

National Weather Service GOES Image of a ferocious storm off the Oregon coast. The storm is wound up so that it has an eye at its center. A similar storm struck Oregon and Washington on 12 December, 1995.

## **Hurricanes hit Portland**

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### **Introduction**

About the time I moved to the Pacific Northwest Portland was treated to a windstorm with gusts exceeding 75mph. The storm caused substantial damage in Portland and Seattle. The Wall Street Journal referred to the storm as a typhoon in all but name. Friends of mine told me that similar storms had hit the area from time to time (see concluding note), and they related how one such storm, perhaps in the 1980's although no one could remember for sure, showed an eye on satellite photos. They recalled saying to one another at the time, "Don't hurricanes have eyes? Can a hurricane get to Portland?"

“Well,” they asked of me, “do you suppose this really was a hurricane?”

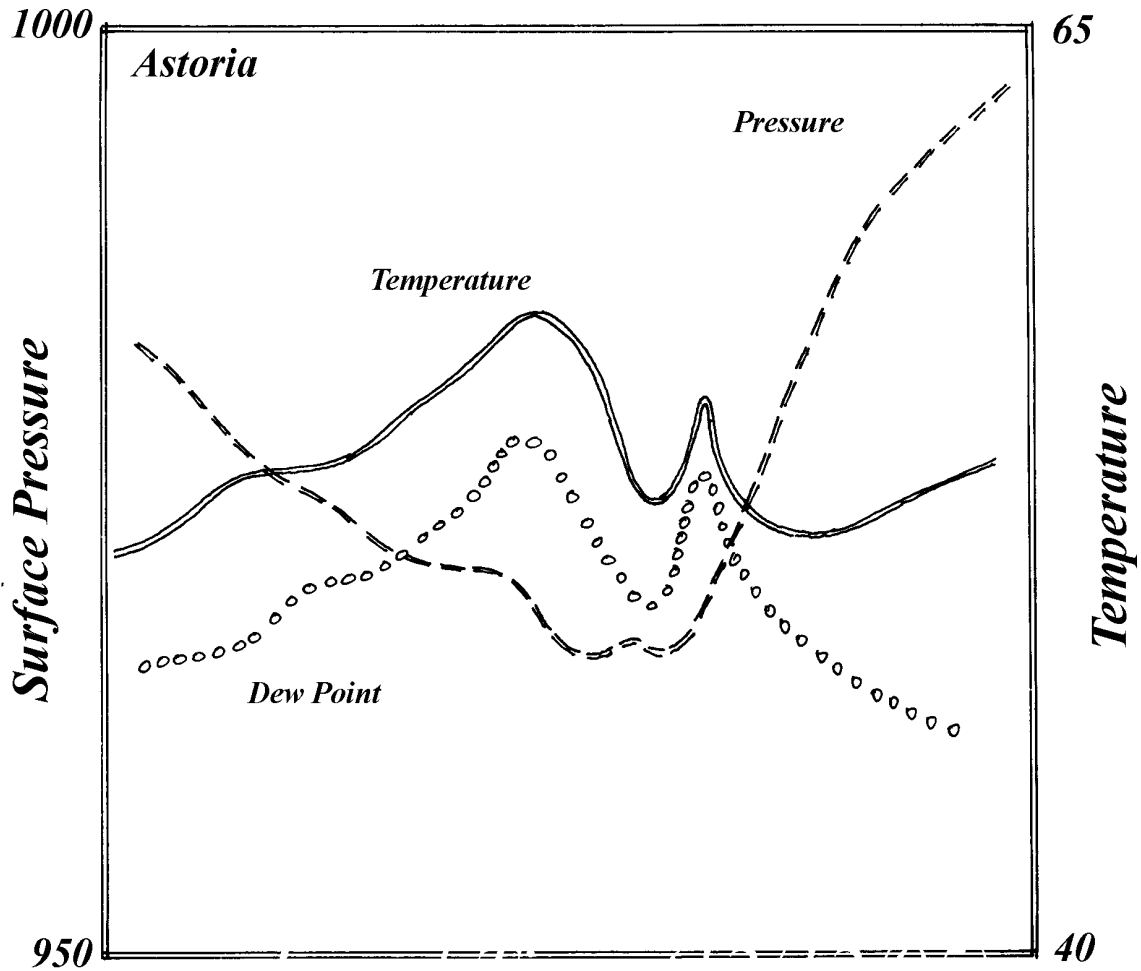
My brain struggled with the idea of how a tropical storm could make its way through the cold waters of the northeast Pacific Ocean. Maybe it was a typhoon, captured by the polar front and pulled rapidly across the ocean to spend its dying days in the Pacific Northwest. Maybe, I thought, it is an Arctic Low, that escaped from the Bering Sea and traveled all the way to Portland undetected. Maybe, I thought, this is an entirely new type of storm. After all, the true nature of the Arctic Low wasn't known ten years earlier.

