Winds of the Monterey Bay Region

by Skip Allan

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WINDS OF THE MONTEREY BAY REGION

DEFINITIONS

WIND is defined as air in motion relative to the surface of the earth.

The MONTEREY BAY REGION has arbitrary boundaries, but for the scope of this paper is defined as the area eastward of a line connecting Point Ano Nuevo to Point Sur, and bounded by the San Mateo County Line on the north and inland to the Santa Cruz mountains, then southeast through the Gabilan Range to the latitude of Soledad in the Salinas Valley, then westward to Point Sur.

DIRECTIONS are based on True North and True North is considered "up" on any map.

WIND SPEED is given in knots at 10 meters elevation, where one knot equals 1.2 miles/hour.

BAROMETRIC PRESSURE is given in millibars.

INTRODUCTION

For a lifelong sailor like myself, the winds of the Monterey Bay Region are not only fuel for commerce and recreation, but also a living, breathing, visible entity whose characteristics have probably changed little since the time Sebastian Vizcaino first dropped anchor in the lee of Monterey Peninsula almost 400 years ago. What are these Aeolian attributes so important then as now, and how have they influenced the history and development of the Monterey Bay Region?

Before embarking passengers for a voyage onto Monterey Bay, I consult not only the VHF weather radio for the day's forecast, but my barometer, the sky, and a host of other clues for what lies offshore on our often rugged local waters.

More often than not, clues are visual: Is the windline at Mile Buoy? Is the yellow smoke at Moss Landing Power Plant Blowing seaward? What direction are the resting seagulls aimed at Twin Lakes Beach?

But clues can also be audible, and even smelled. For example, when I hear freeway sounds at night, I know the landbreeze is gently descending local hills, and tomorrow we will have its counterpart: a westerly seabreeze. On the other hand, when I can hear the moan of Mile Buoy, four miles to the southwest, I know the wind is in transition as a coldfront passes overhead, and that the morning will be cool, with gusty winds accompaning an unstable airmass for the next 24-36 hours. Even the smell of Gayle's Bakery to the northwest gives a hint that offshore northerly breezes through the

Santa Cruz mountains will most likely prevail.

Sounds and smells can carry great distances on the wind. For example, the nightime offshore wind can bring the scent of skunk and creosote three to four miles offshore (west) of Wilder Ranch, just north of the city of Santa Cruz. It is said that in the 1920's, when whaling was an active commerce at Moss Landing, the residents of Santa Cruz, 11 miles northwest, complained bitterly of the stench of rotting whale being delivered to their doorstep by SouthEast winds.

For the following report I first researched weather records via the internet. But it has proven easier to catch the wind with a sail than record its footprint on paper or computer monitor. Local winds have too many variables in speed and direction for the few recording stations to accurately document. For example, in the Monterey Bay Region, local geography has a major influence. The onshore westerly breeze tends to bend around the points and parallel the shore, becoming southwest near shore in the northern part of Monterey Bay. Inland, offshore winds can be funneled down valleys, canyons, and gulches, and blocked by ridges, trees, and buildings.

And several different winds can be blowing at once in the same vicinity. There is no better example of this phenomena than what happens about 5pm on a typical summer afternoon just offshore of Santa Cruz Harbor on the northern side of Monterey Bay. In that area of one square mile, the afternoon westerly seabreeze will be blowing a chilly 25 knots at Mile Buoy, while just inshore of an abrupt transition zone, a 10 knot easterly will be blowing up the beach from Capitola. This easterly blows to the vicinity

of the Small Craft Harbor where it is met by a warm northerly, heating itself as it gusts downslope through mountain passes. For an enjoyable sailing tour of the vicinity, wise captains ride this merry-go-round of winds in a counterclockwise direction, assuring themselves of a circular downwind sail.

Another reason it is difficult to track the footprints of Monterey Bay Region winds is the paucity of accurate measurements. Except for reports from Monterey and Salinas airports, there are few accurate, public accessible, round-the-clock reporting stations inside the Monterey Bay Region. Point Pinos might be one, except for Coast Guard maintenance on its anemometer has traditionally been lax, and that station has previously been notorious for both underreporting windspeed, and having a recalcitrant windvane as I documented a dozen times during the 1980's when visiting my parents nearby residence. During one memorable NorthWest gale, while standing on Point Pinos in the teeth of winds gusting to 40 knots, my VHF weather radio was simultaneously reporting "Point Pinos, SouthEast, 5 knots."

Across Monterey Bay, Santa Cruz Harbor reports its winds by phone to the National Weather Service for rebroadcast over the VHF weather radio. However, the wind gauge is in the lee of the nearby Crow's Nest Restaurant, and wind observations are taken by a sales clerk in the O'Neill retail store and reported by phone to the NWS only during business hours. Consequently, I will limit my references to weather service records and talk of instinct, of what I see, and feel on my ears, and smell with my nose as our boat heels to a fresh breeze. Let's go sailing!

SOUTHEASTERLY

February 3, 2000:The wind filled this morning as the barometer dropped to 1004 millibars and grey-black low clouds scudded in from the south. The windows are shaking, the front door is hard to close, and the 125 foot eucalyptus along Park Ave. are bending to the weight of the breeze, all the while shedding bark, berries, and leaves.

Across the Bay the wind is wreaking havoc with the AT&T golf tournament, causing cancellation of all play because of "oscillating golfballs." And in view at Seacliff Beach, the old Cement Ship resembles a ghost from the Victory at Sea television series, periodically submerging itself into a stormy North Atlantic winter sea on the Murmansk run.

It is a SouthEasterly, and the cold front passage this wind presages can't be too far off. At the brink of Depot Hill Cliff, near where I live, my anemometer shows a steady 25 knots, gusting to the high 30's.

The entire northern side of Monterey Bay is a lee shore in a SE gale, and there would be no shelter found here for a sailing ship. This was certainly true for French Naval Officer Duhaut-Cilly who anchored his ship in Santa Cruz Roads early in February, 1827, and wrote of his experience on a similar day:

"The mooring ground (at Santa Cruz) being protected only from the north, we were compelled, on the 9th, to set sail in great haste, at the approach of a storm from

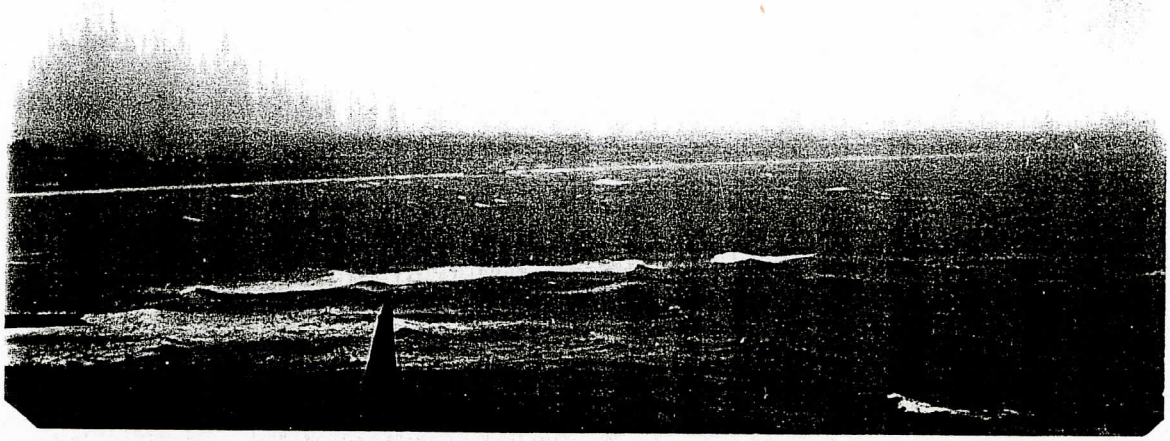
SouthEaster, February 3, 2000
(First day of play of the AT&T Golf Tournament at Pebble Beach cancelled because of "oscillating golf balls."

Weather at the Monterey Bay Buoy, 36-45N x122-24W or 25 miles NW of Carmel. Height of observations is 10 meters.

