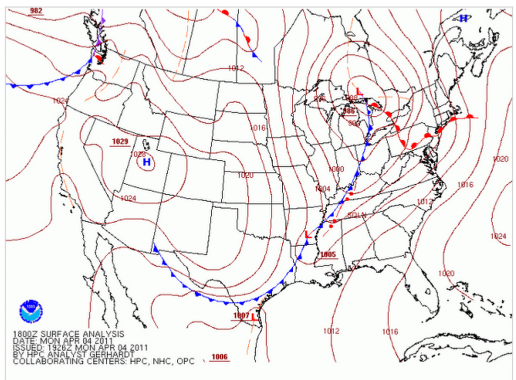
STUDY AID

Reading a Weather Chart

What every mark on the sheet means, what the instruments are telling you, and why there is more than one chart

Capt. Georgia Hilton



A real NWS surface analysis. Brown lines are isobars at 4 mb; blue triangles a cold front, red semicircles a warm front, the two together in purple an occlusion. Every small cluster of figures is one station report. Note 1029 in the western high and 1005 in the low over the Gulf coast.

Chart: NOAA / National Weather Service

A chart is not a picture of the weather. It is a set of measurements, drawn to a convention, and the convention is learnable in an afternoon. This guide takes the surface analysis apart mark by mark, then goes up through the constant-pressure charts to the jet — because the weather you get at sea is decided several miles above your masthead.

The four things this guide will teach you to do.

1. Read a station plot — wind, temperature, dew point, pressure and its trend, from one small cluster of figures.
2. Get a wind speed off the isobar spacing without any instrument at all.
3. Turn a wet and dry bulb into relative humidity, dew point, fog risk and cloud base.
4. Look at the surface chart and the 500 mb chart together and say whether that low is going to deepen or die.

SECTION 1

The surface analysis

Everything that is happening at sea level, at one instant, on one sheet. Start here and work upward.

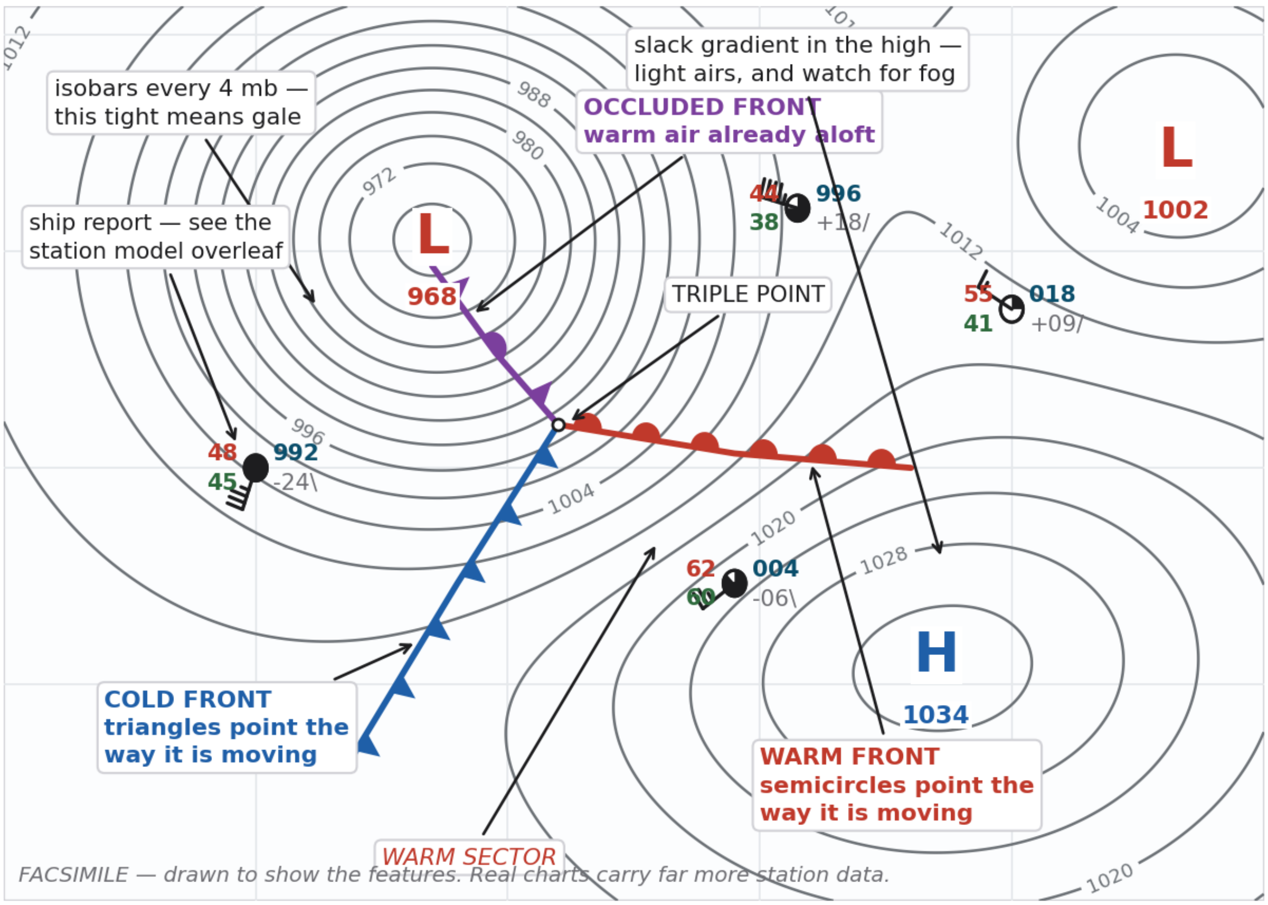


Figure 1 — A surface analysis with the parts named. Drawn as a facsimile so nothing is hidden; a real chart carries far more station data.

The chart is valid for **one moment** — usually 0000, 0600, 1200 or 1800 UTC. Every observation on it was taken at that hour. That is what ‘synoptic’ means and it is the entire reason the chart is worth anything: you are seeing a pattern, not a scrapbook of readings taken at different times.

- **Isobars** — lines of equal pressure, drawn every **4 mb**, reduced to mean sea level so that a station on a hill can be compared with a ship. **Standard sea-level pressure is 1013.25 mb.**
- **H and L** — the centres, with the central pressure printed alongside.
- **Fronts** — blue triangles for cold, red semicircles for warm, purple alternating for occluded, and triangles opposing semicircles for stationary. **On cold, warm and occluded fronts the pips point the way the front is moving.** On a stationary front they oppose each other, because it is not going anywhere.
- **Station plots** — each little cluster is one report, from a ship, a buoy or a coastal station. Section 2 takes one apart.

- **Troughs** — sometimes drawn as a bold dashed line. An elongated area of low pressure with no closed centre. Carries weather out of all proportion to its appearance.

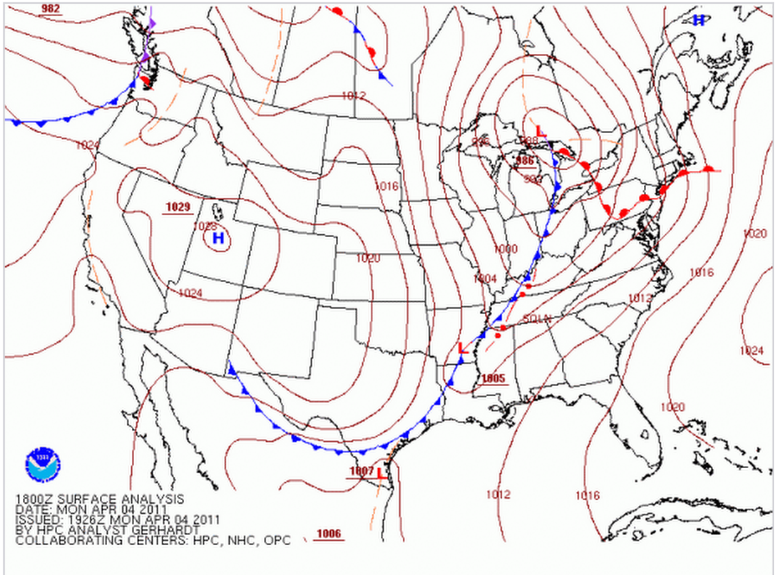


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Chart: NOAA / National Weather Service

Figure 2 — The real thing: an NWS surface analysis. Same grammar, more clutter.