If I am to describe these storms that hit the Portland area every few years as hurricanes typhoons, and not get hooted off-stage, then I needed some evidence linking them to typhoons. What are the defining characteristics of a hurricane? First and foremost, a hurricane exists by nature of disequilibrium between the earth's surface and the atmosphere above it. This is the defining characteristic of a hurricane and all its cousins, including the dust devil and Arctic Low. Mid-latitude cyclones, in contrast, depend on potential energy of temperature differences in the air along the polar front to generate and sustain them.

It is not an easy thing to determine how a large storm obtains its energy, but if the storms that hit the pacific northwest are to be hurricanes or second cousins to hurricanes, then the following characteristics appear absolutely necessary.

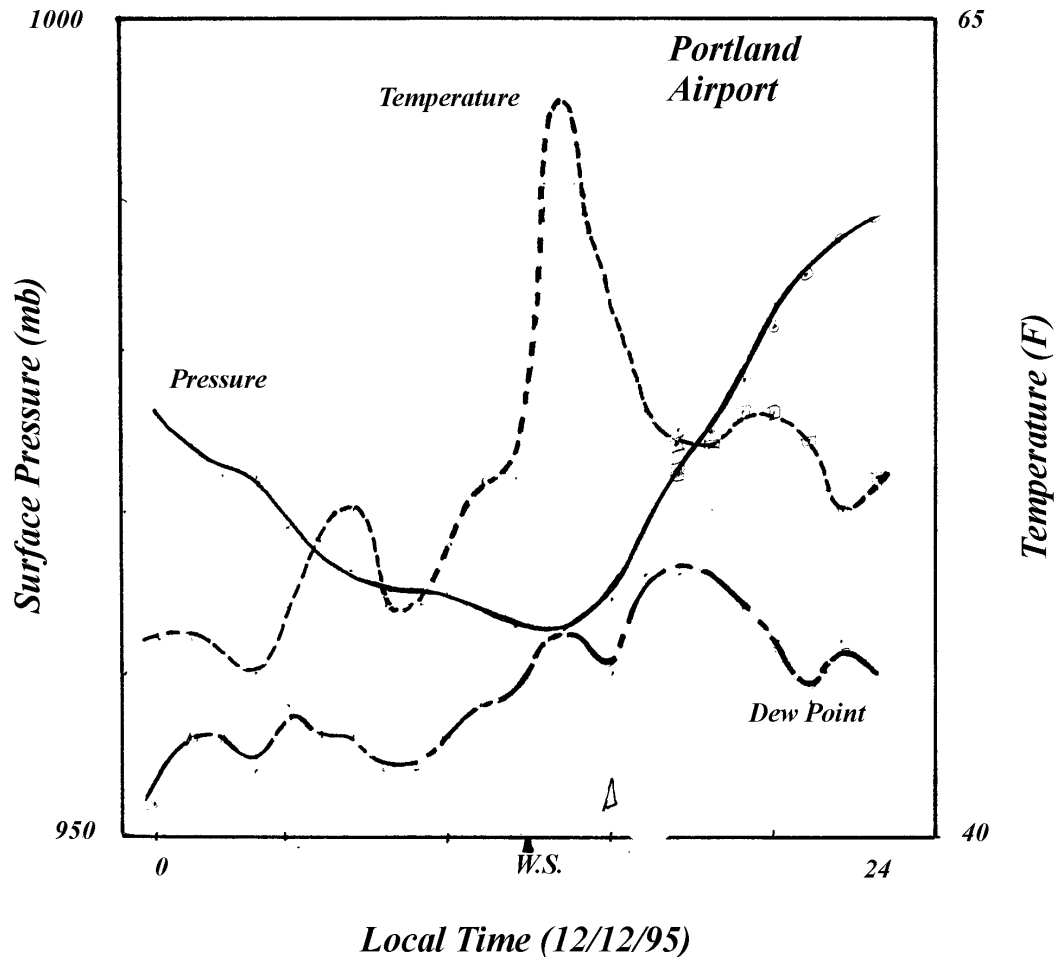
- First, the storm has to have a warm core. Hurricanes, typhoons, dust devils and arctic lows all have warm cores. Mid-latitude cyclones have cold cores.
- Second, the storm should have winds that are a maximum at the surface, and spiral in toward the low pressure center. This true of all hurricane-like storms and implicates the energy inflow to the storm as arising at the surface. Mid-latitude cyclones, by contrast, have winds that reach their maximum values near 200mb high in the troposphere. This suggests they derive energy from a thermal wind expressing the integrated temperature difference from ground to height of the air either side of the polar front.
- Third, the occurrence of an eye has no bearing on the classification of the storm. An eye evolves because the circulation in the storm is very intense near the surface. This lowers air pressure in the storm core to the point that dry air high in the troposphere is pulled toward the ground. It warms and dries as it descends causing a clear-skied eye.