Time	Wind Direction	Wind Speed (knots)	Gusts	Barometer
0600	SE	16	19	29.92 " (1013 mb.)
0700	SE	21	27	29.89" (1012 mb.)
0800	SSE	23	27	29.90" (1012.5 mb.)
0900	SE	27	31	29.89"
1000	SE	27	33	
1015	time of photo from Depot Hill cliffs, Capitola, 36-59N x 121-57W or 27 miles NE of Monterey Bay Buoy			
1100	Approximate time of frontal passage, with heavy rain and rapid wind shift to SW.			
1200	SSW	16	19	29.97 (1015 mb.)

(note: 1 knot equals 1.15 miles/hour)

SeaCliff Beach Cement Ship Aptos



Bombora Reef

photo taken February 3, 2000, at 1015 hours

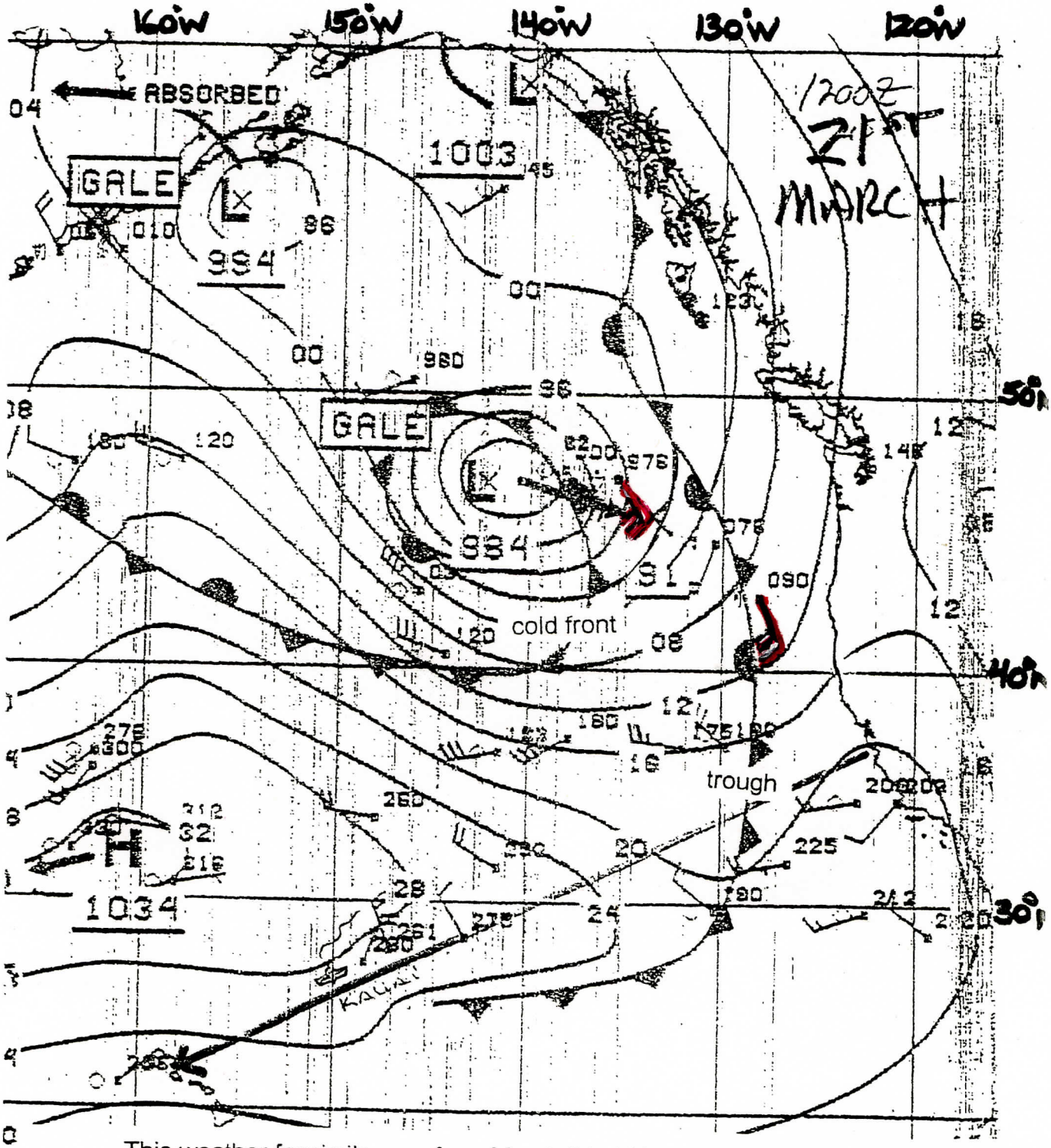
the south which threatened us.....Indeed, when the danger was seen, all our boats were on the beach, loading on grain and hides. I ordered a gun fired at once to recall them.....the loading was taken aboard; the boats hoisted up; and in less than a half-hour we were under sail, at the moment the wind blew violently into the bay."

Though weather service records show true SouthEasterlies blow only about 5-7% of the time during the winter season of November through March, their direction can vary from East to South and such a percentage doesn't really do justice to the personality and historical influence of this wind.

The SouthEasterly is the wind circling counterclockwise around a low pressure area approaching from the west. It is a warm, moist wind, and often accompanied by rain. SouthEasterlies are almost unknown in the summer, preferring to visit the Monterey Bay Region 15-30 days out of any winter season. With the approach of a low pressure area and the trailing cold front, SouthEasterlies can rise in intensity to gale force and above, often in less than 6 hours. This rise in wind is accompanied by a falling barometer. The faster and deeper the fall, the stronger the SouthEast wind.

Even quicker than the rise of Duhaut-Cilly's gale, a SouthEasterly can disappear as the front passes, leaving a confused sea state in the Bay and messy clean up ashore.

If the north side of Monterey Bay offers no shelter from a SouthEasterly, 20 miles across the Bay, at Monterey, things are very different. In December of 1602, 225 years before Duhaut-Cilly's SE gale, a nearly identical wind blew Sebastian Vizcaino's



This weather facsimile map from March 21, 1999, shows the surface analysis of a SouthEasterly storm. Though this particular storm is a late-season event, it may be considered typical in most respects to what affects the Monterey Bay Region 15-30 days out of any winter season.

Noted on this map are the initial trough and the following 976 mb. Low with its associated,classic, comma-shaped cold front dragging to the south. In advance of this cold front, which is moving SE at about 15 knots, are the wind flags (high-lited in red) showing the approaching SouthEasterly winds to be in the 25-30 knot range.