Spacing is the first thing to look at, every time

Before you read anything else, look at how close the isobars are.

Isobars close together = steep pressure gradient = strong wind. You can read that across a room, and it is the single most useful piece of information on the sheet.

The tightest gradient is not always at the centre of the low. It is often on the flank, and frequently just behind the cold front.

SECTION 2

The station model

One small circle, and six separate pieces of information packed round it. Learn the positions once and you never have to think about it again.

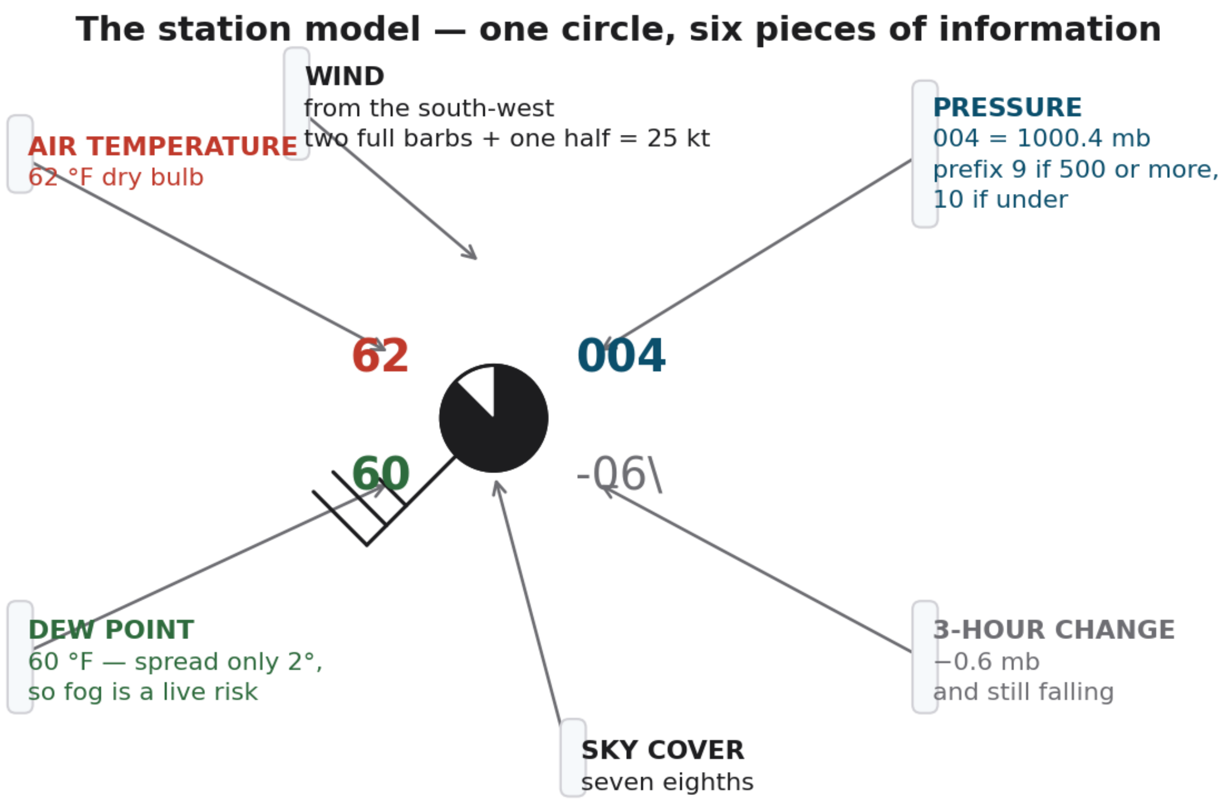


Figure 3 — A single ship report, taken apart. The positions are fixed by convention, so you always know which number is which.

Position	What it is	In the example	What it tells you
Upper left	Air temperature (dry bulb)	62 °F	The air mass you are in
Lower left	Dew point	60 °F	How much moisture is actually there
Upper right	Sea-level pressure, coded	004 = 1000.4 mb	Tenths of a millibar, leading 9 or 10 omitted
Lower right	3-hour change and tendency	–0.6 mb, falling	**The trend — worth more than the reading**
The circle	Sky cover in eighths (oktas)	seven eighths	How much cloud
The shaft	Wind direction and speed	SW at 25 kt	The shaft points into the wind

Decoding the pressure — the one that catches everybody

The chart prints **three digits**, in tenths of a millibar, with the leading 9 or 10 left off. You put it back.

If the three digits are 500 or more, prefix a 9. If under 500, prefix a 10.

So **004** is 1000.4 mb. **982** is 998.2 mb. **247** is 1024.7 mb. **134** is 1013.4 mb.

It works because sea-level pressure essentially never leaves the band 950–1050 mb, so there is only ever one sensible answer.

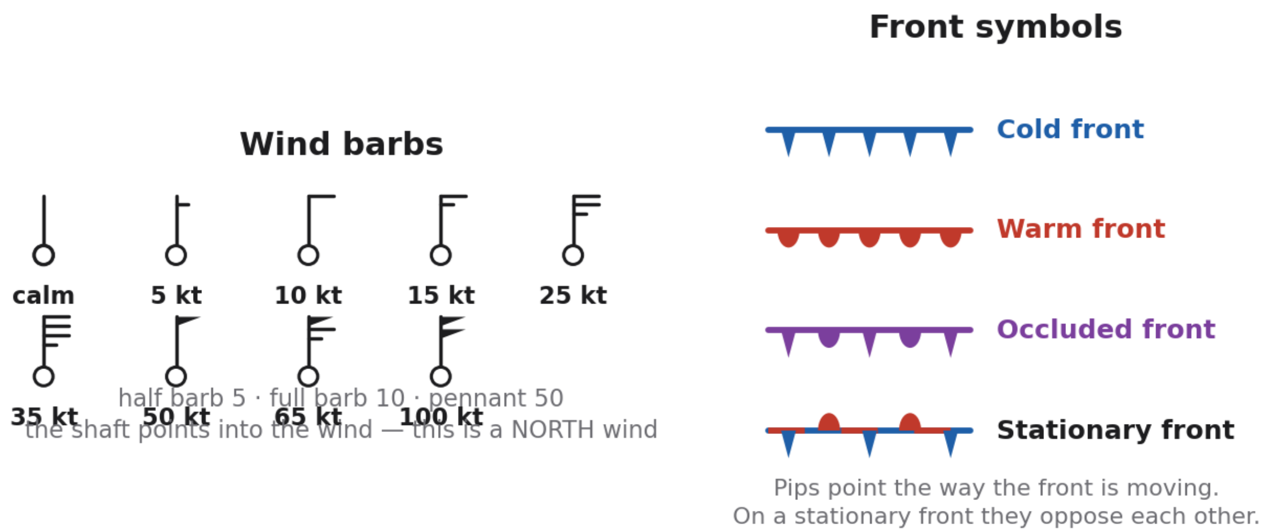


Figure 4 — Wind barbs and front symbols. A half barb is 5 kt, a full barb 10, a pennant 50. Add them up.

The barb shaft **points into the wind** — toward where the wind is coming from, the same convention as a wind vane and the same convention used for naming winds. A shaft pointing north-east is a north-east wind.

Which side do the barbs go on?

Stand at the station and look outward along the shaft — that is, into the wind. In the northern hemisphere the barbs are on your RIGHT.

That side is toward **lower pressure**, which makes it a free cross-check on Buys Ballot every time you look at a plot.

Work it through for a north wind. The shaft is drawn straight up the page and the barbs come off it to the **east**. Now back to that same north wind: you are facing south, and Buys Ballot puts the low on your left — which is east. The two agree.

In the **southern hemisphere** the barbs are drawn on the other side.

SECTION 3

The barometer

The single most valuable instrument on the bridge, and the one most often read carelessly.

Pressure is the weight of the air above you. Near sea level it falls by about **1 mb for every 27 feet (8 metres)** you go up — which is why every reading has to be reduced to sea level before it can be compared with anybody else's.

