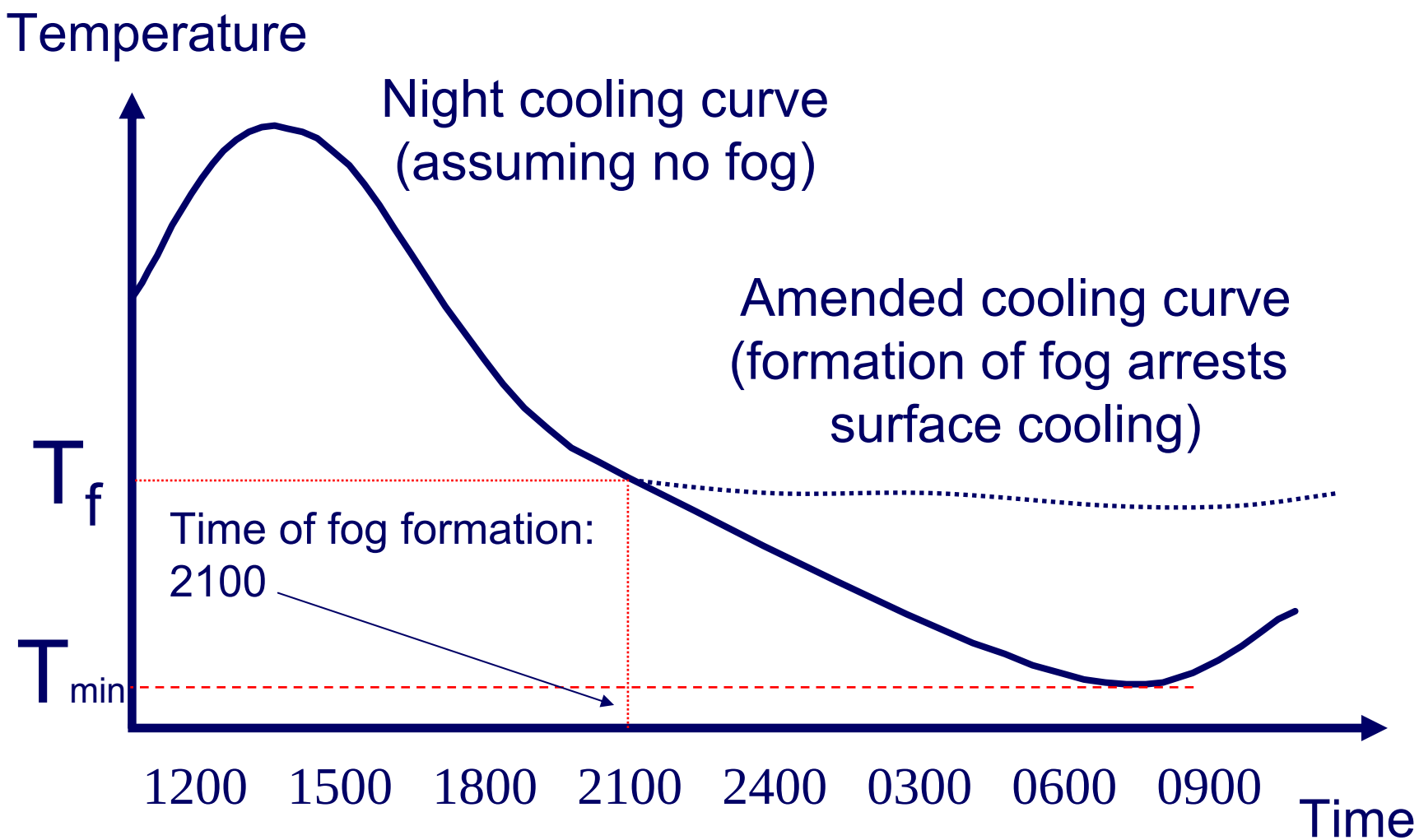
Take your forecast minimum temperature and your fog point,

If $T_f - T_{min} > 0$
Fog is expected

If $T_f - T_{min} < 0$
Mist is expected with fog patches in river valleys

If $T_f - T_{min} \leq -2$
Fog or mist are NOT expected

When will the fog form?



FOG FORMATION FORECASTING QUIZ

1) What are the 3 primary meteorological requirements for the formation of radiation fog?

2) Why is the dewpoint at midday often higher than the dewpoint at midnight?

3) When might the airmass dewpoint be equal to the fog point?

FOG FORMATION FORECASTING QUIZ

1) What are the 3 primary meteorological requirements for the formation of radiation fog?

ANS: Clear skies; low level moisture; calm or light surface winds

2) Why is the dewpoint at midday often higher than the dewpoint at midnight?

ANS: Formation of dew during the evening

3) When might the airmass dewpoint be equal to the fog point?

ANS: Humidity increasing with height near surface; subsidence inversion within 30hPa of surface.

WARM ADVECTION FOG

Warm advection fog formation

- WARM MOIST air moving over cool land or sea

- Windward coasts

- Air cooled to dew point

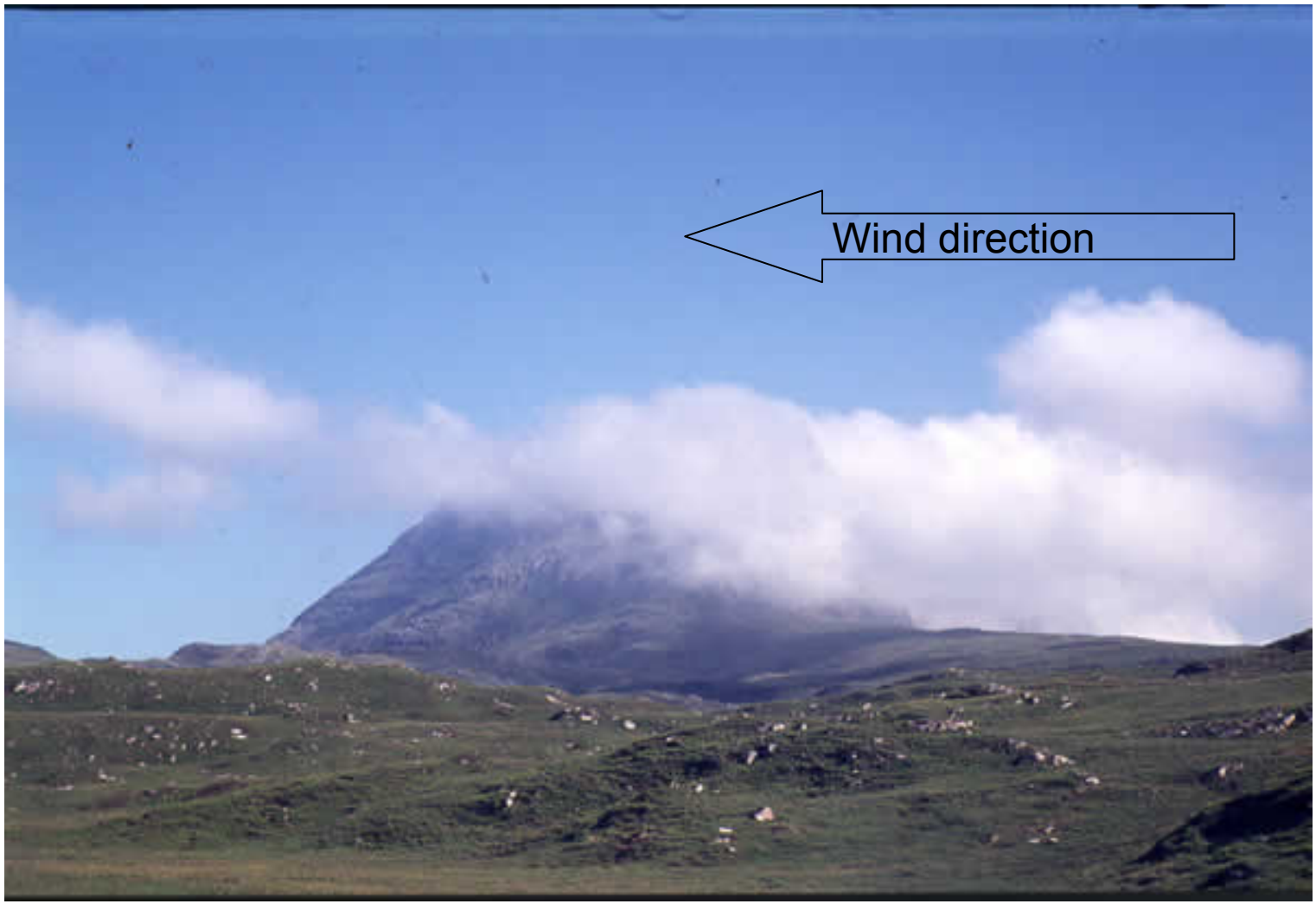
- Light surface wind = fog

- Overland Heating lifts fog into low cloud during the day, rapid in summer, slow in winter