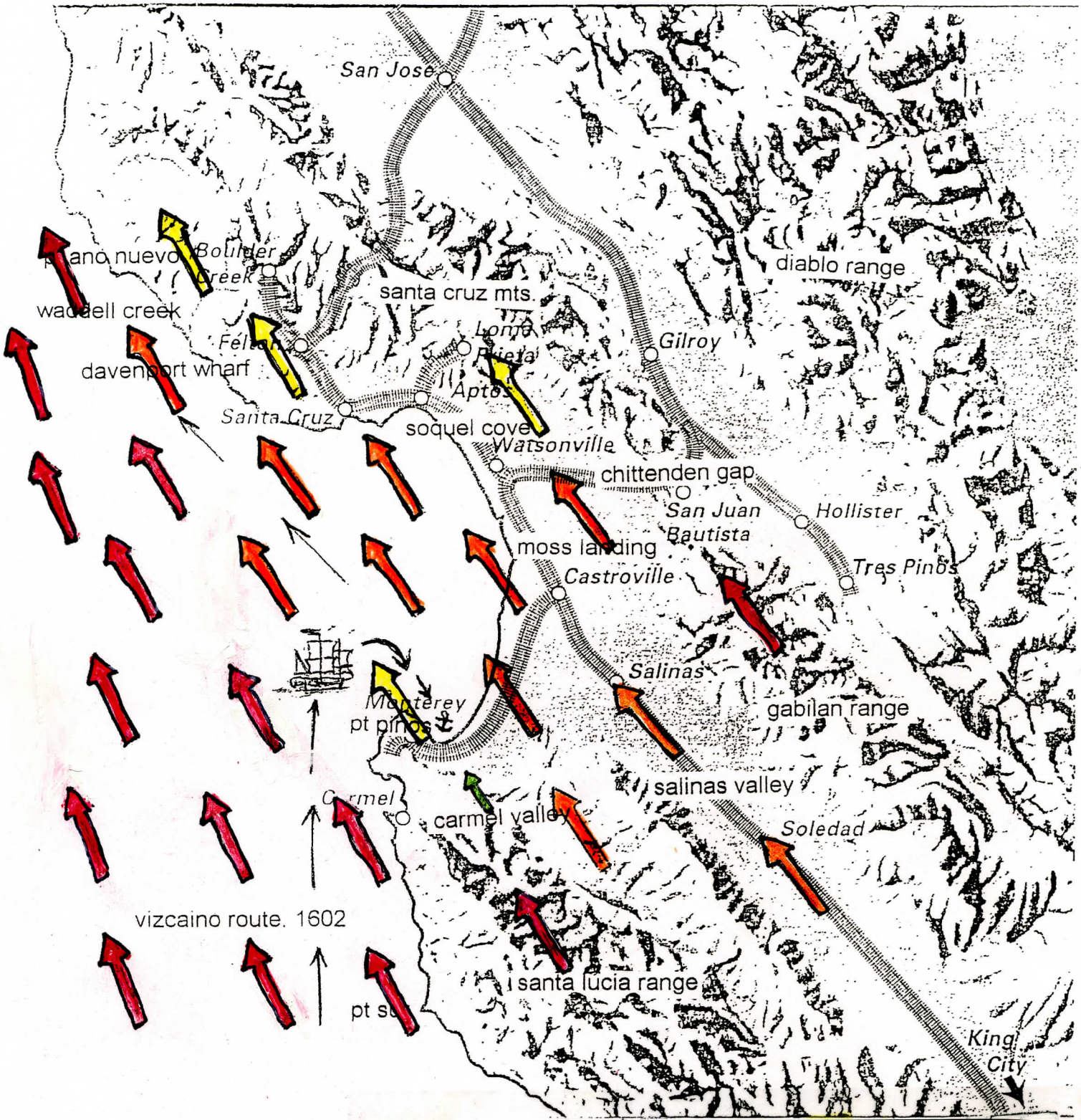
At the time this map was drawn, the Low was approximately 1000 miles NW of Santa Cruz and moving SE at 15 knots. The Low eventually passed over Oregon, bringing steady rain, SE winds , 20-25 knots, and a barometer fall to 1010 mb. to the Monterey Bay Region on March 23-24.

expeditionary fleet, consisting of the flagship galleon SAN DIEGO, the frigate TREYS REYES, and the consort SANTO THOMAS, up the Big Sur Coast, around Point Pinos, and into the lee of the Monterey Penisula.

Vizcaino was under orders from the Viceroy of New Spain in Mexico City to explore the California coast and locate a suitable harbor of refuge for the Manilla Galleons. These ponderous ships, loaded with wealth and passengers from the Phillipines, yearly traversed the North Pacific on their return voyage to Acapulco. And after three to four months at sea with diminishing quantities of fresh food and water, the galleon's scurvy ridden crews were desperately in need of a port of refuge as they closed the coast of Alta California.

With the survey and mapping of such a port of refuge foremost in his mind, Vizcaino's well equipped but unweatherly expeditionary fleet sailed northward from the vicinity of Southern California's Channel Islands in the second week of December, 1602. It was now that a SouthEastly played a major part in the history of California, for Vizcaino's fleet had little hope of tacking NW up the coast against the prevailing NW winds and currents.

But then "...on Santa Lucia's day (December 13) at four in the morning a southeast wind sprang up, ...and it lasted until sunset the next day when we arrived at 37 degrees latitude," (excerpted from Vizcaino's log). This southeast wind allowed Vizcaino to safely sail downwind up the Big Sur Coast, (a daunting voyage for small craft even today), and reach the latitude of Monterey.



MONTEREY BAY REGION WINDS

SOUTHEASTER

Not only did this SouthEasterly allow Vizcaino to reach the Monterey Penisula, but it also most likely influenced his conviction that he had reached an all weather port, "sheltered from all winds." Indeed,at that date, there was no other harbor north of San Diego that offered such perfect shelter from the southeast wind, and adequate anchorage in winds from the rest of the quadrant.

Vizcaino wrote a glowing description of his find, and his charts were reproduced by the cartographer Enrico Martinez in 1603 and disseminated to Spanish shipmasters. 166 years later, it was primarily this account that spurred Portola's Sacred Expedition northward to reconnoiter Monterey Bay in 1769 in an attempt to find Vizcaino's all weather port of refuge.

But Gaspar Portola' and his men were not sailors, and we may assume no SouthEasterly was blowing on October 1, 1769. Consequently, the Sacred Expedition did not recognize the perfect shelter Vizcaino had enjoyed at Monterey and bypassed their elusive goal, eventually being the first non-natives to sight San Francisco Bay a month later.

SouthEasterlies not only were a major factor in the early exploration of the Monterey Bay Coastal Region, but also on early attempts at maritime commerce in the northern half of the Bay during the visits of Duhat-Cilly (1825) and Richard Henry Dana(1835-36). Later, during the period 1850-1880, many ships, both steam and sail, were beached or wrecked on the north side of Monterey Bay, including the EMILY BURNS, OSCEDA, WHITE WING, EAGLE, OAKLEAF, JAMES W.WHITING, LUELLA,

VIRGINIA, CURLEW, GUADALUPE, ANDROSCOGGEN, SOPHIA, TRAVELER, EXCEL, the schooner APTOS (S.E. storm of 1870,) and in 1878 the locally built 60 ton lumber schooner JULIE BROWN was driven ashore by a SouthEasterly at the foot of Point Santa Cruz, near the location of Santa Cruz's first lighthouse.

Basically, SouthEasterlies rendered the open roadstead anchorage off Santa Cruz County as unreliable in winter, and shipping by sea an expensive, time consuming, and problematical proposition during the SouthEaster season of November through March.

As SouthEasterlies continued to make shipping difficult in the nineteenth century, a crisis grew beginning in mid-century that resulted in an eventual turning point in the history of the Monterey Bay Region. This crisis was the result of a new and growing post-Gold Rush economy in the Santa Cruz area with no dependable and economical connection to the outside world and its markets.

By 1870, according to the United States manufacturing census of that year, Santa Cruz county was producing increasing quantities of barrels, flour, gunpowder leather goods, lime, liquor, lumber, machinery, and various metals, all of which needed to be shipped from the area. To accomodate this burgeoning need, piers and wharves were built along the coast, usually near creek and river mouths.

Though it is beyond the scope of this paper to properly document the complete history of wharfage in the Monterey Bay area, it is interesting to note that in 1849 Santa Cruz's first wharf was built by Elihu Anthony to facilitate potato loading. This initial

open ocean wharf was followed by wharves built at Waddell Creek and Ano Nuevo by William Waddell, at Davenport Landing by Captain John Davenport, at Soquel Landing, at Pajaro Landing near Watsonville, and at Moss Landing.

These wharves were all subject to weather and continually suffered damage not only from large ocean swells generated by strong SouthEasterlies, but also by large logs, flotsam and jetsam, that floated down nearby rivers and creeks during heavy SouthEasterly rainfall and knocked out support pilings.

Wharf damage from SouthEasterlies only exacerbated the shipping bottleneck in the Monterey Bay Region and led to increasing demand for a reliable transportation connection to outside markets in the 1860's and 1870's. This need to circumvent the transportation isolation of the region led to the eventual construction of railroad lines into Monterey and Santa Cruz Counties. It was the railroad more than anything that forever altered the landscape and destiny of the region, and it was the SouthEasterly's restriction on reliable maritime commerce that played a significant part in drawing the railroad to the coast.

Today SouthEasterlies continue to influence local events such as the AT&T Tournament, power outages, and road closures due to downed trees, continuing a line of weather tradition in the region that began with the early Spanish explorers many years ago.

NORTHWESTERLY

April 24, 1993: It is the annual 75 mile Monterey-Ano Nuevo-Monterey Ocean Race, and the 70 foot sloop MIRAGE

"rounded the whistle buoy off Ano (Nuevo) in first place shortly after 3pm. The NW'erly had been building all afternoon, and had filled to a blusterly 25 to 32 knots from 310 degrees by the time we reached Waddell Creek."

"The spinnaker run back home was exhilarating. With MIRAGE averaging over 13 knots, the boat was surfing to well over 20 knots in gusts. Even the windsurfers off Waddell had trouble keeping up as we flew by."