The corrections, in the order you apply them

- **Index error** — the instrument's own calibration, from the certificate. Check it against a known standard when you can.
- **Height** — reduce to mean sea level. About **1 mb per 27 ft** of height of the instrument above the waterline. On a large ship the bridge may be 100 ft up, which is nearly 4 mb — the difference between an ordinary day and a warning.
- **Temperature** — a mercury barometer needs it because the mercury and the brass scale both expand. An aneroid is compensated but not perfectly.
- **Latitude and gravity** — mercury only, and small, but the tables are there for a reason.

The tendency is worth more than the reading

A barometer showing 1005 mb tells you very little on its own.

A barometer that has fallen **6 mb in three hours** tells you a great deal, and none of it is good.

Log pressure every watch, and log the trend with it — rising, steady or falling, and how fast. The station plot has a whole field devoted to this because forecasters value it that highly.

For tropical revolving storms the thresholds are specific: a corrected reading **3 mb below the seasonal mean** is a warning; a **5 mb fall**, or **3 mb accompanied by high wind**, means act. A **barograph** trace is better than any set of readings, because the shape of the curve is the message.

SECTION 4

Wind speed straight off the isobars

The chart will give you a usable wind speed with nothing but a pair of dividers. This is the most practical skill in the guide.

The pressure gradient force drives air from high toward low. Coriolis bends it until the two balance and the wind runs **along** the isobars — the **geostrophic wind**. The closer the isobars, the steeper the gradient, and the stronger that wind.

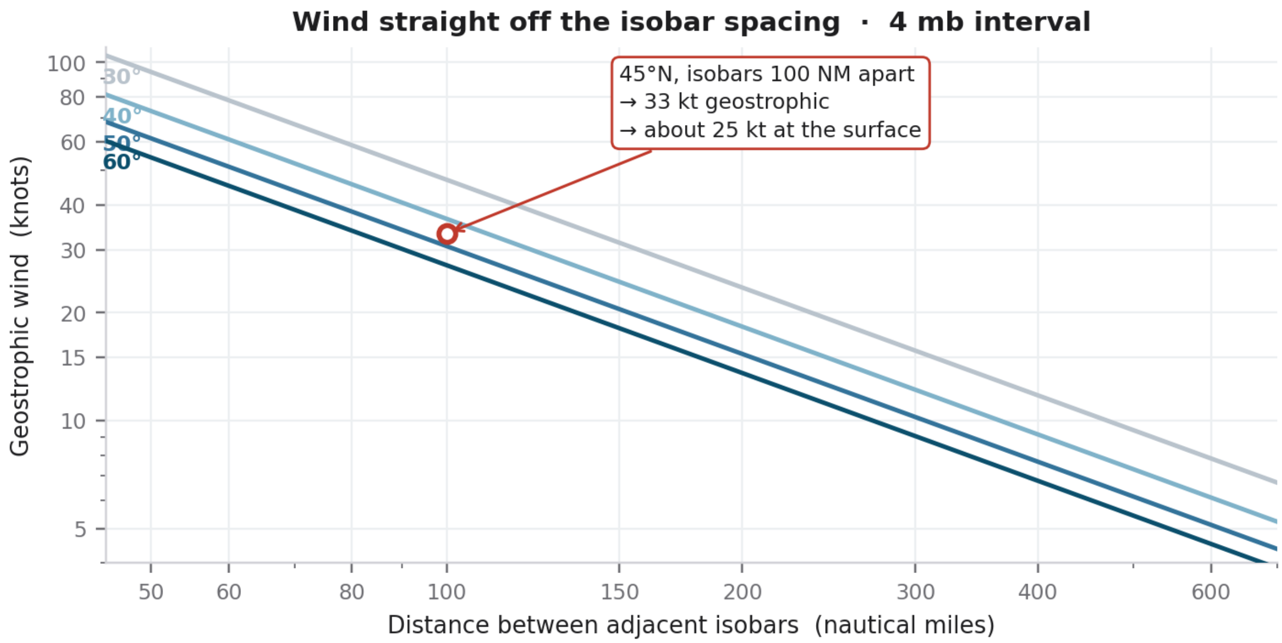


Figure 5 — Geostrophic wind against isobar spacing, for a 4 mb interval. Note how strongly it depends on latitude: the same spacing is far windier in the tropics.

Isobars 4 mb apart	30°N	40°N	50°N	60°N
60 NM	78 kt	61 kt	51 kt	45 kt
100 NM	47 kt	37 kt	31 kt	27 kt
150 NM	31 kt	24 kt	20 kt	18 kt
200 NM	23 kt	18 kt	15 kt	14 kt
300 NM	16 kt	12 kt	10 kt	9 kt
400 NM	12 kt	9 kt	8 kt	7 kt

Geostrophic wind at about 600 m. To get the surface wind, read on.

From the chart to what you will actually feel

Over the sea: the surface wind is about **70–80%** of the geostrophic value, **backed 10–20°** from the isobars. Friction slows it, and a slower wind generates less Coriolis, so it swings inward across the isobars toward the low.

Over land: nearer **50%**, backed **30°**.

Worked example. 45°N, isobars 4 mb apart, measured 100 NM apart. Geostrophic = **33 kt**. Surface = **23–26 kt**, and expect gusts reaching up toward the full 33.

Curvature. Round a **low** the flow is turning, so the real wind is a little **weaker** than geostrophic. Round a **high** it is a little **stronger**. A small tight low is not quite as vicious as its spacing suggests; the edge of a big high is windier than it looks.

Most charts print a **geostrophic wind scale** in the margin — a fan of latitude lines you lay your dividers against. It gives the same answer as the table above, faster. Note that it assumes straight isobars and applies no correction for curvature.

> **Buys Ballot — the chart in your head**
>
> **Northern hemisphere:** back to the wind, the low is on your **LEFT** and slightly **ahead**. **Southern hemisphere:** low on your **RIGHT**.
>
> This is the same physics as the isobars, used backwards. If you can feel the wind you can find the centre, and if you can find the centre you can sketch the isobars. On a passage with no chart at all, Buys Ballot plus the barometric tendency is a workable forecast.

SECTION 5

Dry bulb, wet bulb and dew point

Two thermometers, one of them wearing a wet sock. It sounds primitive. It is also how you know fog is coming.

A **psychrometer** is two identical thermometers side by side. One is bare — that is the **dry bulb**, and it reads plain air temperature. The other has a wet muslin wick round it — the **wet bulb**. Water evaporating off the wick takes latent heat with it and cools that thermometer down.

How much it cools is the measurement. In dry air, evaporation is fast, the cooling is strong, and the wet bulb reads far below the dry. In saturated air nothing can evaporate, so there is no cooling at all and the two read the same. The difference between them — the **wet-bulb depression** — is a direct measure of how far the air is from saturation.

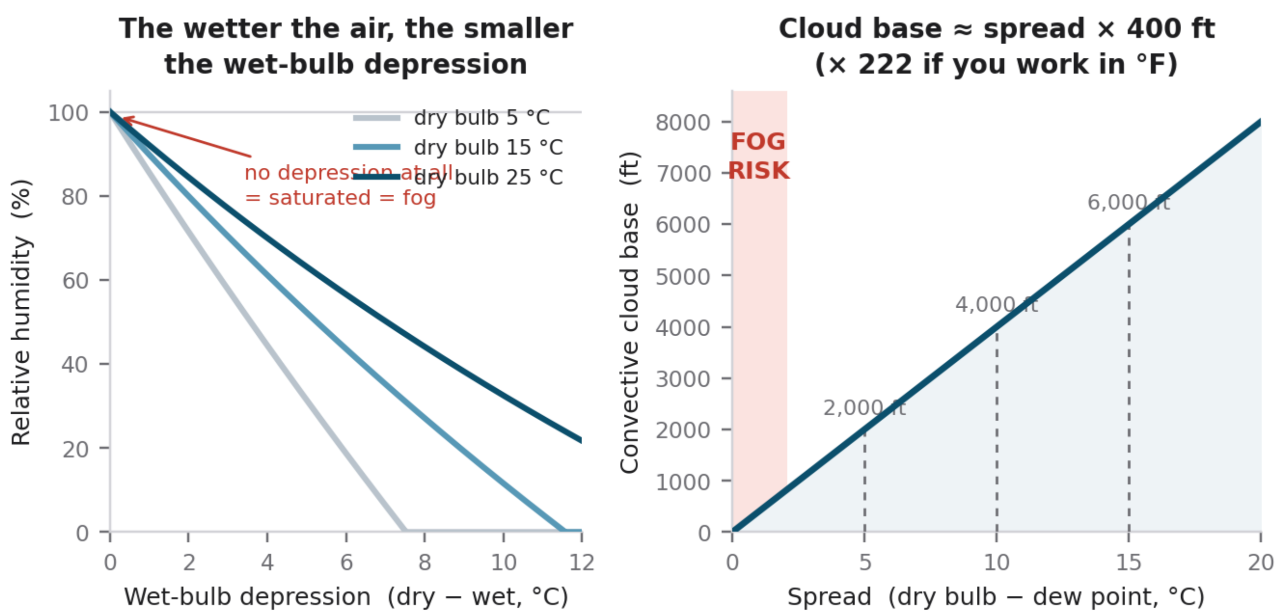


Figure 6 — Left: relative humidity falls away fast as the wet-bulb depression grows. Right: the spread between air temperature and dew point gives you a cloud base, and warns you about fog.