- >10KT surface wind = low cloud

- $(T_{dry}-T_{dew})x350$ = Stratus base above ground level

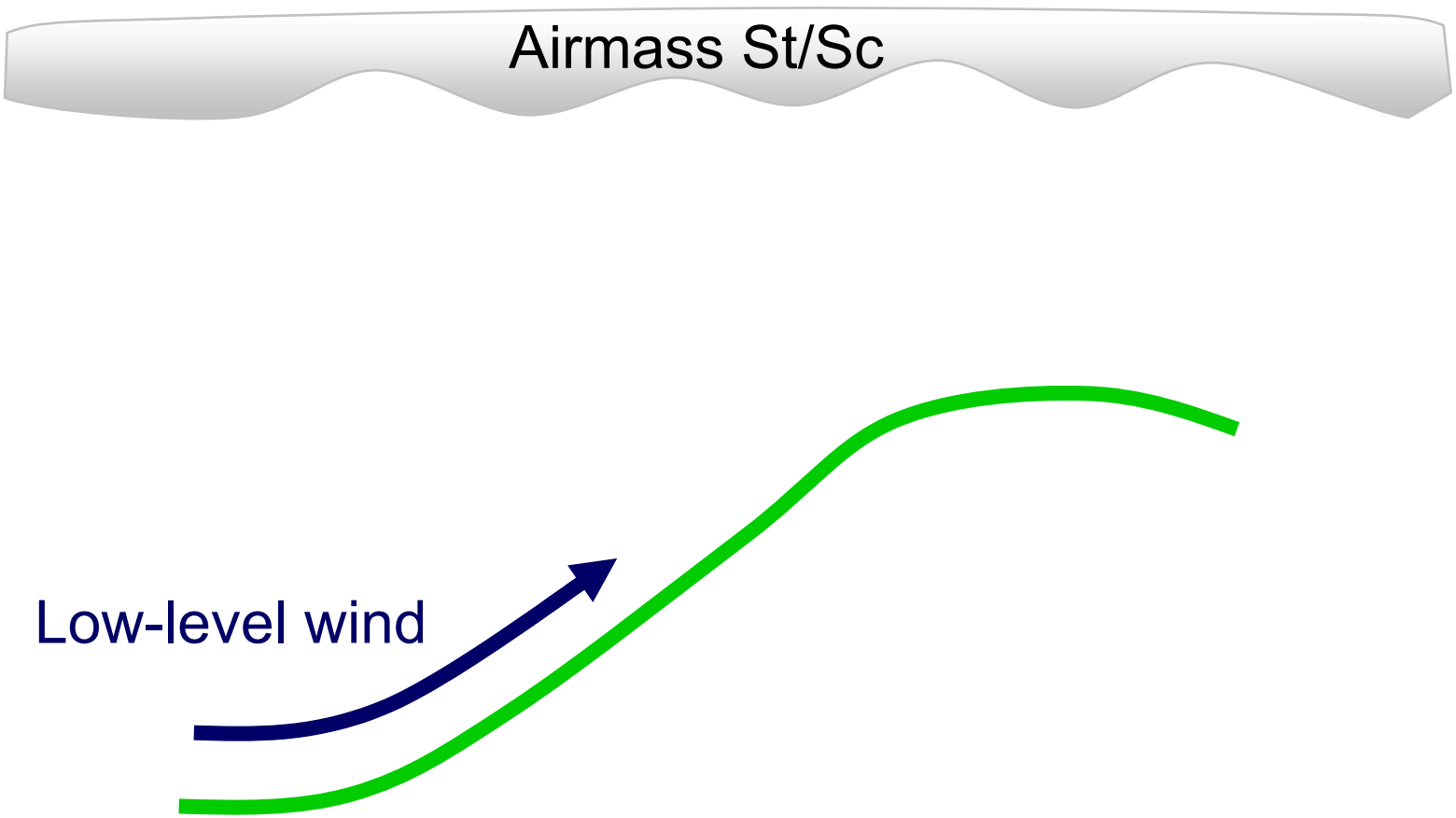
UPSLOPE FOG



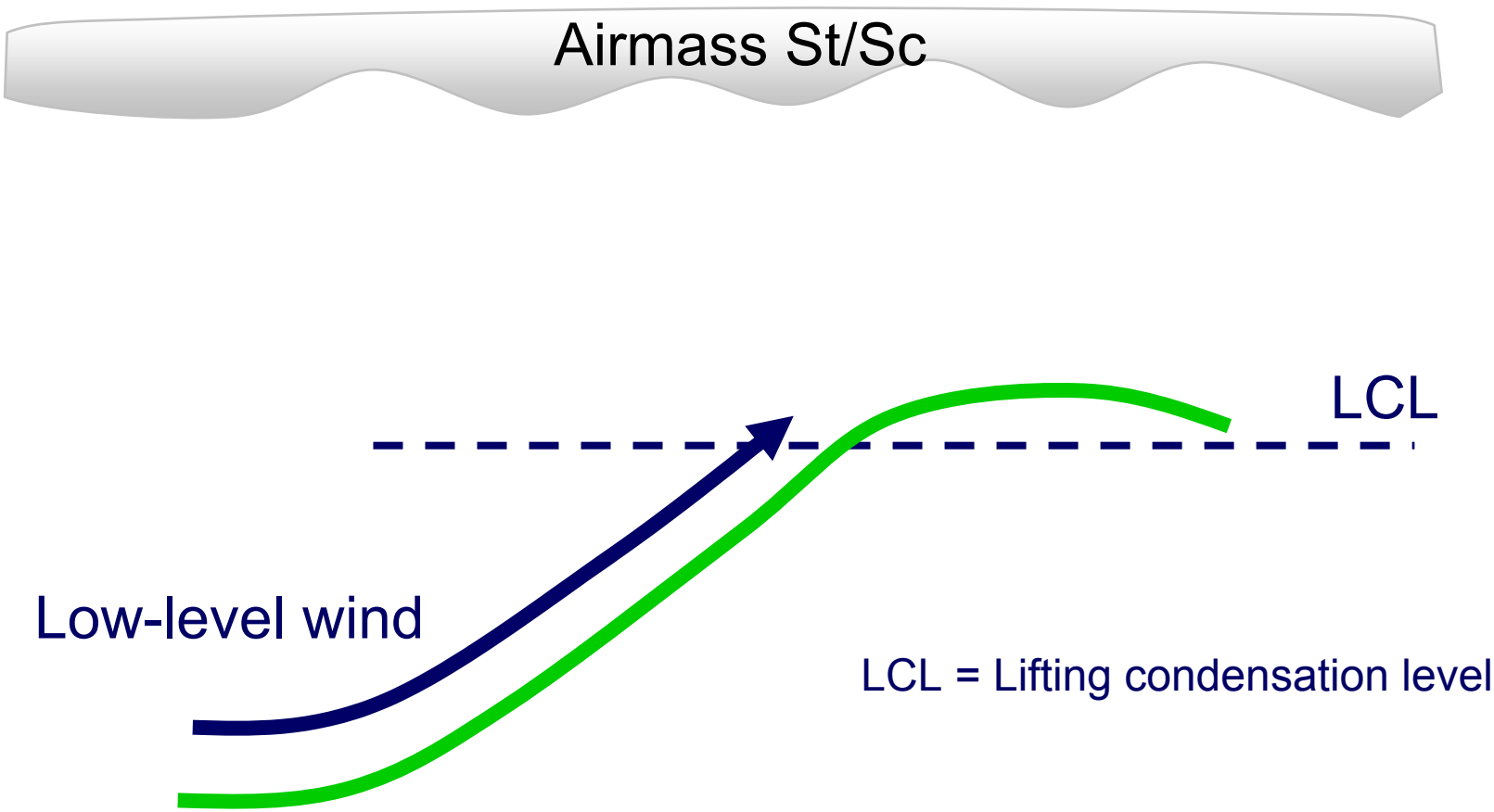
Upslope fog (stratus) formation

- Air forced to rise over hills
- Warm, moist, moderate to strong winds
- Stable air
- Air cools on ascent
- Very common on windward coasts and hills