I can say nothing of the mystery storm that my friends spoke of in the 1980s, but the most recent similar storm occurred on the 12<sup>th</sup> of December, 1995. I sought meteorological records from Portland and Astoria to help build a case for the storm's kinship. The two following figures show surface pressure, air temperature, and dew point, beginning at 12 midnight local time on the 12<sup>th</sup> and extending through the day.



### *Local Time (12/12/95)*

Astoria shows a surprising symmetry of weather elements through the storm. The temperature and dew point both reach maximum values coincident with the lowest surface pressure. There is a substantial excursion of both dew point and temperature during the storm, however, which suggests that a inflow jet of cold, dry, arctic air is found near the core. An inflow like this is shown in the frontispiece to this paper nicely. There is no true wind shift line as the low pressure passes. One main feature of the storm at Astoria is that the peak temperature and dew point occur on the descending flank of the low pressure, just as would happen in a mid-latitude cyclone.



At Portland Airport the story is similar. There is a distinct wind shift line coincident with passage of the lowest pressure. The wind direction changed by 90° at this point which certainly seems more like a mid-latitude cyclone than it does a hurricane.

### Conclusions

The one storm I have examined here has a structure like that of a compact mid-latitude cyclone when it is at sea. Passing over the coast range near Portland gave the storm a symmetry much like that in an arctic low or hurricane, but this does not make it one. The occurrence of an eye in this storm and others like it does not suggest a close relationship to hurricanes, but is simply a manifestation of extreme circulation near the ground surface. The GOES image in the frontispiece shows quite a bit about the energy source of storms like these. Note the substantial flow of moist, warm air from the south that feeds the heavy piles of clouds to the east and north of the storm center. There seems little doubt that this storm gathers its energy from the polar front.

*Note: Most people recall the Columbus Day storm of 1962. However, their memories may be somewhat faulty. There were two storms in October, 1962, two weeks apart to the day that were probably equally destructive. In fact, the peak wind gust was higher in the*

*storm that struck October 26 than it was in the Columbus Day storm. An equally rough storm struck in October, 1964. The memory of it may also be confused with the Columbus Day storm, and may add to its perceived ferocity.*