The three numbers, and what each is actually for

- **Relative humidity** — the percentage of the moisture the air *could* hold at its current temperature. Read it off a psychrometric table with the dry bulb and the depression. Useful, but treacherous on its own: RH changes when the temperature changes even though not one molecule of water has moved.
- **Dew point** — the temperature the air must be cooled to before it saturates. **This is the honest measure of how much water is actually there**, because it does not move when the temperature moves. Two air masses with the same RH and different dew points are not the same air at all.
- **The spread** — dry bulb minus dew point. This is the one you act on.

Wet-bulb depression	What the air is doing	What to expect
0 °C — the two read the same	Saturated. RH 100%	You are in fog or cloud, or about to be
1–2 °C	Very close to saturation, RH about 85–90%	Fog risk overnight, or on any further cooling
3–5 °C	Damp, RH roughly 60–75%	Low cloud, drizzle, poor visibility in rain
6–10 °C	Moderately dry, RH roughly 25–50%	Cumulus with a decent base; comfortable
Over 10 °C	Dry, RH under about 25%	High bases, good visibility, dust and haze over land

That table is for air near 20 °C — and the temperature matters a lot

The **same depression means drier air when the air is colder**, because cold air holds so much less water to begin with. A 6 °C depression is about **50%** RH at 20 °C, about **44%** at 15 °C and about **34%** at 10 °C. Rough correction: at 10 °C take **15 to 20 points off** the figures above; at 30 °C add five to ten.

There is also a **ceiling on the depression itself**, set by completely dry air — about 6 °C in air at 0 °C, 9.5 °C at 10 °C and 11.7 °C at 15 °C. **In air below about 12 °C a depression over 10 °C is not physically possible**, so if you read one, check the wick, the ventilation and the thermometer before you believe it.

Use the printed psychrometric tables for anything that matters. The bands above are for orientation, not for a log entry.

Two things the spread buys you

FOG. Watch the dry bulb and the dew point converge. When the spread closes to about **2 °C and still shrinking**, you are running out of margin — and if the air is warm and moist and the water under you is cold, that is advection fog and it will not burn off in the morning. This is a forecast you can make an hour ahead with nothing but two thermometers.

CLOUD BASE. For convective cloud, the base is roughly **spread × 400 ft** with the spread in °C, or **spread × 222 ft** in °F. A rising parcel cools at about 3 °C per 1,000 ft while its dew point falls at only about 0.5, so the gap closes at 2.5 °C per 1,000 ft — 400 ft per degree. A 10 °C spread puts the cumulus base near 4,000 ft.

On a ship the psychrometer is usually whirled or aspirated to force air over the wick — a **still** wet bulb does not evaporate fast enough and reads too high, which gives too small a depression — so the air looks **moister** than it is and the fog risk looks worse than it is. Read the wet bulb *first* and quickly, before the wick dries out.

SECTION 6

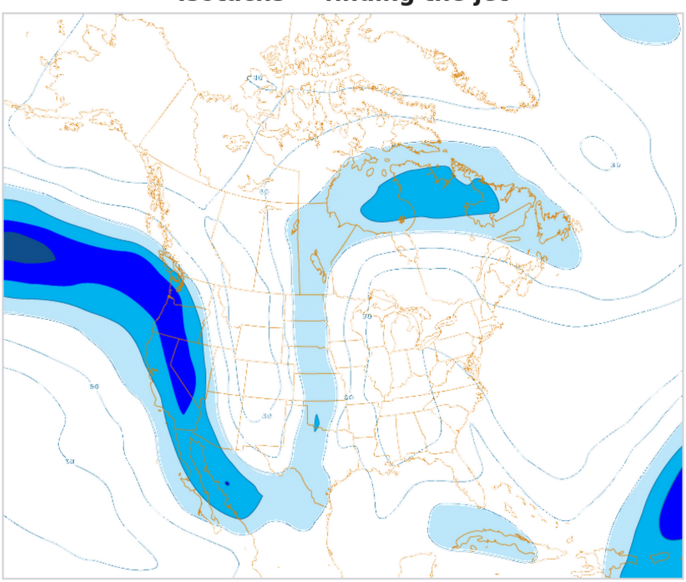
Up the stack — the constant-pressure charts

The surface chart tells you what is happening. The charts above it tell you what happens next.

Above the surface, meteorologists stop drawing maps at fixed heights and start drawing them at fixed **pressures**. It sounds backwards until you see why: pressure is what a balloon actually measures, and the equations of motion come out far cleaner in pressure coordinates.

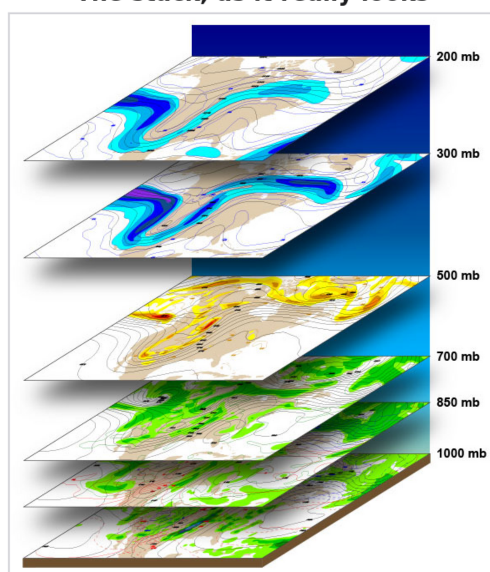
> ### The idea that makes all of it click
>
> **You are not mapping pressure on these charts. You are mapping the HEIGHT of a pressure surface.**
>
> The 500 mb surface is not flat. It sits near 18,000 ft, but it bulges up over warm air and sags down over cold air, because warm air is less dense and takes more vertical distance to produce the same weight above you.
>
> So **low heights mean cold air, high heights mean warm air** — and the height contours behave *exactly* like isobars. Close together means strong wind. The wind blows along them, low heights on the left in the northern hemisphere. Everything you learned about the surface chart transfers straight up.
>
> Heights are contoured in **decametres**: 5640 on the chart means 5,640 metres, often written as 564.

Isotachs — finding the jet



wind SPEED contoured, not direction · the shaded cores are the jet — 70 kt or more

The stack, as it really looks



1000 to 200 mb, one above the other same weather, six different questions

Chart: NOAA / National Weather Service

Figure 7 — The jet found by contouring wind speed, and the stack of charts it sits at the top of.

Level	Height	What it is for
Surface	sea level	MSLP analysis. Fronts, isobars, actual wind. The weather you will get
1000 mb	about 360 ft	Effectively the surface. Paired with 500 mb to give **thickness**
925 mb	about 2,500 ft	The boundary layer. Low-level jet, and the moisture being fed into a system
850 mb	about 5,000 ft (3,800–5,200)	**Above friction.** The air mass without the ground interfering. Temperature advection, the freezing level
700 mb	about 10,000 ft (7,700–10,500)	**Moisture and vertical motion.** Where the cloud and the rain are actually made
500 mb	about 18,000 ft (16,000–20,000)	**The steering chart.** Troughs, ridges, vorticity. Half the atmosphere's mass is below it
300 mb	about 30,000 ft (27,000–32,000)	**The jet in winter.** Sits poleward of the 200 mb jet
250 mb	about 34,000 ft	The jet, and the divergence aloft that deepens surface lows
200 mb	about 39,000 ft (35,000–41,000)	**The jet in summer and the tropics.** The subtropical jet shows here, and is weak or absent at 300

Two labels worth getting right

There is no 750 mb chart. The mandatory levels are 1000, 925, 850, **700**, 500, 400, 300, 250, 200, 150 and 100 mb. NOAA's own teaching set is 850, 700, 500, 300 and 200. If you meet ‘750’ in a set of notes, it means 700.