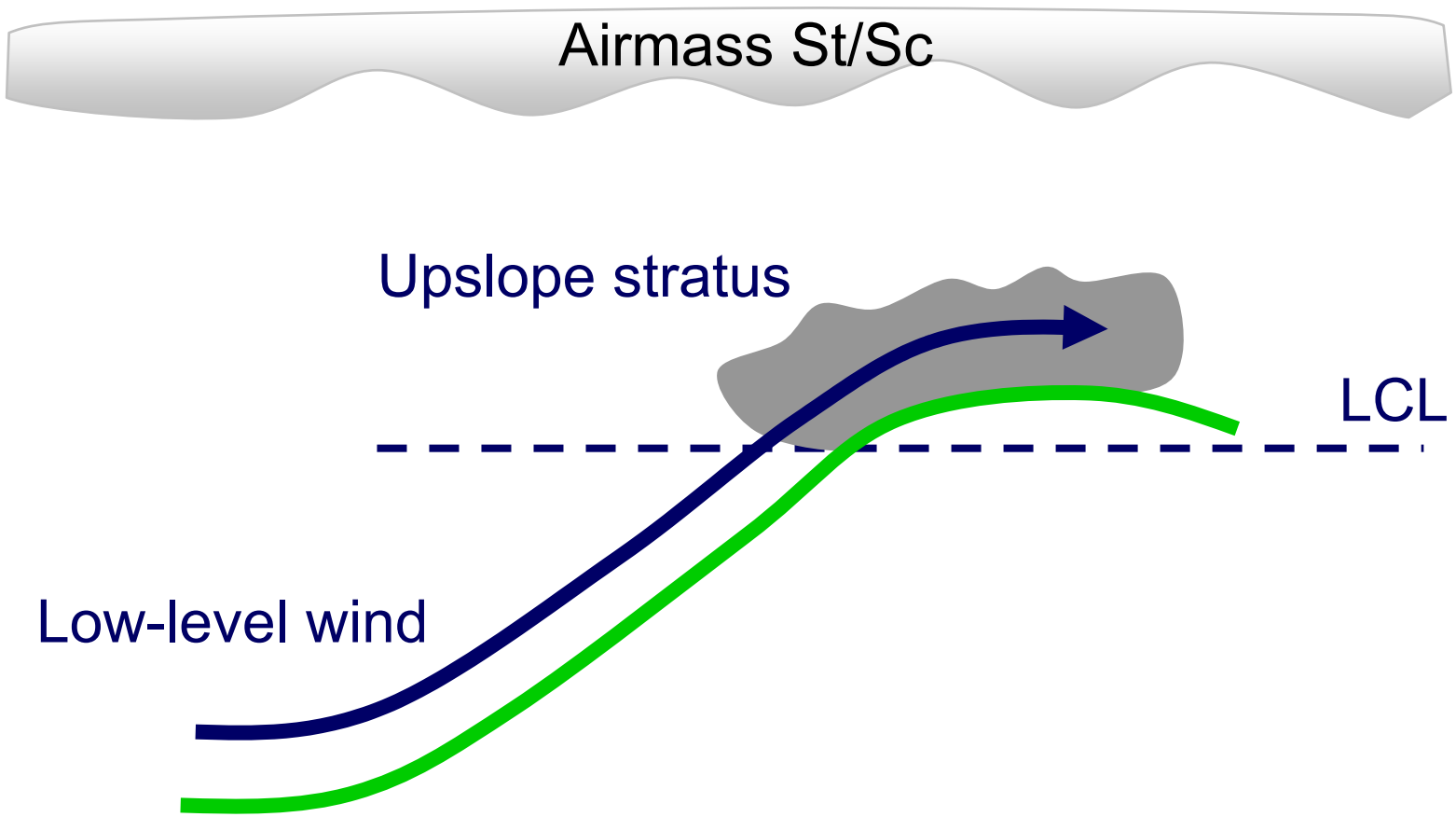
Upslope fog or stratus



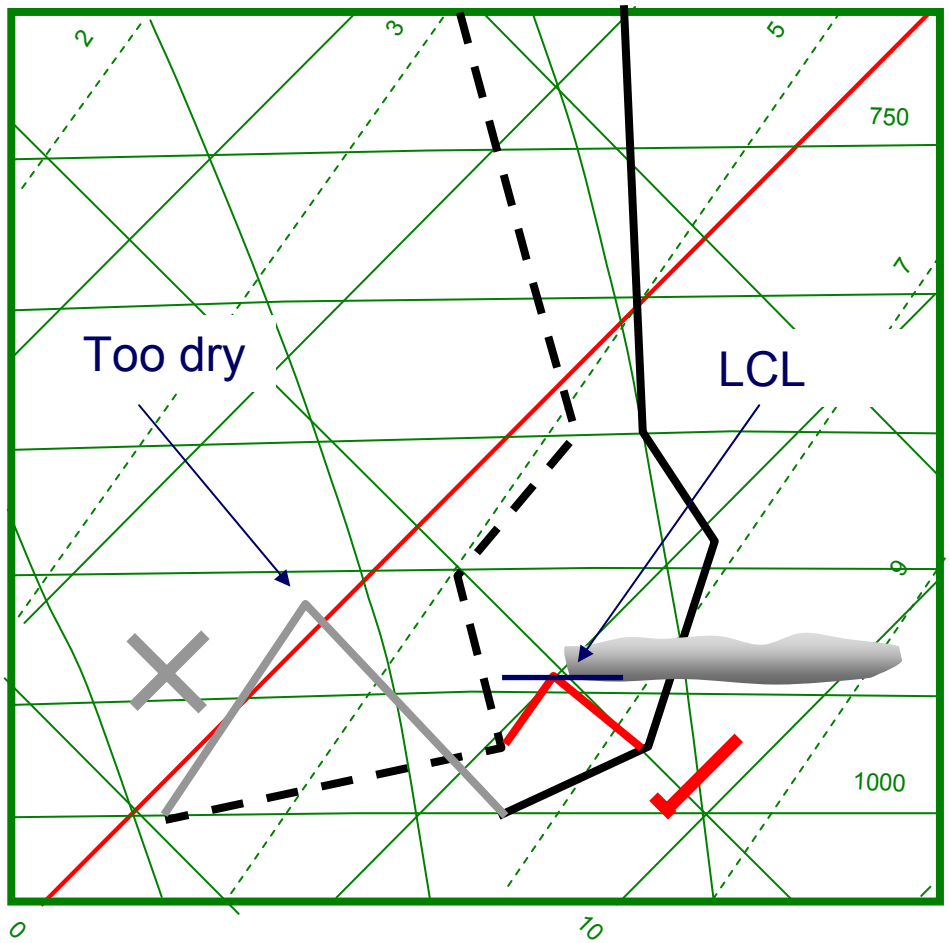
Upslope fog or stratus



Upslope fog or stratus



Forecasting upslope stratus



- Select a representative ascent
- Then determine the lowest LCL
- This is a process of trial and error!
- Lowest LCL = Upslope Stratus Base

One last fog type, steam fog

- Cold advection fog
- ‘Arctic sea smoke’
- Cold air flowing over relatively warm sea
- Low layer near surface becomes very unstable
- Convective swirls
- Evaporation then condensation

Steam fog

WHAT CLEARS FOG?