This excerpt from my log on that date was not a weather exception to the rule. But by being able to take full advantage of prevailing NorthWesterly conditions with a fast, seaworthy, ultralight, seventy footer, or even a 20 pound windsurfer, this wind provided a distinctive contrast to a time when Manilla Galleons lumbered southward off these same waters 300-400 years earlier.

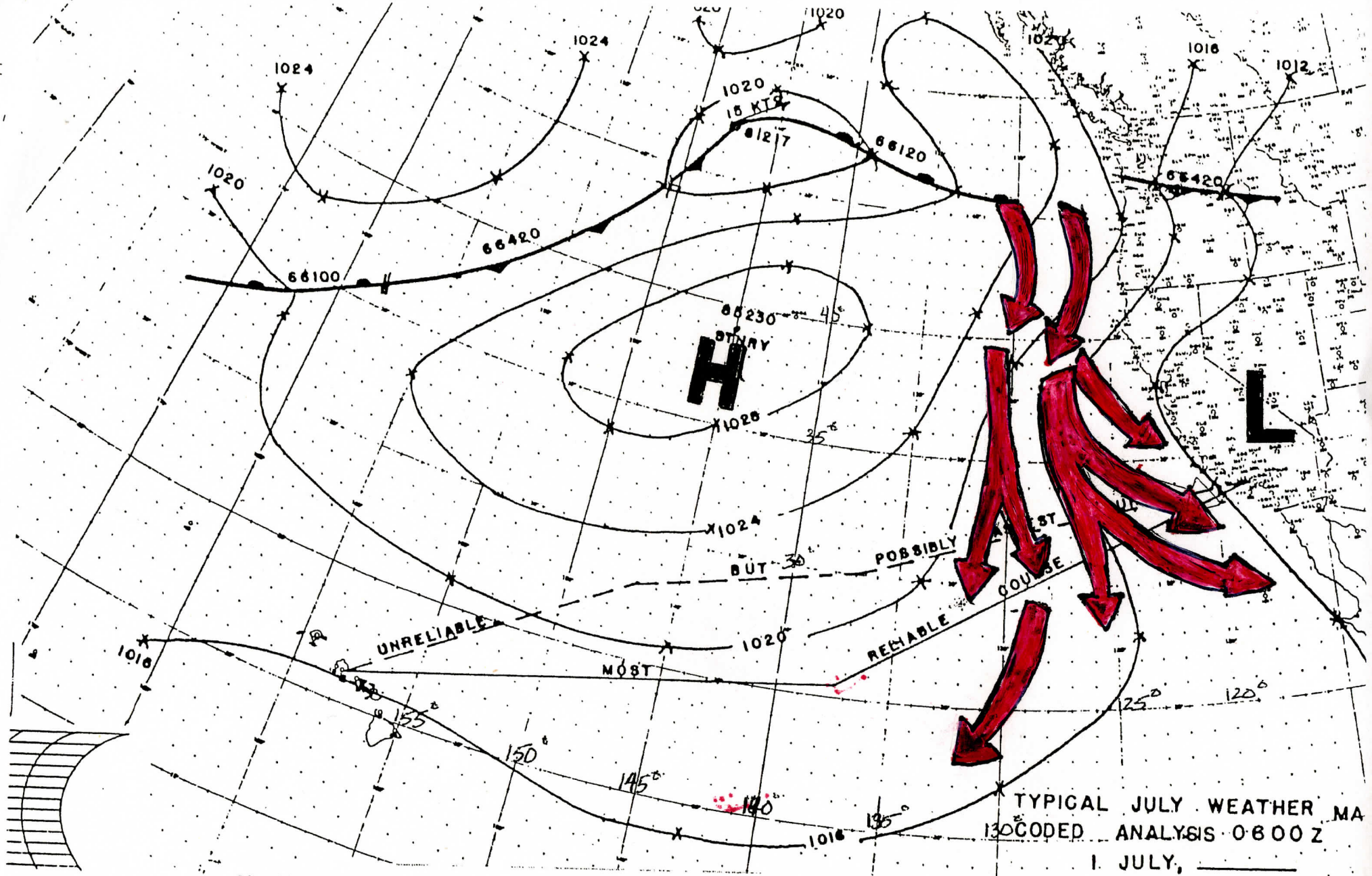
Where our crew of 14 was outfitted in synthetic fleece, waterproof foulweather gear, and turkey sandwiches, the Galleon's compliment of 200-300 were already in advanced stages of scurvy and impoverishment. But their captains relied on a similar NorthWesterly to blow them to Acapulco, just as we were relying on this breeze to push us towards the finish line.

The NorthWesterly is Monterey Bay's resident wind, and according to Weather

Service Records, blows about 40% of the time in the Monterey Bay Region. This predictable breeze awakens from its diurnal sleep to whitecap Monterey Bay most every afternoon, spring, summer and fall.

The NorthWesterly is a product of three interdependent forces acting together in concert. The first is the clockwise rotation of winds around the Pacific High, a semi-permanent, but wandering resident of the Eastern Pacific whose average center in mid-summer lies at 37N x145W, or about 1000 miles west of California . The average summer central pressure of the Pacific High is 1028 millibars (30.36"), but this can easily rise or fall 10 millibars (.30") inside of 72 hours and increase or decrease windspeed flowing outwards into the clockwise gyre around the center. It is this clockwise direction of wind around the Pacific High that produces the northwest component to our local NorthWesterly. As the wind flows outward from the center of the Pacific High, it is deflected to the right by the earth's rotation, or coriolis force, and blows parallel to the coast of Central California before veering off more southwest under the High, where it eventually merges into the northeast tradewinds.

A second force acting upon the NorthWesterly is the presence of a thermal or surface trough of low pressure in the California Central Valley and desert Southwest. This area of low pressure is the result of intense surface heating that raises daytime temperatures into the 100's, and extends from the Sacramento Valley south through the San Joaquin Valley, and into Imperial and Death Valley, southwest Nevada and northwest Arizona.



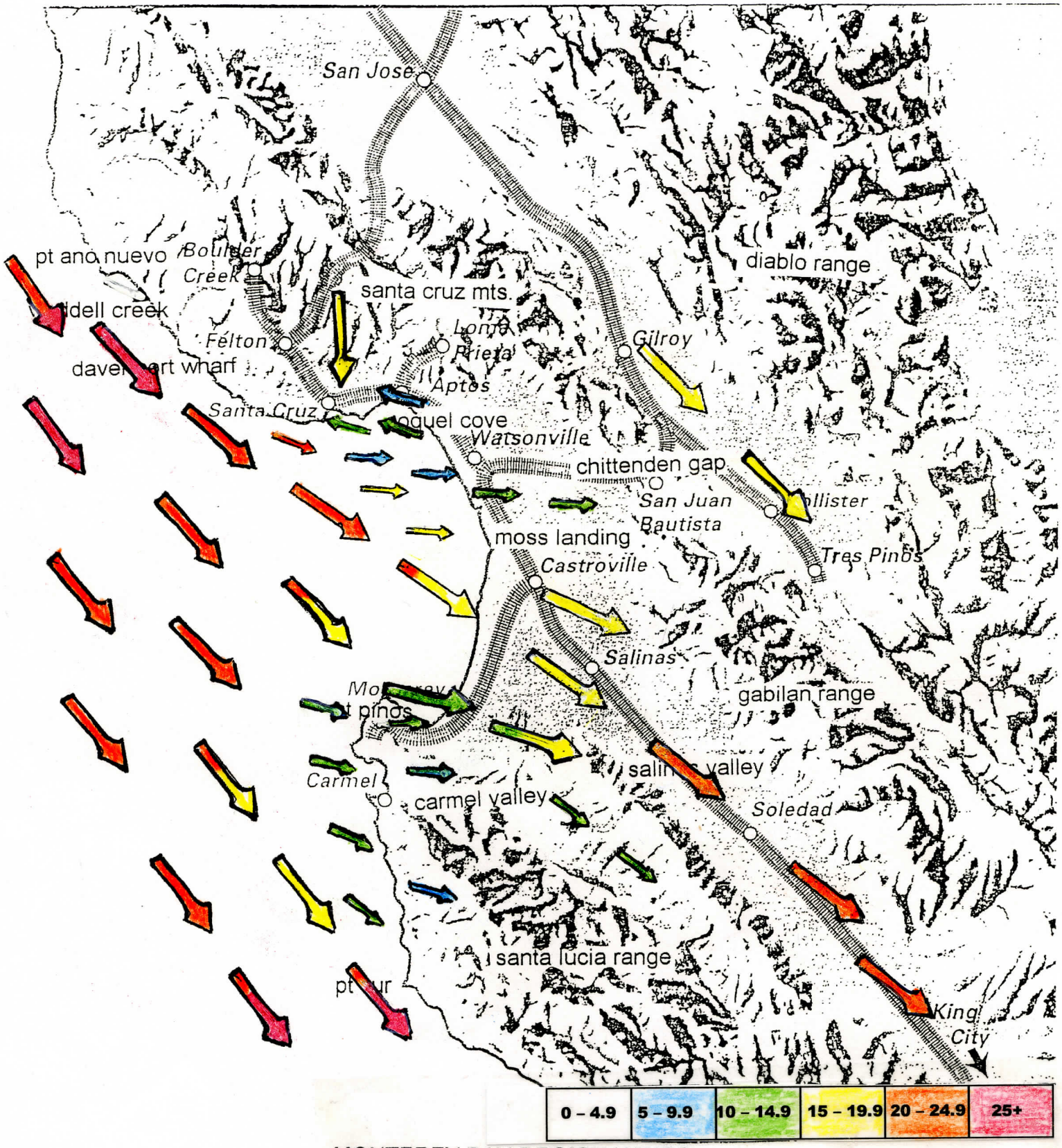
NorthWesterly windflow in red arrows in the eastern quadrant of a typical summertime East Pacific High (H). Note the NorthWesterly flow off the Central California Coast, and the tendency of the nearshore wind to bend more inland towards the thermal Low (L) of