1013 mb is not a chart, it is a value — standard sea-level pressure, 1013.25 mb, the reference every surface reading is compared against. The chart nearest the surface is the **1000 mb** chart, and the surface analysis itself is drawn in mean sea-level pressure rather than at a constant pressure at all.

SECTION 7

850 and 700 — the air mass, and where the weather is made

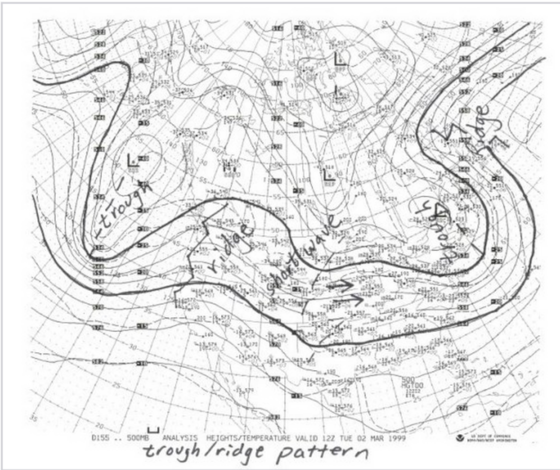
Low enough to matter to you, high enough to be honest.

850 mb, about 5,000 ft. This is the first level that is properly clear of surface friction, sea breezes, night-time inversions and local terrain. Look here for the **real** temperature of the air mass, and for **temperature advection** — whether warm or cold air is being carried into your area.

You read advection off the angle between the wind barbs and the isotherms. Wind blowing across the isotherms from warm toward cold is **warm air advection** (WAA): warm air is being pushed in on top of colder, denser air, so it has to rise, and rising air means cloud and rain. Wind blowing from cold toward warm is **cold air advection** (CAA): sinking, drying, clearing. If the wind runs parallel to the isotherms there is no advection at all.

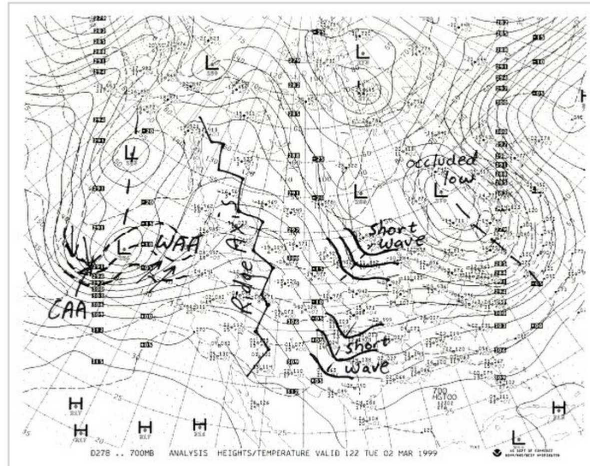
700 mb, about 10,000 ft. This is the level NOAA describes as where you go looking for ‘both moisture and vertical motion to find and forecast precipitation’. Most of the cloud and rain in a mid-latitude system lives in this layer. Charts often shade relative humidity here, and plot **omega** — vertical motion — with rising air negative and sinking air positive.

500 mb — the steering chart



heights in decametres · trough, ridge and shortwave marked in pen

700 mb — where the weather is made



the same hour, lower down · WAA and CAA are warm and cold air advection

Chart: NOAA / National Weather Service

Figure 8 — The same hour at two levels, annotated by hand. Note WAA and CAA marked on the 700 mb chart, and the trough, ridge and shortwave axes on the 500.

A rule that is worth the price of the whole guide

Warm advection = rising air = cloud and precipitation.

Cold advection = sinking air = clearing.

And there is a version of it you can use at sea with no chart: **northern hemisphere**: if the wind **veers with height**, that is warm advection; if it **backs with height**, cold advection. Watch the low cloud against the high cloud — if the upper cloud is moving clockwise of the surface wind, warm air is on the way.

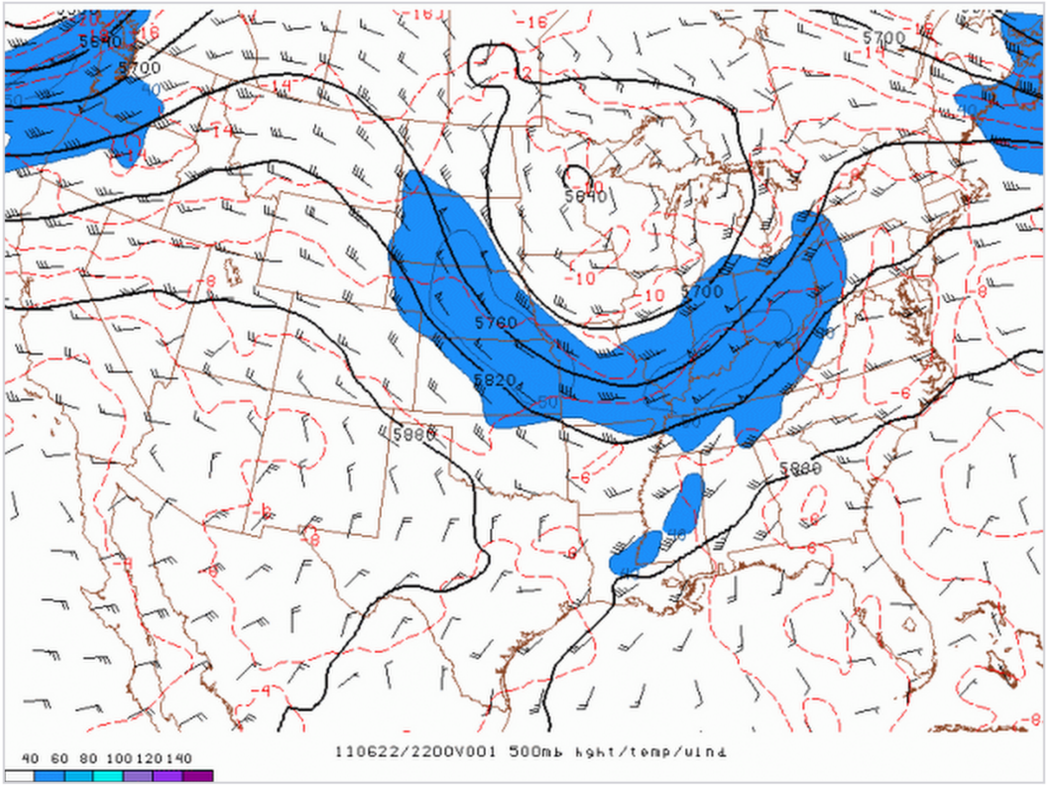
This one reverses in the southern hemisphere. Below the equator **backing** with height is warm advection and **veering** is cold. It falls out of the thermal wind relation, whose sign follows the Coriolis parameter — and that changes when you cross the line.

SECTION 8

500 mb — the steering chart

If you were allowed only one upper chart, this is the one. NOAA calls it the mainstay of the upper air charts, and forecasters look at it before they look at anything else.

500 mb sits near 18,000 ft, and it is the middle of the atmosphere in the only sense that matters: **half the atmosphere's mass is below it**. The flow at this level is smooth, broad and slow to change, and it is what carries the surface systems along underneath.



500 mb heights (black, decametres), temperature (red, °C) and wind barbs, with the strongest winds shaded.
The 5640 and 5700 lines are labelled — this is the 564 and 570 decametre contour. Cold air sits under low heights.

Chart: NOAA / National Weather Service

Figure 9 — A 500 mb analysis: heights in black, temperature in red, wind barbs, strongest winds shaded. Cold air sits under the low heights.