Four main methods of clearance

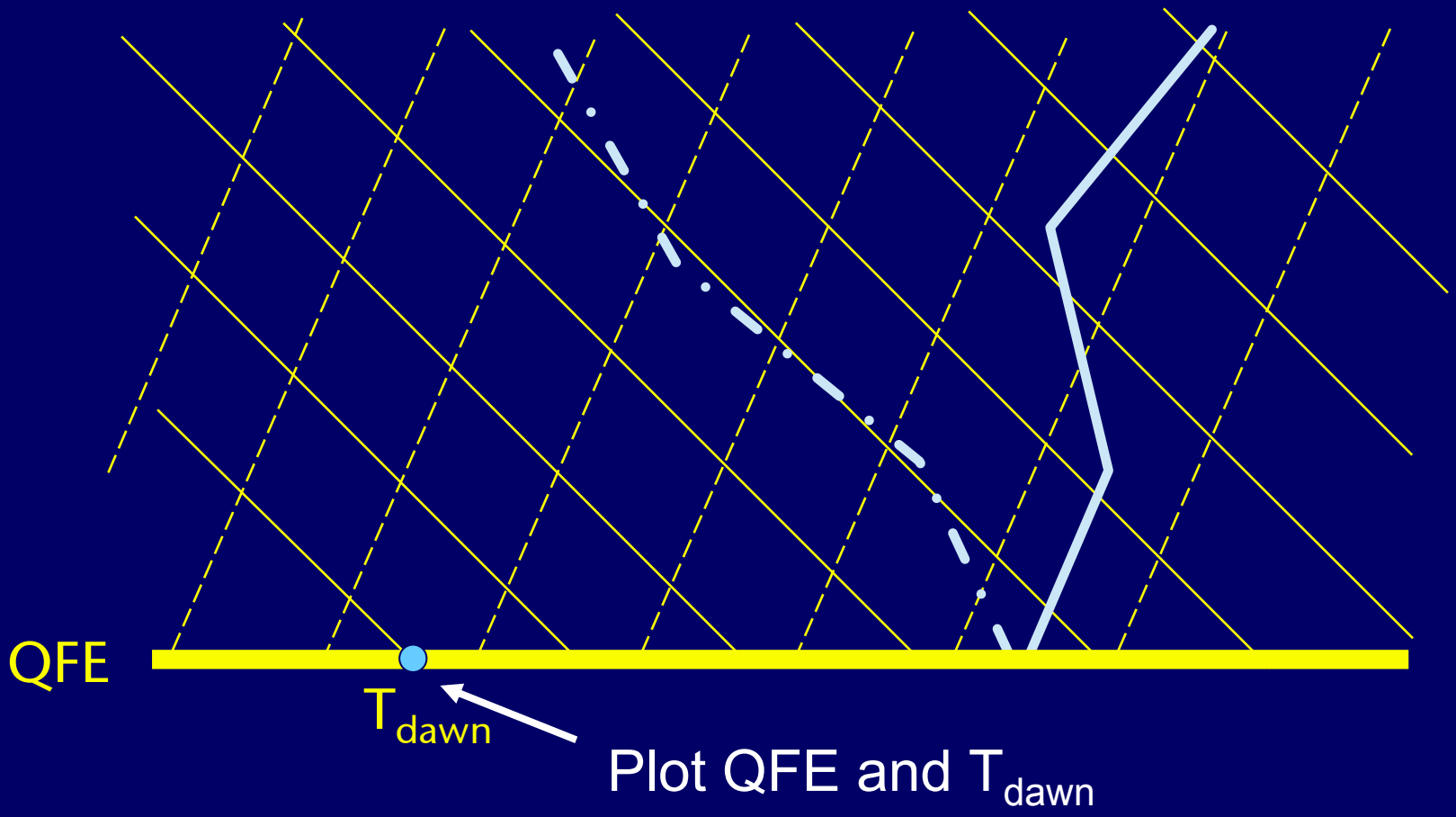
- Increasing wind – lifts into stratus
- Increasing cloud cover – long wave radiation onto the top of the fog (most effective method)
- Advection of drier air – change of air mass or variations within an airmass
- Solar radiation – diurnal clearance.

Solar radiation clearance technique

- Widely used in UK
- Representative ascent
- Usually a midnight or early morning ascent
- Ascent has to be modified for your station's conditions at T_{min}/dawn
- 3 types.

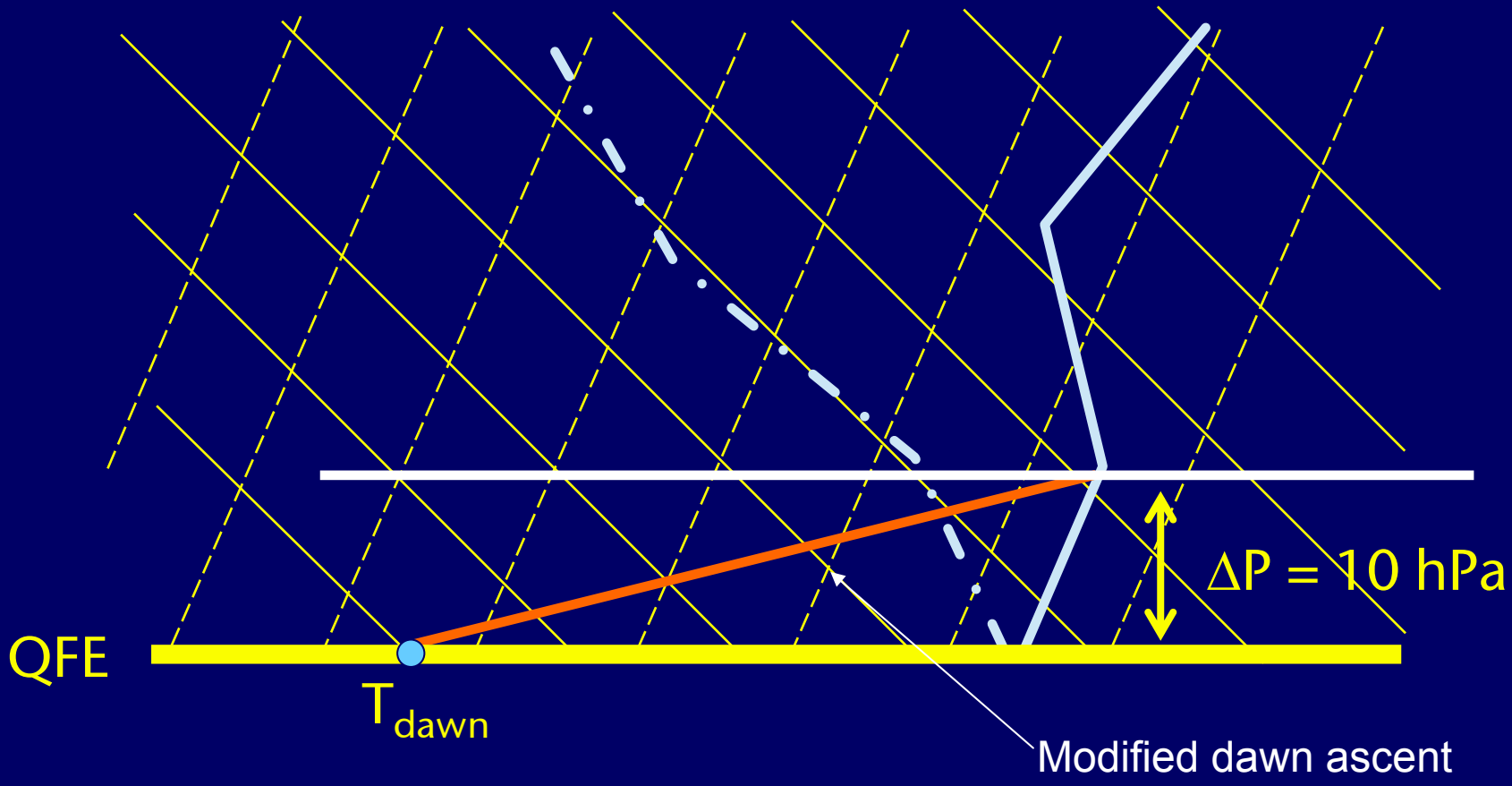
Case A Sky Visible at Station – No inversion on ascent