The effect of this thermal trough is to reinforce the gradient flow of wind from the (Pacific) High towards the ((Desert) Low. This reinforcement is increased by an intensifying Pacific High, a deepening Desert Low, or both. During the fall months, when the Pacific High begins to weaken and the desert begins to cool, the gradient reinforcement is decreased, resulting in less boisterous NorthWesterlies across Monterey Bay.

The final force acting on our NorthWesterly is the daytime warming, and nightime cooling of the land, especially in the air shed of the southern reaches of the Salinas Valley. As the inland warms, moisture evaporation from the agricultural fields of the Salinas Valley increases upvalley and draws cool ocean air inward where it heats and rises, creating a building afternoon seabreeze that reinforces the gradient wind. This difference in inland evaporation has been well studied, and found to be 2 to 3.5 times greater at Solédad, 30 miles inland, than at Moss Landing.

This afternoon wind can extend more than 40 miles up the Salinas Valley, and appears to increase with distance from the coast, with maximum winds inland occurring later in the afternoons than on the coast. Conversely, as the land begins to cool after sunset, the local air begins to sink, diminishing the NorthWesterly flow in coastal zones and creating an early a.m. lull or even reversal of wind direction (offshore).

Our NorthWesterly has all the classic "monsoon" characteristics, but on a meso-climatic scale, where a monsoon is defined as a seasonal wind caused by much greater annual variation of temperature over large land areas compared to neighboring ocean



MONTEREY BAY REGION WINDS

NORTHWESTERLY

surfaces, resulting in an excess of pressure over continents in winter and a deficit in summer. In the above definition, drawn from the Glossary of Meteorology, if we were to substitute DAILY for "seasonal" and "annual," NIGHT for "winter," DAY for"summer," and SALINAS VALLEY for "continents," we can visualize the daily ebb and flood that takes place between the unmixed marine air, and the dryer, inland airmass over the Salinas Valley. The new definition of our local monsoon would then read: "a daily wind caused by much greater daily variation of temperature over large land areas compared to neighboring ocean surfaces, resulting in an excess of pressure over the Salinas Valley at night and a deficit during the day."

Bordered by the Gabilan Range on the east, and the Sierra de Salinas to the west, the lower Salinas Valley averages approximately 12 miles in width for 40 miles and essentially is a windtunnel for farmers and residents alike. As early as 1890, extensive windbreaks of eucalyptus trees were planted athwart the afternoon NorthWesterly in an attempt to divert and diminish the chilling and land-raking rush of marine air invading the Salinas Valley. Even in more modern times, construction workers at the Pajaro Dunes complex of resort homes at the mouth of the Salinas Valley bowed to the resident NorthWesterly and had written into their contracts that for safety reasons, they would not handle sheets of plywood after 12 noon.

Windbreaks and construction contracts aside, as regular as clockwork the NorthWesterly visits the Monterey Bay each afternoon, beginning as cat's paws about 11am PDST and building to a maximum strength of 17 to 28 knots over 40% of the

time in outer Bay waters.

Nearer to shore, within several miles of the coast, the NorthWesterly is significantly influenced both in strength and direction by local geography as it crosses the Monterey Bay Region. The wind is accelerated by hills and mountains just inland from the coast. And two bold points, Ano Nuevo at the most northwestern boundary of Monterey Bay, and Sur, the most southeastern point, at first restrict the NorthWesterly's flow and then provide a Venturi like jet immediately downwind.

At Point Ano Nuevo, a predominant jut of land with the nearby Chalk escarpment, Professor Burney La Boeuf of the University of California at Santa Cruz, while studying the resident population of pinnipeds, documented that the local sand dunes were not only aligned with the NorthWesterly at "40 degrees west of north," but also migrate southeast at a rate of up to 25 feet per year due solely to the vociferousness of the NorthWesterly at that location. The NorthWesterly has caused significant geographical changes at Point Ano Nuevo that continue to this day as the wind relentlessly reshapes the dunes and drives waves against the Point and its offshore island.

Point Conception has long been considered the "Cape Horn of the Pacific." But in my experience of over 50 roundings of Point Sur both from south to north and north to south, it is my contention that Point Sur can have just as much, if not more wind, than its counterpart 130 miles to the southeast. This fact did not go unnoticed by the lighthouse keepers and their families at Point Sur who routinely kept their chickens and

children tethered to the rock for fear they would blow away downwind on any given afternoon!

The NorthWesterly can also be reduced in flow when it meets a high landmass head on. In this situation, it must rise up and over, or split its flow to go around. This phenomenum is encountered off the NW tip of the Monterey Penisula at Point Pinos, where the NorthWesterly "backs up" and creates a local area of reduced surface flow that extends around the Penisula from Carmel to the Monterey Harbor. This local area of disturbance extends about one to two miles offshore and reduces the windspeed an average of 25% in that area.

The heating and cooling of the land also influences the direction of the near shore NorthWesterly. As the local afternoon seabreeze builds inland to the east, a west to east component is introduced to the wind , turning the NorthWesterly more into a Westerly, and even Southwester, near shore.

And once again, conversely, as the nightime offshore breeze begins to be felt, the onshore component fades and an offshore, east to west component begins to turn the Northwesterly into more of a Northerly, NorthEasterly, Easterly, and even SouthEasterly (Salinas Valley region).

The local NorthWesterly wears many hats. It is the bearer of fog for the Monterey Peninsula, the builder of magnificent sand dunes at Point Ano Nuevo and along the coast from Moss Landing to Monterey Harbor, and a primary reason that Santa Cruz Harbor and Soquel Landing became fairweather commercial ports of

significance for the export of lumber, potatoes, tallow and hides,and other local resources in the early days of California. These two ports on the northern, or weather shore of Monterey Bay, were ideally sheltered when the NorthWesterly was in town, April through October.

In addition, the NorthWesterly not only provided reliable propulsion for the early fishing fleets on both sides of the Monterey Bay, but produced coldwater upwelling by displacing the surface waters so that colder water from the depths rose to the surface. This upwelling continues to be a critical influence on the Monterey Bay habitat, bringing nutrients to the surface that feed many fish and bird species that contribute to the uniqueness of the Monterey Bay Marine Sanctuary.

Finally, the cooling influences of the NorthWesterly were particularly welcomed by visitors to the region from the Central Valley, where summer temperatures into the 100's drove a significant number of vacationers to the coast in search of relief. These visitors, and the potential economic windfall they engendered, created a new era in the Monterey Bay Region. Both on the north side of the Bay where Santa Cruz and Capitola touted their unsurpassable climate, and in Monterey where the Del Monte Hotel opened in 1880 to become a linchpin in the development of tourism, the NorthWesterly and its natural air-conditioning features, again had a major role in local history.