- **Troughs** — where the contours dip toward the equator. Cold air, rising motion downstream, and the surface weather. **The greatest storminess is found downstream of the trough axis** — east of it in westerly flow, which is why it is usually described as lying to the right of the trough on the printed chart.
- **Ridges** — where the contours bulge poleward. Warm air, sinking motion, settled weather. A ridge sitting over a surface low will kill it.
- **Shortwaves** — small ripples running through the larger pattern, easy to miss and responsible for a great deal of weather. Precipitation is most likely **downstream of — ahead of — the shortwave axis**, which in westerly flow means east of it.
- **Vorticity** — spin. It comes from three things: **shear** (wind speed changing across the flow), **curvature** (the flow turning), and the earth's own rotation. Positive vorticity being carried into an area means rising air and developing weather.
- **Height falls and rises** tell you where the troughs and ridges are going next.

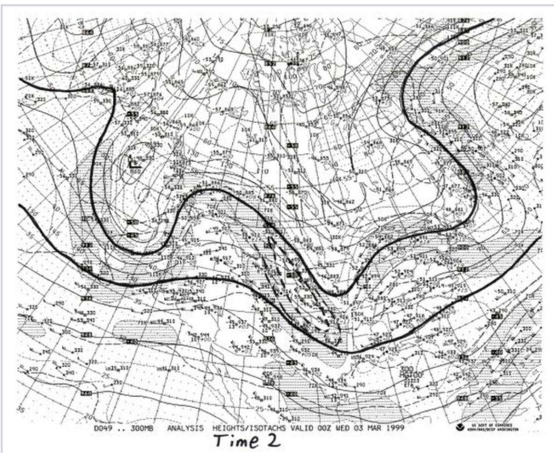
SECTION 9

The jet — 300, 250 and 200 mb

The engine room. Surface lows do not deepen because they feel like it; they deepen because something above them is taking air away.

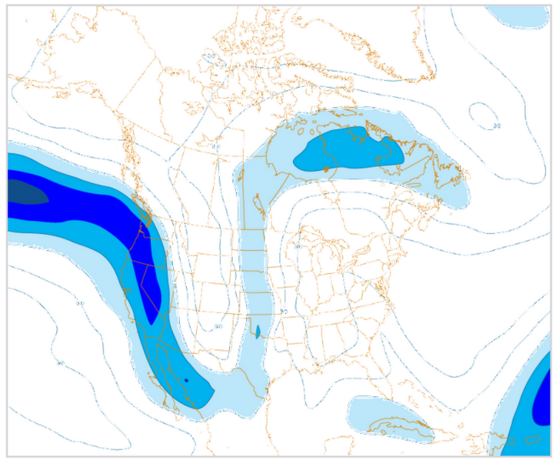
The jet is found by contouring **wind speed** rather than direction — those contours are **isotachs**, and the NWS calls it a jet where the wind reaches **70 kt or more**. Which chart you use follows the season and the jet you are after: **300 mb in winter**, when the polar jet is lower and stronger; **200 mb in summer and in the tropics**, where the subtropical jet sits higher and is weak or absent at 300. **250 mb** splits the difference and is the common operational choice.

300 mb — heights and isotachs



the heavy pen traces the jet core
same case as the 500 and 700 charts

the same idea, in colour



isotachs shaded · 70 kt or more is a jet

Chart: NOAA / National Weather Service

Figure 10 — A 300 mb analysis with the jet core traced by hand, from the same March 1999 case as Figures 8 and 9 — and the same information rendered in colour. Isotachs, not isobars: these contours are wind SPEED.

Why a mariner should care about a chart at 34,000 ft

A surface low can only keep deepening if air is being removed from the column above it **faster than it is being supplied below**. That removal is **divergence aloft**, and it happens in specific places relative to the jet core — particularly ahead of an upper trough.

So the jet chart is where you find out whether the gale in your forecast is going to be a gale or a storm.

Find the jet and you have found the storm track. Depressions form under it, run along it, and deepen beneath the **divergent quadrants of a jet streak** — the right-hand side of the entrance, where the flow accelerates, and the left-hand side of the exit, where it slows. The **left exit** is the classic cyclogenesis position.

SECTION 10

Thickness, and reading the charts together

Two charts subtracted from one another give you a third piece of information neither one contains.

Thickness is the vertical distance between two pressure surfaces — almost always **1000 mb to 500 mb**. Because warm air is less dense and takes more vertical distance to produce the same weight, **thickness is a direct measure of the mean temperature of the lower half of the atmosphere**. It is drawn as dashed contours in decametres.

- **Low thickness = cold column. High thickness = warm column.**
- The **5400 m (540 dam)** line is the classic rain-or-snow divider over the sea in temperate latitudes. Below it, precipitation is likely to fall as snow; above, as rain. Over land and at height the working figure shifts, and 5,460 m is often used near coasts — check what your own service uses.
- Thickness contours packed together mean a strong temperature gradient through the whole lower atmosphere — which is exactly where depressions are born, and where the jet runs overhead.

The single most useful thing you can do with two charts

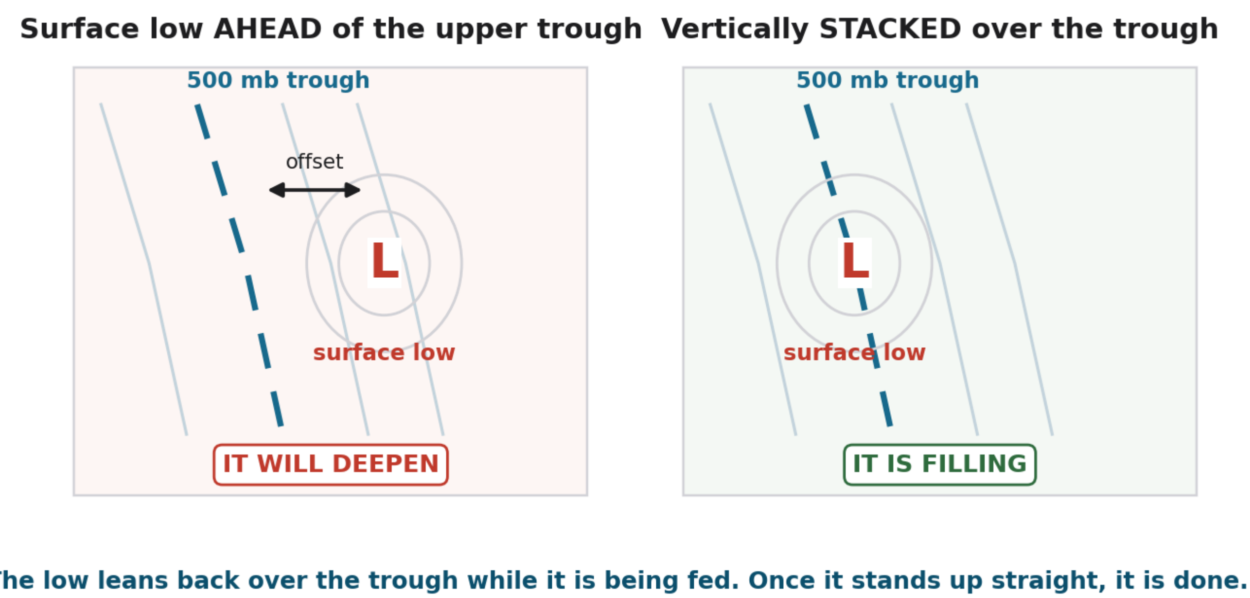


Figure 11 — Where the surface low sits relative to the upper trough tells you whether it is growing or dying.

Will it deepen, or is it done?

Surface low displaced downstream of the 500 mb trough — the system leans back with height. Divergence aloft is over the surface centre, pulling air out of the column. **It will deepen.**

Surface low vertically stacked under the 500 mb low — the system is standing up straight. The upper support is no longer displaced, nothing is removing mass, and the warm air has usually already occluded away. **It is filling.**

This one comparison, made in ten seconds with two charts side by side, will tell you more about the next thirty-six hours than any amount of staring at the surface analysis alone.

A reading order that works

- **1. 500 mb first.** Where are the troughs and ridges? Which way is the flow steering things? Is it a broad slow pattern or a fast zonal one?
- **2. The jet.** Where is the core, and is there divergence over anything that matters to you?
- **3. 700 mb.** Where is the moisture and where is the air rising?
- **4. 850 mb.** Warm or cold advection over your position?
- **5. Surface last.** Now the isobars and fronts mean something, because you know what is driving them and where they are going.
- **6. Your own barometer and psychrometer.** They are the only observations you have that are certainly correct, certainly current, and certainly about where you actually are.