Representative midnight ascent

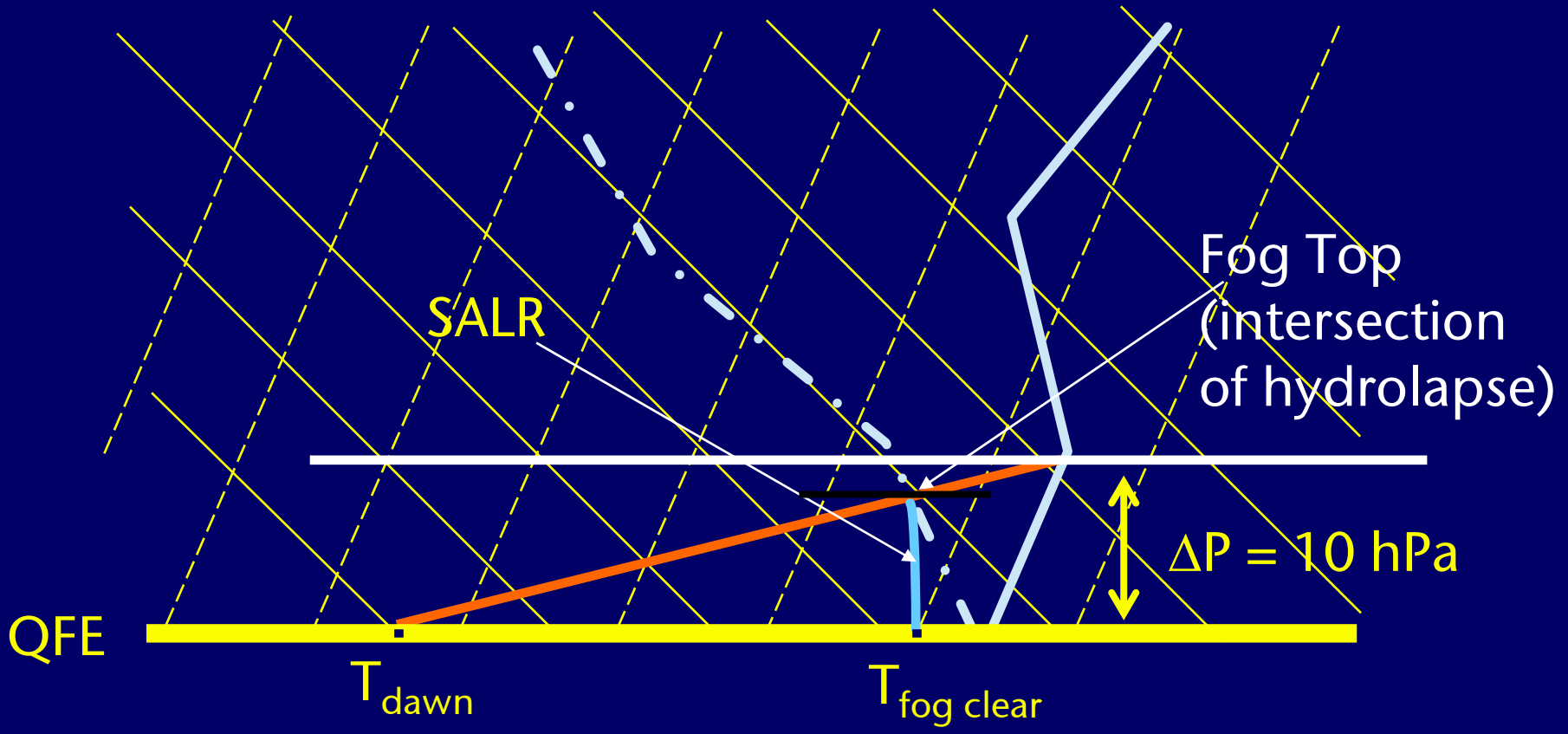


Amend ascent for conditions at dawn

ΔP is assumed to be a universal depth for all seasons and all locations

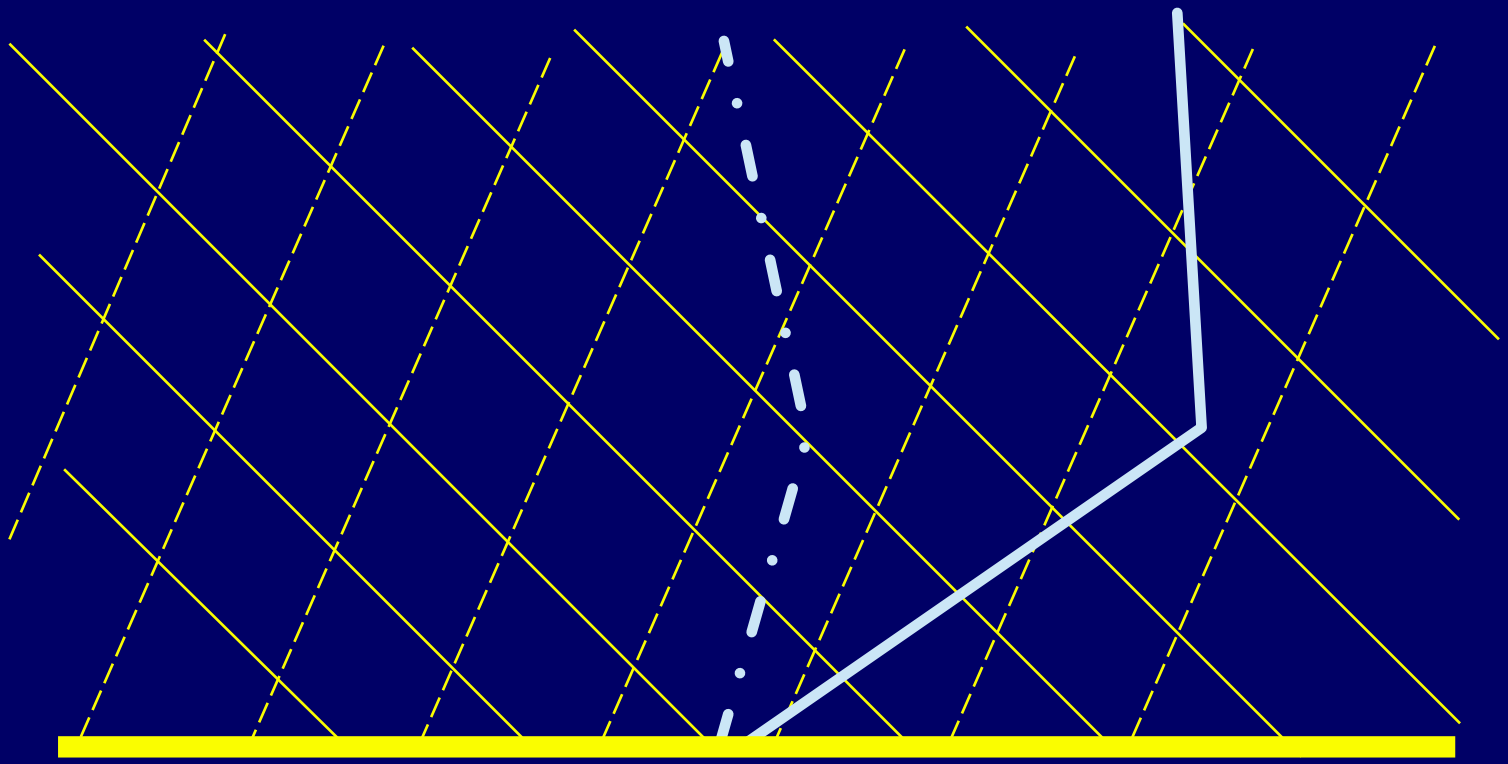


Case A Sky Visible at Station – No inversion on ascent



