Re: Geostrophic winds cannot be exactly parallel to isobars

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From: Yokel (*yokel_at_surefish.co.uk*)
Date: 08/25/04

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Date: Wed, 25 Aug 2004 23:18:18 +0100
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"Scott" <ScottLWI@mouse−potato.com> wrote in message
news:412c741d$0$1341$80265adb@spool.cs.wisc.edu...
| Lawrence D¹Oliveiro wrote:
| > In article <ldo−84681C.12150123082004@news.wave.co.nz>,
| > I wrote:
| >
| >
| >>Another thing to keep in mind is that the Coriolis force increases with
| >>latitude. This means that, even in the complete absence of drag, the
| >>wind cannot follow a closed path (which is what an isobar is), as that
| >>would cause a pressure build−up at some point, which would stop the wind
| >>flowing.
| >>
| >>Thus, even neglecting drag, the idea of winds flowing parallel to
| >>isobars is still unrealistic.
| >
| >
| > Let me explain this a bit further. Assume you have a wind flowing around
| > a closed path with zero drag and air viscosity. Due to the Coriolis
| > force, this flow will be anticlockwise in the northern hemisphere, and
| > clockwise in the southern hemisphere. Or to put it another way, the half
| > flowing east−to−west is closer to the respective pole than the half
| > flowing west−to−east.
| >
| > But closer to the pole, the Coriolis force is stronger. That means that
| > the half of the wind flowing closer to the pole must be moving on
| > average faster than that half further from the pole, otherwise the
| > deflection in direction caused by the Coriolis force would mean their
| > paths would not join up.
| >
| > But if the east−to−west part is flowing faster, then there must be a
| > buildup of pressure at the western side of the path, and a corresponding
| > reduction in pressure at the eastern side. These changes in pressure
| > represent transfers between the kinetic energy of the wind and the
| > potential energy of the atmospheric pressure. But the Coriolis force

| > cannot perform such transfers of energy−−it can do no work, since it
| > always acts perpendicular to the direction of motion. Therefore any such
| > pressure buildup would stop the wind from flowing.
| >
| > Therefore the closed−path wind motion is not physically possible.
|
| I know of no one who suggests that strongly accelerating
| flow, such as your flow around a closed path, would be
| geostrophic. Also, I'm not sure why you have assumed
| that the pressure gradient would be the same initially
| all around this low. If your initial conditions are not
| physically realistic, I'm not surprised that your concluding
| the flow is not physically possible.
|
|

There was a discussion about geostrophic flow on curved isobars a month or two back on this very newsgroup (in June, thread "Wind Velocities"). The curvature adds an extra term to the formula (the "cyclostrophic term") representing the force required to accelerate the air and maintain it on the curved path of the isobars.

It is possible for a balance to be set up between this cyclostrophic force and the pressure gradient force alone, without regard to the coriolis force. To all intents and purposes, this is what happens in a tornado, which it is why it is possible to get an "anticyclonic" or "wrong way" tornado − the coriolis force is insignificant on this scale (even though it may have an effect on the scale of the cloud generating the tornado).

I would refer you back to that thread by the usual methods of reading old ng postings.

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"Yokel" now posts via a spam−trap account.
Replace my alias with stevejudd to reply.
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