The Monterey Bay Region owes much of its rich history, flora and fauna to the subtle influence of this remarkable wind. You can catch it any summer afternoon,

whether you are standing at Waddell Creek watching windsurfers dance like butterflys on the glistening Pacific, or bucking headwinds while driving up Highway 101 from King City towards Salinas. As Juan Rodriguez Cabrillo probably more than once admonished his crew as they coasted our area: "abre ojos!" "Open your eyes!" You can see the wind!

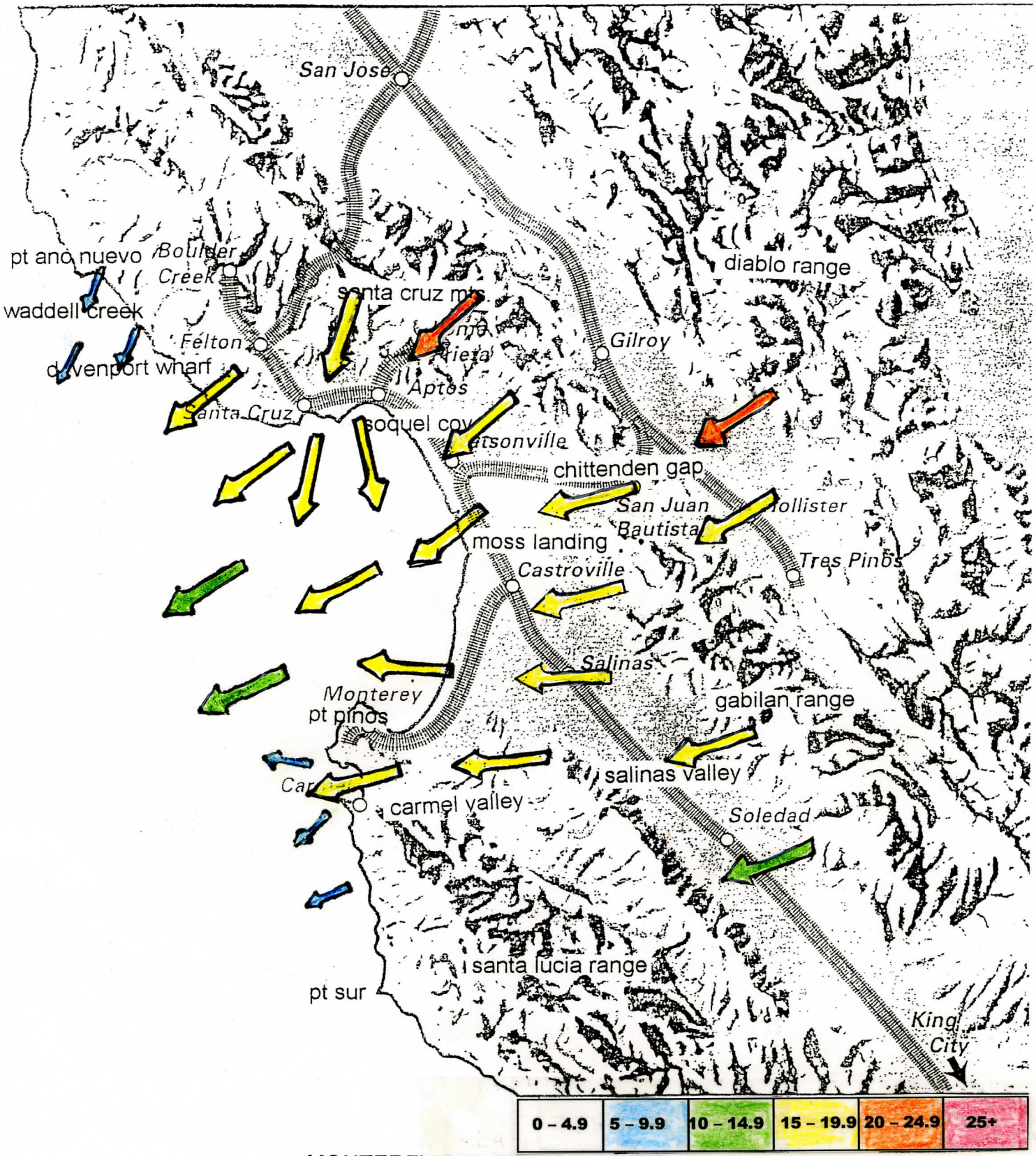
NORTHEASTERLY

"El Hermano Grande" and "La Hermanita"

The NorthEasterly is perhaps the least noticed. but most enjoyed wind in all of the Monterey Bay area. This wind is an "offshore," a mountain gap wind funneling down the the canyons of the coastal hills and mountains to empty into Monterey Bay.

The NorthEasterly blows as a result of two weather criteria. "El Hermano Grande" or "Big Brother" NorthEasterly is the result of an area of high pressure building eastward from the Pacific and setting up temporary residence over the Great Basin area of Utah. Winds blowing from this High towards the West Coast are the progenitor of El Hermano. In Southern California a NorthEaster event, often blowing from a more easterly direction, is called a "Santana," "Santa Ana," or "Devil Wind," for its hot, dry, gale force personality.

El Hermano, blowing 10 to 20 days per year, has similar, but less boisterous characteristics to the Santana, partly due to the fact it is blocked by both the Sierra and Diablo Ranges. Both El Hermano and the Santana usually blow during the late fall and



MONTEREY BAY REGION WINDS

NORTHEASTERLY
"EL HERMANO GRANDE"

winter months, November through March, when the Pacific High has broken down and is replaced by low pressure systems tracking eastward embedded in the Jet Stream. It is in between these lows that a high can set up over the Great Basin, usually lasting three to four days, before itself moving on east.

El Hermano, on its journey from the Great Basin to the coast of Monterey Bay, passes over the Central San Joaquin Valley where high pressure traps ground fog for days on end between the Sierra Foothills to the east and the Diablo Range to the west. El Hermano does not blow through this region at ground level, prefering to stay above 1500 feet. The Valley, or "Tule" fog remains undiluted and stagnant, and temperatures can remain in the 30's and 40's all day, all week, and sometimes all month.

But as El Hermano descends the Diablo Range, the Gabilan Range, the Santa Cruz mountains, the Sierra de Salinas, and the Santa Lucia Range, it undergoes a thermodynamic change and warms rapidly, often astonishingly so, bringing clear skies and a mid-winter heatwave to the Central California Coast.