Case B Sky obscured at station – inversion on ascent

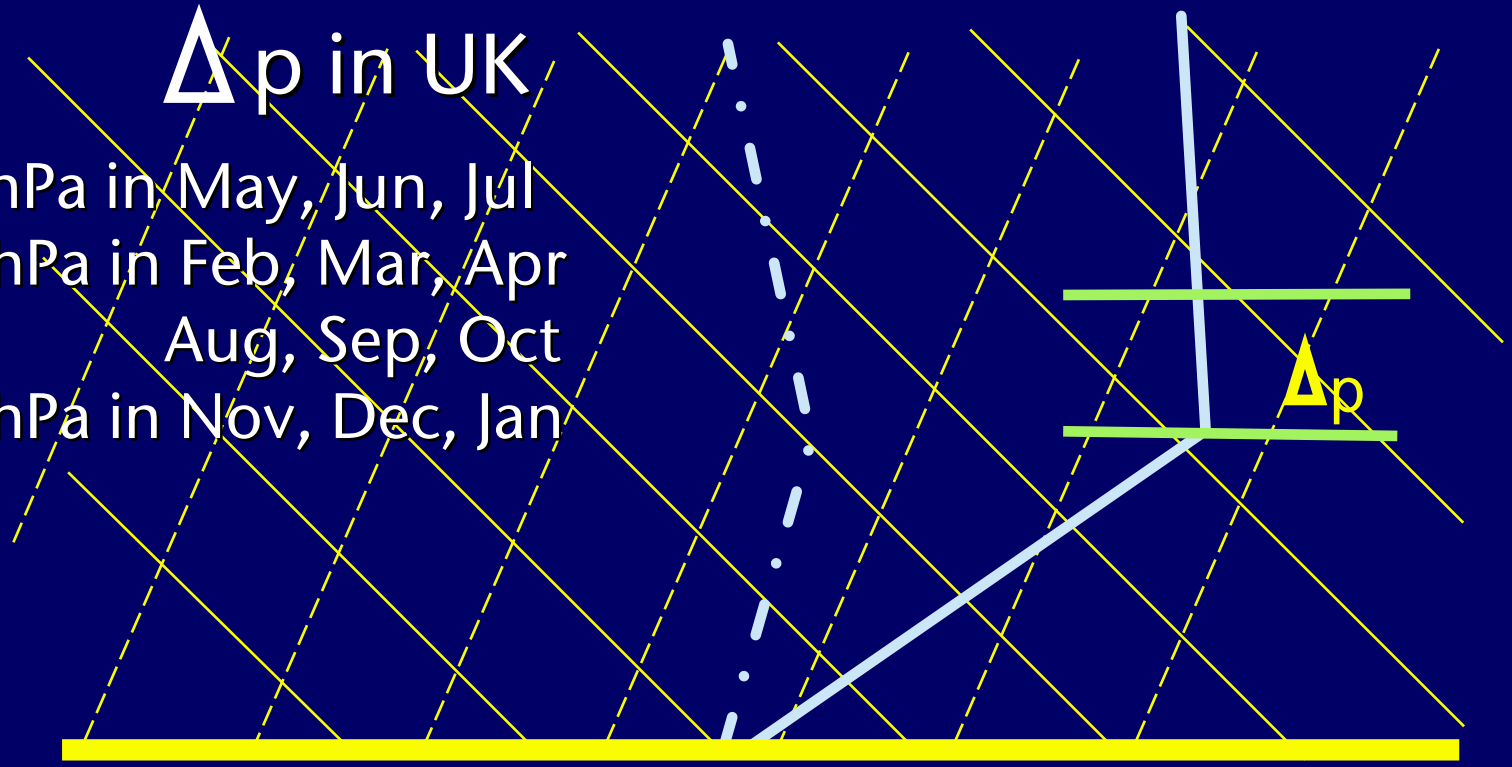
Representative midnight ascent



Add Δp

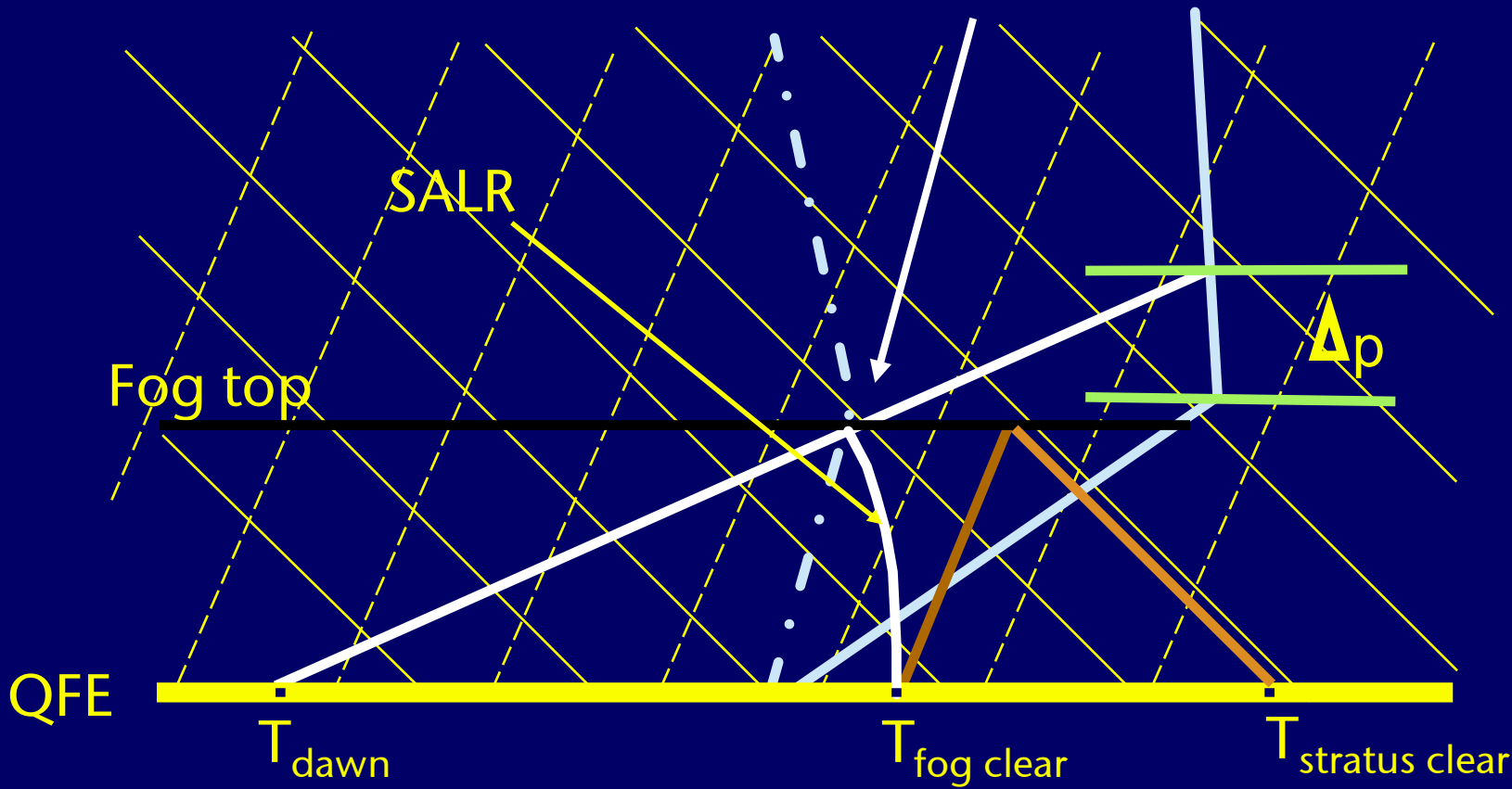
Δp in UK

6 hPa in May, Jun, Jul
12 hPa in Feb, Mar, Apr
Aug, Sep, Oct
18 hPa in Nov, Dec, Jan