SECTION 11

Where to get the charts

All of it is free, and most of it is produced by people who would rather you used it.

- **Ocean Prediction Center — ocean.weather.gov**. Surface analyses and forecasts for the Atlantic and Pacific, wind and wave charts, and the high-seas text forecasts. This is the mariner's page.
- **Weather Prediction Center — wpc.ncep.noaa.gov**. Surface analyses and short-range forecast charts.
- **NOAA JetStream — noaa.gov/jetstream**. A free online school of weather, with a whole section on constant-pressure charts. If one link in this guide is worth following, it is this one.
- **NWS Education — weather.gov/education**. The National Weather Service's teaching portal — classroom material, explainers and training aimed squarely at instructors.
- **National Hurricane Center — nhc.noaa.gov**. Tropical advisories, wind radii, and the forecast cone.
- **captaingeorgia.com** — the live NOAA surface analysis is posted there, so you can pull today's chart without hunting for it.
- **NWS radiofax schedules** — still broadcast, still worth having a receiver for, and still working when the satellite terminal is not.

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SECTION 12

Worked example — a weather report for the bridge

Real charts, a real position, a real morning. Everything above this point was method; this is the method used.

The problem

Your ship: a merchant vessel at **36°30′N 073°30′W** — about 80 NM east-south-east of Cape Henry, in the Chesapeake approaches.

The time: 1500Z Thursday 13 August 2026, which is 1100 local.

What you have: the WPC surface analysis for 1500Z, three WPC forecast charts for 00Z, 06Z and 12Z Friday, and a 500 mb chart.

What the master wants: the weather for the next 24 hours, in English, on one page, with a recommendation.

Step 1 — Put yourself on the chart

Nothing else works until you have done this. Find your position, then look at what is within about 300 miles of it in every direction — because that is what will reach you inside a day.

1500Z THU 13 AUG 2026 · WPC surface analysis · the situation now

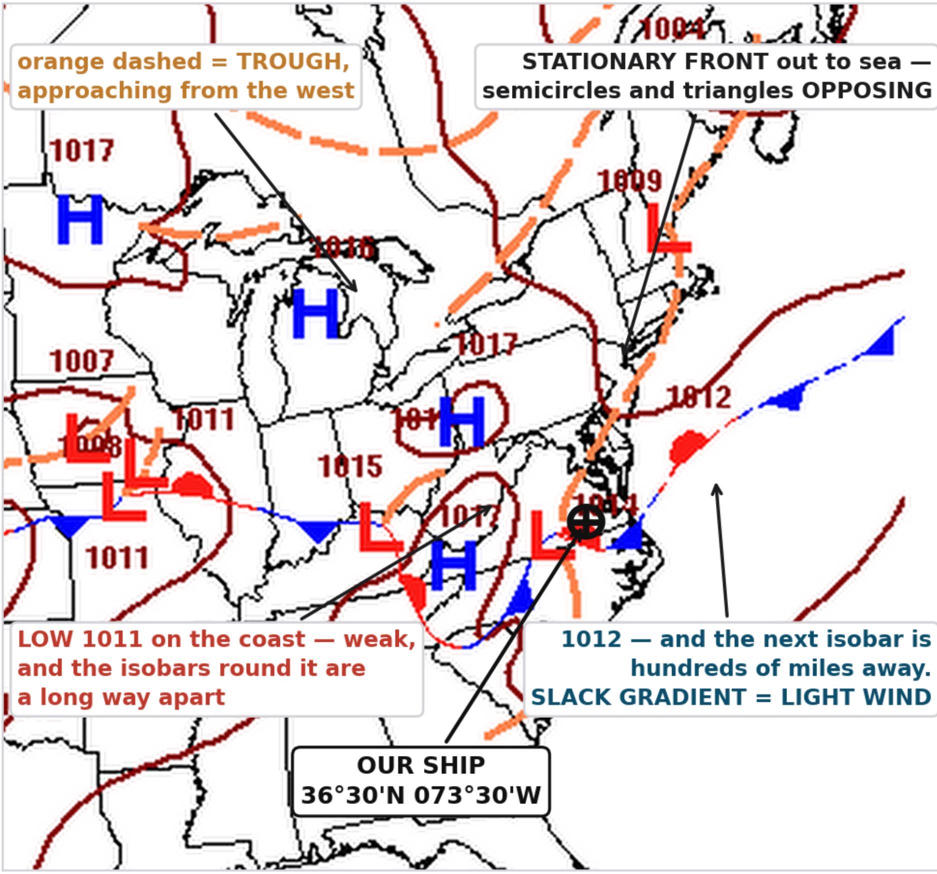


Chart: NOAA / NWS Weather Prediction Center

Figure 12 — The 1500Z analysis, with the ship marked. Read outward from your own position, not inward from the biggest feature on the sheet.

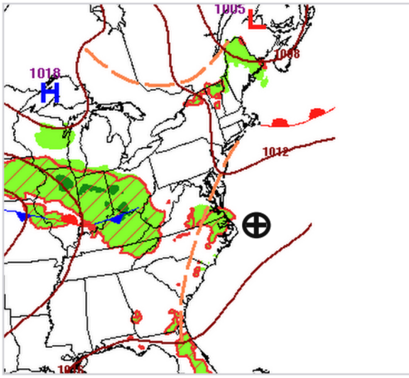
Step 2 — Read what is around you

- A weak **LOW, 1011 mb**, sitting on the coast about 70 NM to the west-north-west.
- A **stationary front** running east-north-east out of that low, out over the water — and effectively across our position. You can tell it is stationary because the semicircles and the triangles are on **opposite** sides of the line.
- A **cold front** trailing away to the south-west, down across the Carolinas.
- A **pre-frontal trough** — the orange dashed line — over the Appalachians and moving east toward us.
- A weak ridge, **1017**, over the Ohio Valley, and a second low, **1009**, up in the Gulf of Maine. The Gulf of Maine low is 500 miles away and going away from us. **Note it, then ignore it.**
- **The isobar spacing is the headline.** 1012 runs near us and the next one is hundreds of miles off. That is a slack gradient, and a slack gradient means light wind no matter what else is drawn on the chart.

Step 3 — Run the sequence

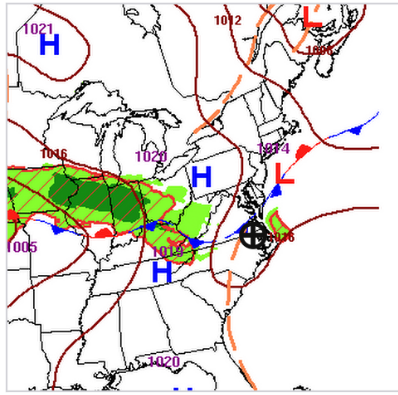
One chart is a photograph. Three charts are a film, and the film is what you actually forecast from.

00Z FRI (+9 h)



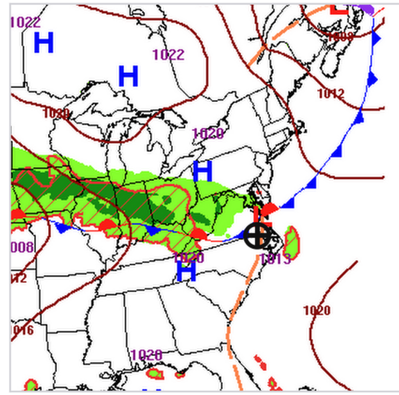
trough over the coast,
showers and storms inland

06Z FRI (+15 h)



rain band organising
along the Ohio Valley

12Z FRI (+21 h)



LOW 1013 at the Capes —
FILLING, and 1020 building in

Charts: NOAA / NWS WPC

Figure 13 — The forecast sequence: 00Z, 06Z and 12Z Friday 14 August, with the ship marked in each. One chart is a photograph; three are a film.

The call that matters, and you can make it without any upper chart

The low goes **1011 mb now** → **1013 mb by 12Z Friday**. It is **FILLING**, not deepening.