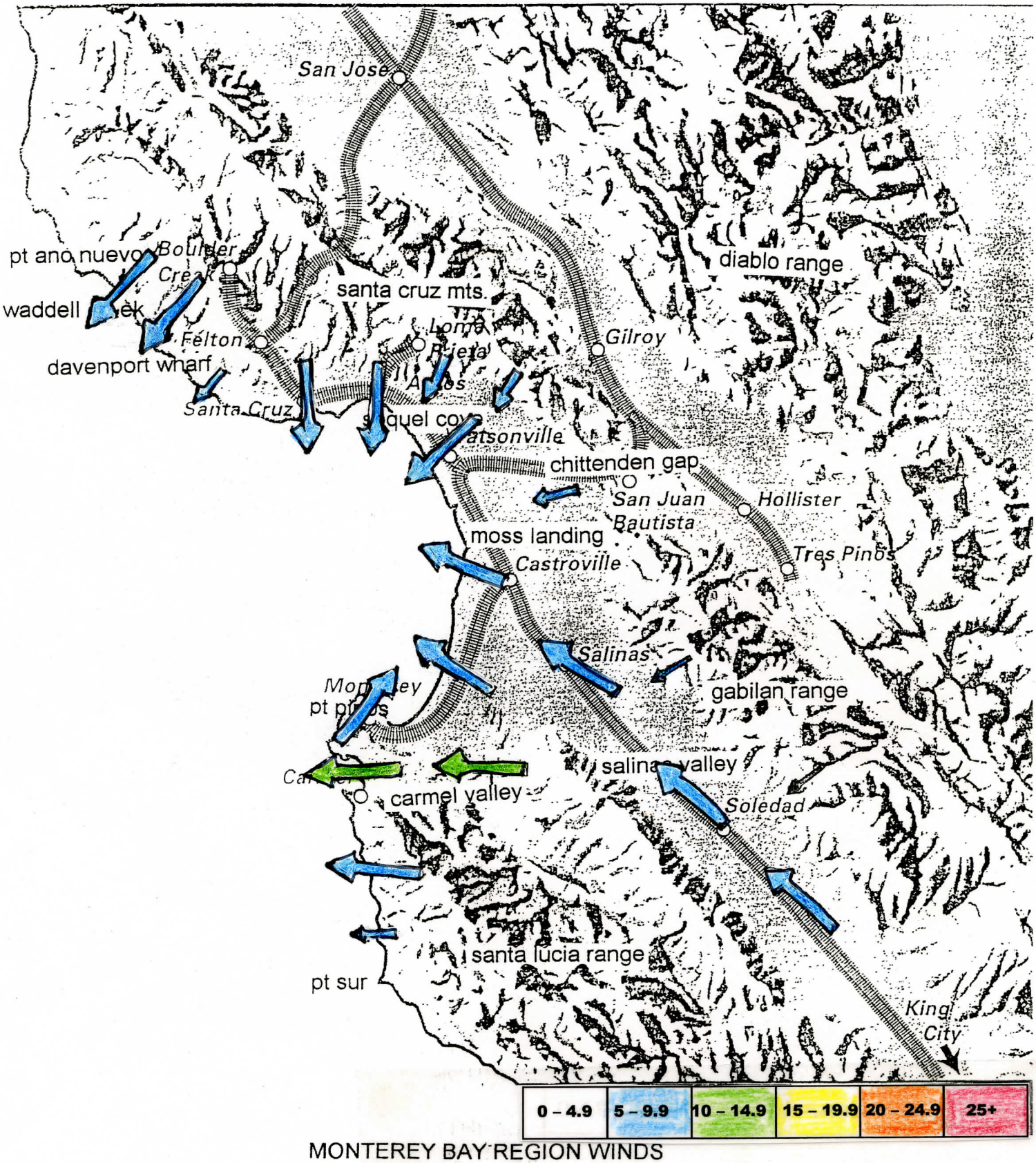
This thermodynamic change is called adiabatic heating and is the process where descending winds compress the atmosphere, causing warming at an average five degrees per 1000 feet of descent. In winter, when the weather is 40 degrees, fog, and calm in Stockton, Fresno, and Bakersfield, but 75 degrees, clear, and 15, gusting 25 knots from the northeast in Carmel, Monterey, and Big Sur, you can bet El Hermano is blowing and bringing smiles to Monterey Bay visitors and residents alike.

El Hermano Grande's little sister is "La Hermanita." Though La Hermanita is a year-round resident of the Monterey Bay Region, she is most evident during the summer as a counterpart to the afternoon NorthWesterly seabreeze. La Hermanita is a night wind, usually beginning just before sunset and continuing to just after sunrise. She is a result of the land cooling and the cool air descending the same valleys that her big brother, El Hermano, travels, but in a different season.

The transition between the seabreeze and La Hermanita is subtle, but distinct, even in the smallest canyons. The best place to feel La Hermanita is at the beach just after sunset as she gathers the scent of moss, sage, and pine and delivers them seaward, especially down the Waddell Creek, Scott Creek, San Lorenzo River, Soquel Creek, and Aptos Creek watersheds on the northern side of Monterey Bay, and down the Pacific Grove boulevards and out Carmel Valley on the southern side of the Bay.

La Hermanita is a gentle breeze, averaging only 6-8 knots, and rarely exceeding 12 knots, except down the Carmel Valley where the land can funnel La Hermanita into Carmel Bay at the occasional 15-20 knots. Due to her gentleness, La Hermanita does not reach far offshore, rarely extending her skirts more than two to three miles. But this is enough to push the summertime marine layer and fog seaward, making for clear nights with temperatures in the 50's in much of the Monterey Bay Region.

El Hermano Grande and La Hermanita are the most geographically influenced winds we have studied, the result of variations in direction of coastal canyons For example, on the northern side of the Bay, the canyons run in a predominantly



MONTEREY BAY REGION WINDS

NORTHEASTERLY
"LA HERMANITA"

northeast to southwest direction, and the NorthEasterly there is a true northeast wind. In mid-Bay the canyons run more east to west, and the wind direction becomes more easterly. And in the south Bay, particularly down the Carmel River and Big Sur watershed, the NorthEasterly flows almost from the southeast towards the northwest.

El Hermano Grande and La Hermanita. Playful names for a playful wind!

EASTERLY

You will never see the Easterly reported on any television weather report, or even find its presence detected in weather service records. This is because the Easterly is a local breeze, a "sub-regional meso-scale" wind in weather forecast terminology. It's boundaries extend east/west from Aptos Beach to the Santa Cruz Small Craft Harbor, and north/south from Highway One to a mile at sea, a total maximum area of about 10 square miles at full development.

The Easterly blows most afternoons from late spring to early fall, usually May through September. It's formation begins about 1pm off SeaCliff Beach in Aptos, near the Cement Ship, in a strip about 100 yards wide, just offshore. Gradually the Easterly builds downwind (westward), arriving off Capitola Beach about 2pm, and Soquel Point by 3pm.

By 4 pm the Easterly will have usually reached the vicinity of the Santa Cruz Small Craft Harbor, and inland to Highway One. By 6pm the Easterly will have reached

full development, with maximum windspeeds of 12-14 knots off Capitola, and 6-10 knots off Twin Lakes State Beach. The Easterly continues to blow into the evening, gradually fading in strength until about 10 pm, when it is replaced by the offshore, "La Hermanita."

The Easterly is the child of two parents. Its father is the afternoon NorthWesterly blowing onshore, as it tries to bend with the coast in its eastward curve towards Soquel Cove. But the NorthWesterly has momentum behind it, and can't back fully with the geography as it rushes southward into the Salinas Valley. Thus the NorthWesterly, as it develops as a seabreeze in Monterey Bay, bypasses the most sheltered northeastern portion of the Bay, the local waters of Soquel Cove.

As the NorthWestly rushes by offshore, it creates an eddy downwind in the lee of Point Santa Cruz. This eddy creates the circulation that becomes the Easterly, and the dividing line between the two winds is known locally by sailors as the "transition." This "transition," or area of calm, varies in width from several hundred yards to a boat length. In fact, I have known instances where the bow of the boat is in the Easterly, while the stern is still in the NorthWesterly!

There is evidence of similar eddy formation on a bigger scale along the coast. The most graphic demonstration is the Catalina Eddy off Southern California. Here, the strong NorthWest winds accelerating past Point Conception cannot bend eastward with the land, and create an eastery flow, or eddy, up the Catalina Channel from San Diego towards Santa Barbara. This Catalina Eddy is most pronounced when the

NorthWesterly is at its strongest: gale warnings off Point Conception are sure to result in the development of a Catalina Eddy formation in the inshore waters off Southern California. Except for scale, our local Easterly and the Catalina Eddy have significant similarities: an easterly trending coastline immediately downwind of a prominent point or headland with an accelerating NorthWesterly close offshore creating a back eddy in the lee of the headland.

While the eddy of the NorthWesterly is the Easterly's father, the inland heating of the Santa Cruz/Scott's Valley/ Felton area is the Easterly's mother. This heating, with summer temperatures in the 80's and 90's, causes a local thermal low over the San Lorenzo watershed and Highway 17 corridor. The Easterly, with its cool marine air father, wants to rush towards this thermal low, and indeed does so until the land begins to cool after sunset.

The Easterly is truly a local wind and was likely used by Native Americans to facilitate hunting and fishing in the waters of Soquel Cove, where they could be assured of not drifting too far offshore, due to the Easterly's onshore component and gentle sea state.

But we do have later evidence of the Easterly blowing in the 1880's from an "Old Drawing of Camp Capitola" (page 35) where, evidenced from flags, the trim of sailing vessels, and the smoke from the train and an offshore steamship, there is an Easterly blowing near the beach and just offshore, while summer bathers frolic in the Capitola surf.

7 for important

Improved channels shown by broken lines are subject to shoaling, particularly at the edges.

used with caution.

Station positions are shown thus:

⊙(Accurate location) ○(Approximate location)

INNER CHANNEL	14.8	7.1	2.1
INNER TURNING BASIN	10.8	10.4	11.7

NOTE-CONSULT THE CORPS OF ENGINEERS FOR CHANGES SUBSEQUENT

PRODUCED BY COMPUTER ASSISTED METHODS

CAUTION

Temporary changes or defects in aids to navigation are not indicated on this chart.