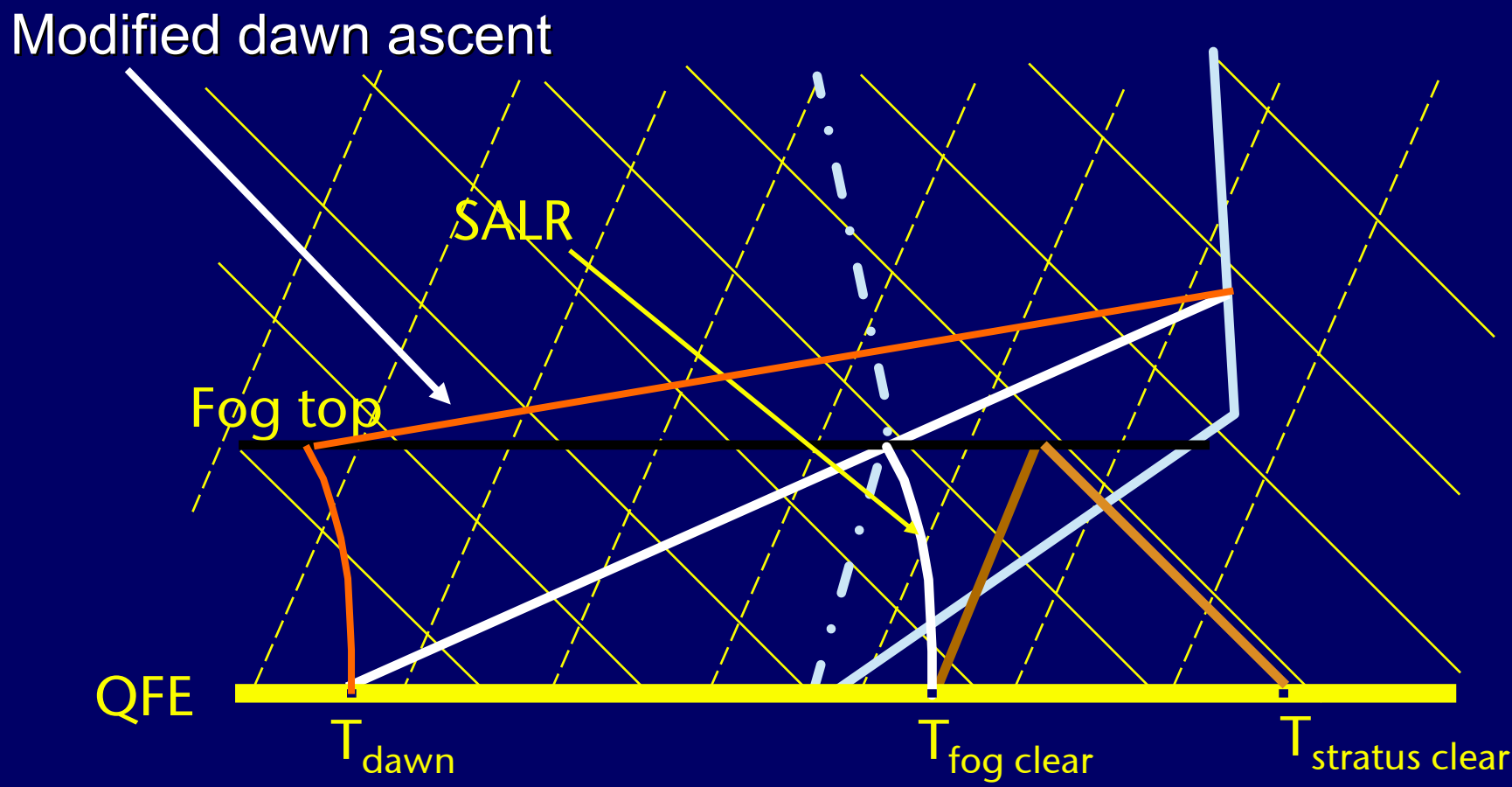


Plot T_{dawn} and determine fog top

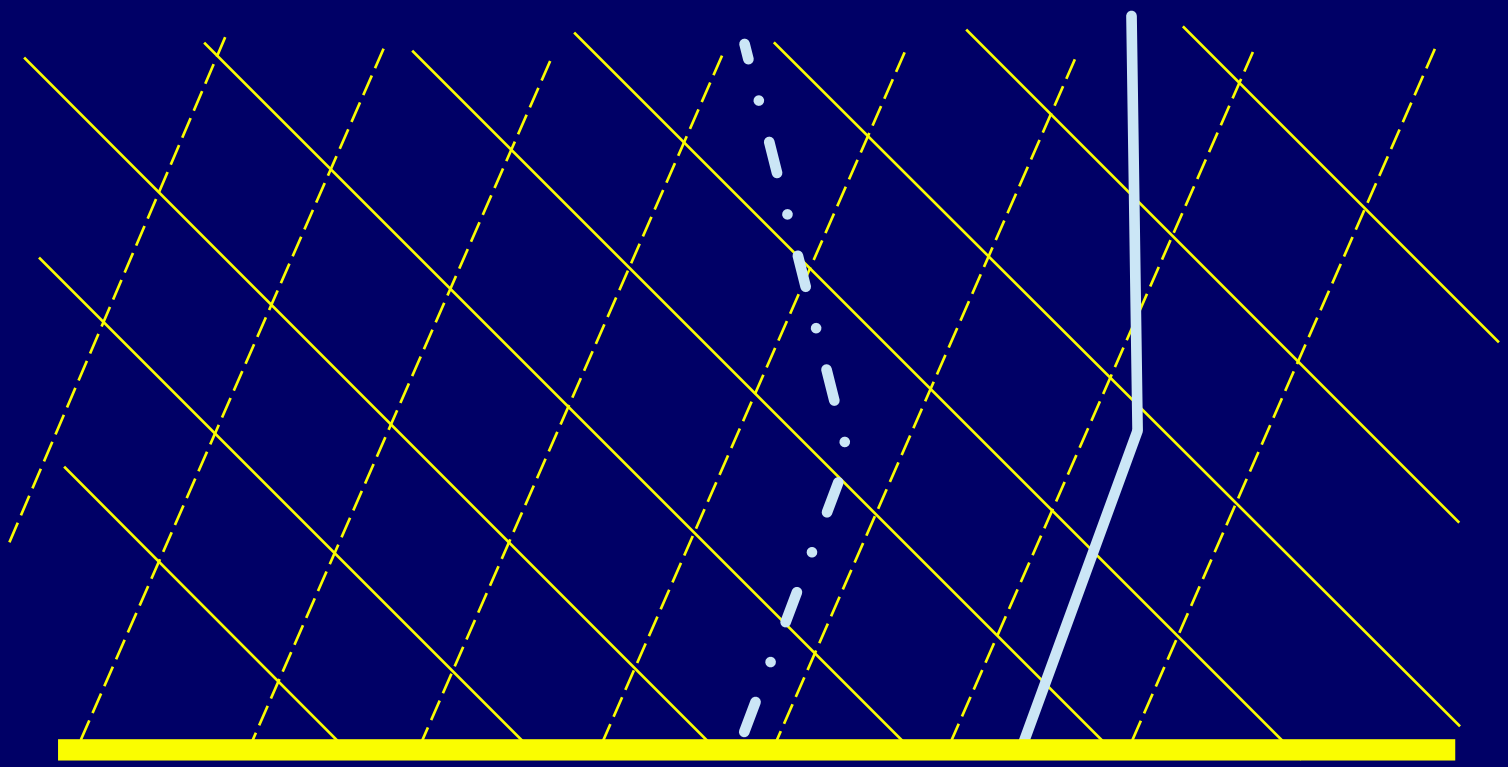
Interception with dewpoint curve



Case B Sky obscured at station – inversion on ascent



Case C Sky obscured at station – no inversion on ascent

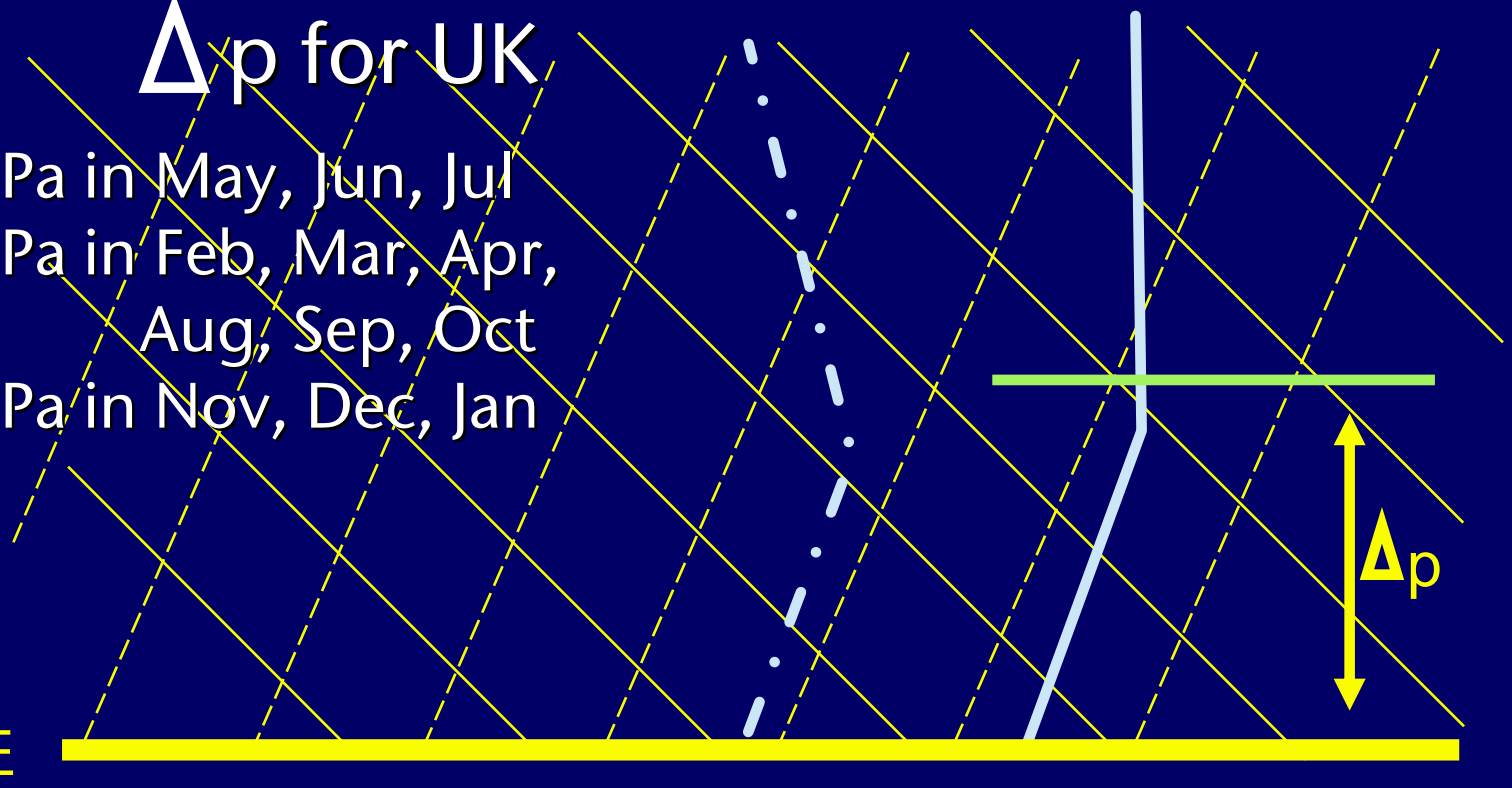


Representative 0000Z ascent

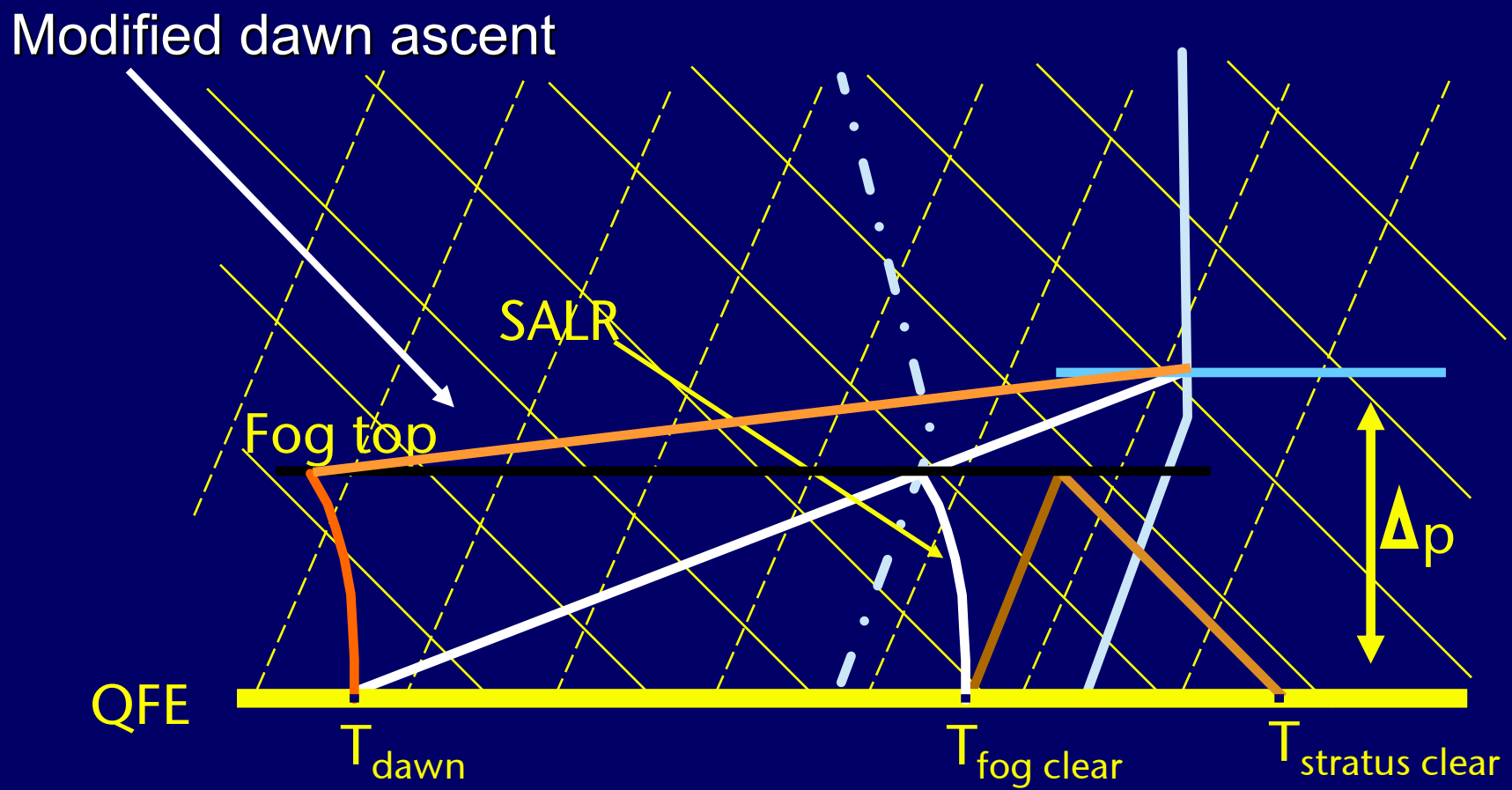
Case C Sky obscured at station – no inversion on ascent

Δp for UK

30 hPa in May, Jun, Jul
35 hPa in Feb, Mar, Apr, Aug, Sep, Oct
40 hPa in Nov, Dec, Jan



Case C Sky obscured at station – no inversion on ascent



Forecasting time of fog clearance

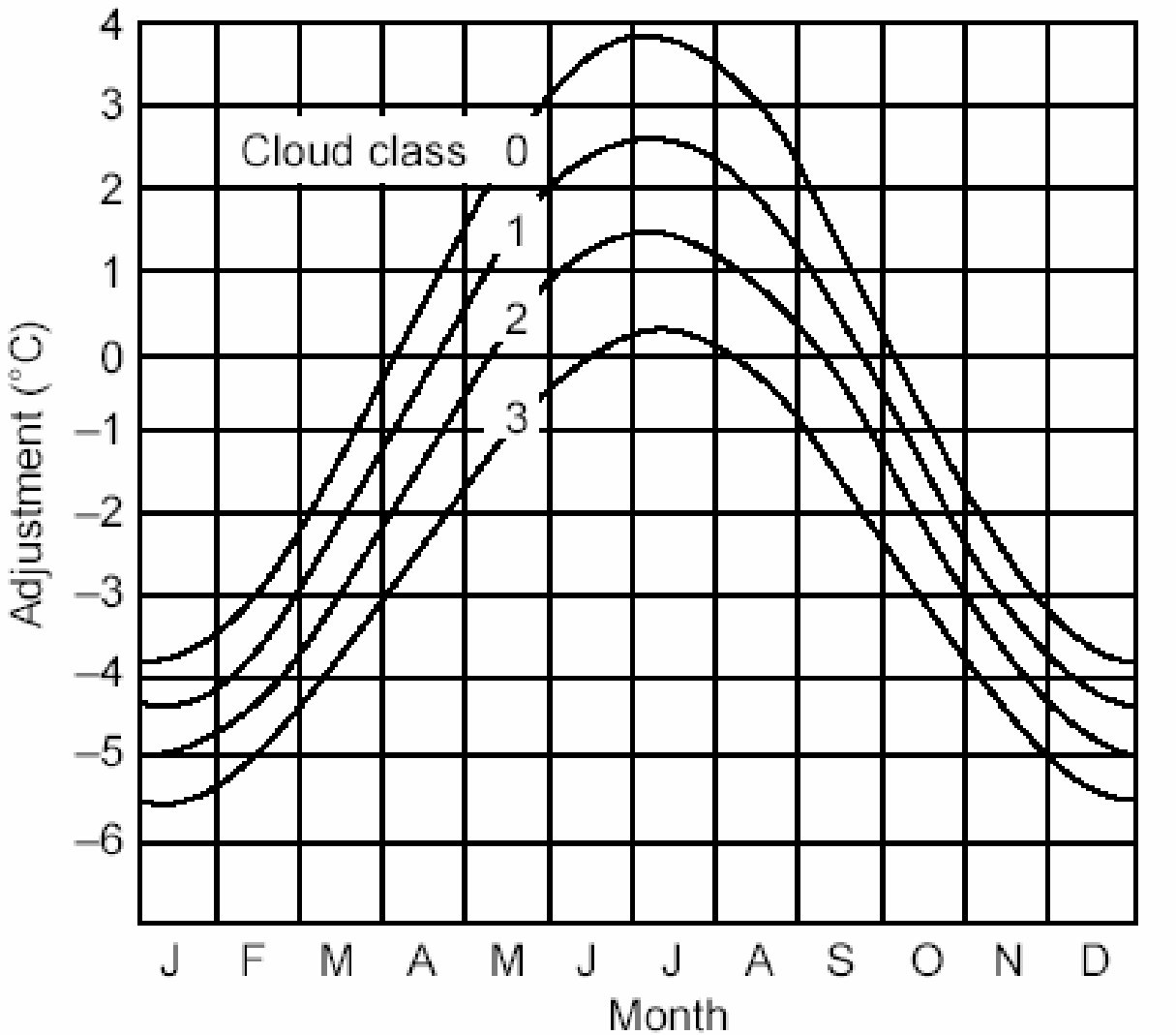
1) Calculate unadjusted Tmax temperature using the formula T_u = -192.65+0156h where h is the 1000-850hPa thickness (in gpm)

2) Adjust T_{max} for persistence of fog using Fig1
- For thick fog (≥10hPa deep) use curve 3
- For thin fog (sky visible) use curve 1

3) Plot temperature rise against time assuming:
- persistence of fog
- straight line connecting T_{min} and T_{max}
- T_{min} = Fog point = sunrise + 1 hour
- T_{max} = 1400 local time

4) Approximate fog clearance time is intersection of calculated fog clearance temperature with straight line

Figure 1: Tmax adjustment graph



FOG CLEARANCE FORECASTING QUIZ

1) What are the 4 primary means of clearing fog?

2) Describe the 3 types of tephigram fog clearance technique

3) What conditions are required for steam fog?

FOG CLEARANCE FORECASTING QUIZ

1) What are the 4 primary means of clearing fog?
ANS: Cloud spreading over top of fog; drier air; increasing wind; solar radiation

2) Describe the 3 types of tephigram fog clearance technique
ANS: Sky visible, no inversion; sky obscured, inversion; sky obscured no inversion

3) What conditions are required for steam fog?
ANS: Polar or arctic air over a comparatively warm sea.

Low cloud