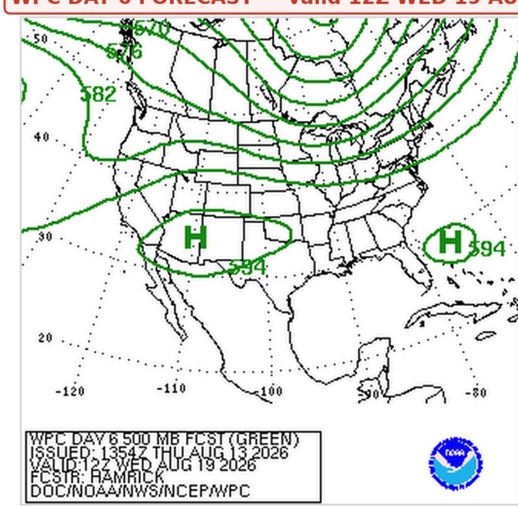
And a **1020 high is building in behind it** from the south-west.

There is no gale in this pattern. That single conclusion, read straight off three charts in about thirty seconds, is the most valuable thing you will tell the master today.

Step 4 — Go up a level. But read the small print first.

500 mb — but read the small print

WPC DAY 6 FORECAST · valid 12Z WED 19 AUG



This is SIX DAYS out. It cannot tell you anything about tonight's low.
What it can tell you: a 594 dam ridge is in charge next week — hot, humid, suppressed.

The most common chart-reading mistake there is

That 500 mb chart is a **DAY 6 FORECAST, valid 12Z Wednesday 19 August**. It is six days out.

It cannot tell you one thing about tonight. It is not an analysis, it is not valid today, and using it to decide whether tonight's low will deepen would be worse than not looking at an upper chart at all.

Always read the validity line before the picture. Every chart carries the time it is valid for, and forecast charts and analyses look almost identical at a glance.

What it *is* good for is next week: a **594 decametre ridge** in charge of the western Atlantic. Very high heights mean a deep warm column — hot, humid, and frontal activity suppressed. Useful for planning the voyage. Useless for planning tonight.

For tonight you would want today's 500 mb analysis, and the question you would ask of it is the one from Section 10: is the surface low displaced downstream of the upper trough, or stacked underneath it?

Step 5 — The technical data sheet

Before you write a word of English, get the numbers down. This is what you hand to anyone who wants to check your work, and it is what you write in the log.

	Observed / derived	How you got it
Position	36°30′N 073°30′W	80 NM ESE Cape Henry
Valid	1500Z Thu 13 Aug 2026	WPC analysis, issued 1619Z
Pressure	about 1012 mb, slow fall	Interpolated between isobars
Gradient	4 mb in roughly 300 NM	Dividers on the chart
Geostrophic wind	13 kt	Table, 4 mb / 300 NM at 36.5°N
Surface wind	**SSW–SW 8–12 kt**	70–80% of geostrophic, backed ~15°
Air mass	maritime tropical (mT)	Southerly flow off the Gulf Stream
Air temp	28 °C / 82 °F	Observed
Dew point	24 °C / 75 °F	Wet and dry bulb
Spread	4 °C → RH about 79%	Dry bulb – dew point
Convective cloud base	about 1,600 ft	Spread × 400 ft
Sea temp	28 °C / 82 °F	Air ≈ sea, so **no advection fog**
Visibility	8–10 NM, hazy	Observed
Sea / swell	SSW sea 2–3 ft; low SE swell 2–3 ft	Wind, fetch and duration all small
Fronts	Stationary front across position; trough approaching from W	Surface analysis
24 h trend	**Low fills 1011 → 1013; 1020 high building**	The 00Z / 06Z / 12Z sequence

Step 6 — Now write it in English

The data sheet is for you. This is for the master, who wants to know what is going to happen to his ship and what he should do about it. Short sentences, no hedging, and one clear recommendation.

WEATHER REPORT — 36°30′N 073°30′W — 1500Z 13 AUG to 1500Z 14 AUG

We are sitting on a weak stationary front, about 70 miles east-south-east of a 1011 low on the Virginia coast. The pattern is slack — the isobars around us are hundreds of miles apart — so the wind stays light for the whole period.

Expect south-westerly 8 to 12 knots, occasionally 15. Slight sea, 2 to 3 feet, with a low south-easterly swell. Visibility good at 8 to 10 miles but hazy in the humidity.

The one thing to watch is thunderstorms. This is maritime tropical air straight off the Gulf Stream, dew point 24 °C, convective cloud base down at about 1,600 feet — the atmosphere is loaded. A trough is crossing the Appalachians now and reaches the coast this evening. Expect storms to build inland after dark and drift out over us between roughly 0200 and 0800 local. **In any one of them the wind will jump to 30 or 40 knots from a completely different direction with almost no warning**, with heavy rain and visibility down to a cable.

The low itself is not a threat. It fills from 1011 to 1013 over the next 21 hours and a 1020 high builds in behind it. There is no gale in this pattern.

After this period: the trough clears through, the wind veers into the north-west and freshens, the glass rises and the visibility improves.

RECOMMENDATION: no routing change. Secure the decks for squalls before 2000 local rather than after. Brief the watch on the overnight storm risk and keep the radar on for cells.

What that report does, and what it deliberately does not do

- **It leads with the wind**, because that is what the master asked even if he did not say so.
- **It names the one real hazard** — and it is not the low. The low is the biggest thing on the chart and the least dangerous thing in the forecast. A report that leads with the low would be technically true and practically useless.
- **It gives the storms a time window and a magnitude.** ‘Chance of thunderstorms’ is not actionable. ‘0200 to 0800, 30 to 40 knots, no warning’ is.
- **It says what happens after the window**, because the master is planning further ahead than you are.
- **It ends with one recommendation**, not four options.
- **It does not hedge.** If you are not sure, say what you are not sure about and why — but do not spread uncertainty evenly over the whole report to protect yourself. That is how a real warning gets lost.

TEAR THIS OUT

The Chart Card

THE STATION PLOT

Upper left **air temp** · lower left **dew point** · upper right **pressure** · lower right **3-hour change** · circle **sky cover** · shaft **wind**.

Pressure: three digits, tenths of a mb. **500 or more → prefix 9; under 500 → prefix 10.** 004 = 1000.4 · 982 = 998.2.

Barbs: **half 5 kt · full 10 kt · pennant 50 kt.** The shaft points INTO the wind.

THE BAROMETER

Falls about **1 mb per 27 ft** of height. Correct for index, height, temperature, latitude — then compare.

The tendency beats the reading. 6 mb in 3 hours is a warning whatever the number says.

TRS: **3 mb** below the seasonal mean = warning. **5 mb fall**, or **3 mb with high wind** = act.

WIND FROM THE ISOBARS · 4 mb interval

100 NM apart: 47 kt at 30°N · 37 at 40° · 31 at 50° · 27 at 60°.

Wind goes as **1 ÷ spacing**. **200 NM:** halve those. **60 NM:** × **1.7** — not 2, which reads 94 kt where the truth is 78.

Surface over the sea = **70–80%** of that, backed **10–20°**; over land 50%, backed 30°. Curved flow: **weaker** round a low, **stronger** round a high.

BUYS BALLOT: back to the wind → LOW on your LEFT, slightly ahead (NH).

WET AND DRY BULB

Depression = dry – wet. Big depression = dry air. No depression = saturated.

Dew point is the honest measure of moisture — it does not move when the temperature moves. **Spread = dry – dew point.**

Spread closing to 2 °C = fog. Warm moist air over cold water and it will not burn off.

Cloud base ≈ **spread × 400 ft** (°C), or **× 222 ft** (°F).

THE LEVELS

Surface MSLP — fronts and wind. **850** ~5,000 ft — air mass and advection. **700** ~10,000 ft — moisture and lift.

500 ~18,000 ft — **the steering chart**, half the atmosphere below it. **300 / 250 / 200** ~30–39,000 ft — **the jet** (70 kt or more).

Heights in decametres — **low heights = cold air**. **Thickness** 1000–500 = mean temp of the lower half; **5400 m** = rain/snow.

DEEPENING, OR DYING?

Surface low DOWNSTREAM of the 500 mb trough — leaning back, divergence aloft over the centre → **IT WILL DEEPEN.**

Surface low STACKED under the 500 mb low — standing up straight, no support → **IT IS FILLING.**

Warm advection = rising = rain. Cold advection = sinking = clearing. Veering with height = warm advection (NH; reverses south).

Read them in this order: **500 → jet → 700 → 850 → surface → your own instruments.**