STORM WARNINGS

The National Weather Service displays storm warning signals at the following approximate locations:

Monterey [U.S. Station] (36°36.5'-121°53.7')

Moss Landing (36°47.6'-121°47.5')

0 – 4.9	5 – 9.9	10 – 14.9	15 – 19.9	20 – 24.9	25+

The Port Direct
harbor entrance o
April. It is recomm
do not attempt to
swells. The Port D
16 (156.80 MHz fr

31

SANTA CRUZ

SPIRE

DOME

Hosp.

Seabright

Twin Lakes

Granary Tr

S. P. R. R.

Capitola

Soquel

Soquel Cr.

Lumber R. R.

Seacliff Beach

Aptos

Valencia Cr.

Rio Del Mar

SOQUEL COVE

R Bn 294
Occ G 6M HORN

R TRS
(KSCO) 1080 kHz

Santa Cruz Harbor

Black Pt

HORN (Apr 15 to Nov 1)
Priv 5½ maintd

Fl 6sec
60ft 17M

COLREGS 82 1205

Pt Santa Cruz

Soquel Pt

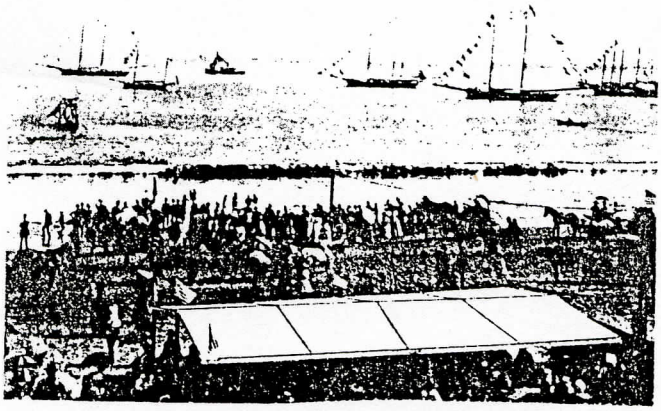
"transition line"

"transition line"

BW"SC"

In addition, there is a photograph taken about the same period from the Santa Cruz Main Beach showing a half-dozen schooners and yawls anchored close offshore lying to an Easterly wind while beach goers celebrate a summer holiday, probably Fourth of July, on the neaby sand.

The Easterly is synonomous for summertime at the Beach. Windchimes tinkle in Capitola Village. Wednesday Night Sailboat Races begin at Santa Cruz Harbor. And the giant American Flag at the USA gas station on 41st Avenue blows due west towards Santa Cruz.



Easterly Breeze, Santa Cruz Main Beach, circa 1890

CONCLUSION

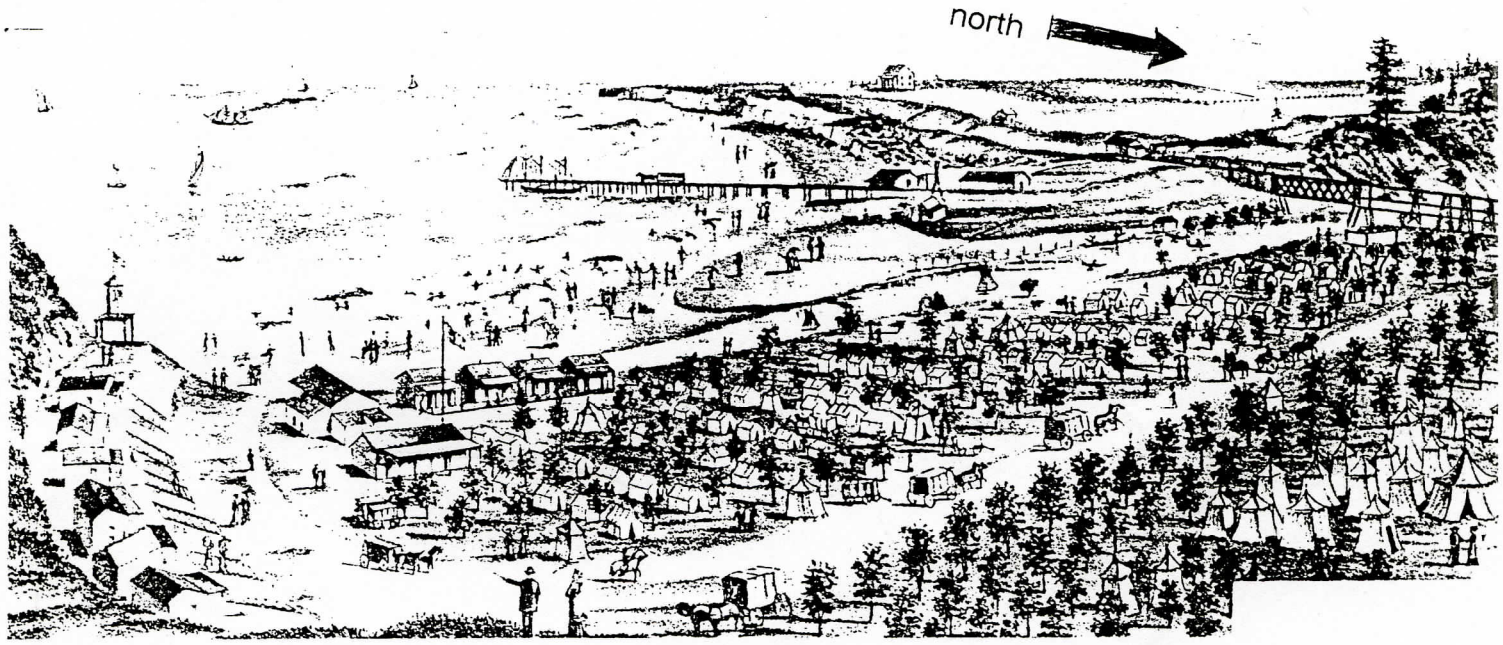
The winds of the Monterey Bay Region have played a subtle but significant role from the time of early exploration, through late Nineteenth Century regional development, right up to present day recreation. Flora, fauna, agriculture, geology, architectural design, and especially areas of human use and development are but a few of the areas impacted by regional winds.

The SouthEasterly influenced early discovery and development of Monterey as a port, and later helped bring the railroad to the Santa Cruz area as maritime commerce was unable to use the northern half of the Bay year-round, primarily due to the SouthEasterly storms.

The NorthWesterly, our resident wind, is as much a part of the landscape as the rugged hills, the fertile valleys, and magnificent Bay on our doorstep. The NorthWesterly is drawn up the Salinas Valley by marine air rushing inland, and is the afternoon wind we all take for granted. The NorthWesterly cools tourists, provides recreation on and around the Bay, and influences the biology of local waters as it causes upwelling in the Bay, and a maritime climate inland.

The NorthEasterly is a whimsical breeze, coming from off the land and down its many contours. It's two variations, El Hermano Grande and La Hermanita, warm as the breeze descends the hills, 5 degrees for every 1000 feet, due to adiabatic compression.

The Easterly is our "certifiable local" wind, appearing just inshore and offshore of the coast from Aptos to Santa Cruz most summer aftenoons. If the Capitola Chamber of Commerce were to design and build one wind, this would be it.



Old drawing of Camp Capitola

EASTERLY

Soquel Cove

REFERENCES

Fagan, B., & Pomeroy, G. (1979). Cruising guide to the Channel Islands. Santa Barbara and Van Nuys: Capra Press and Western Marine Enterprises.

Griffes, P., (1995). Pacific Boating Almanac, Northern California Edition. Los Angeles: PBA Publishers.

Huschke, et.al. (1959). Glossary of meteorology. Boston: American Meteorological Society.

Koch, M., (1973). Santa Cruz County, parade of the past, Fresno: Valley Publishers.

Le Boeuf, B., & Kaza, S., editors. (1981). The natural history of Ano Nuevo. Boxwood Press.

Lydon, S., (2000). A history of the Monterey Bay region, volume 1 to 1880. Draft copy. Capitola: Capitola Book Company.

Moss Landing Marine Laboratories. (1971). Marine air penetration of the Monterey Bay coastal strip and Salinas Valley, California. National Sea Grant Project by National Oceanic and Atmospheric Administration and Dept. of Commerce.

Rowland, L., (1980). Santa Cruz County-the early years. Santa Cruz: Paper Vision Press