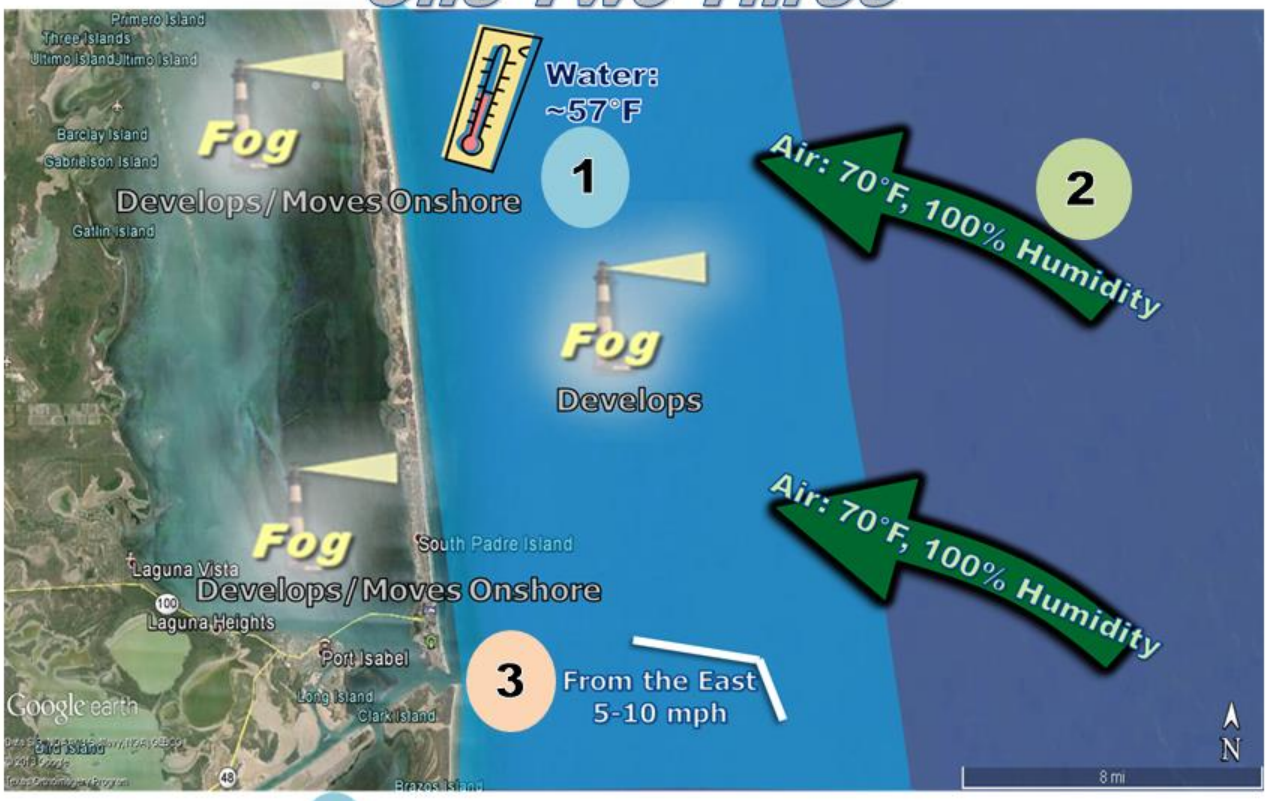
The Making of Sea Fog: (Feb 22-26 2014)
One Two Three



Cold Water Nearshore 1
Warm, Nearly Saturated Air Overriding the Cold Water 2
Light Winds from the Gulf, Perpendicular to the Coast, Nudging the Air Onshore 3

On Little Cat's Feet

Dense Fog Socks in South Padre Island for Nearly Four Days, Feb 22-26 2014

Across the Rio Grande Valley, dense fog is an occasional hazard. Fog season typically runs from November through March, when cooler nights combine with clear skies, light winds, and just enough moisture near the ground to create fog. A higher frequency of moderate to strong south winds reduces the number of foggy days in the Valley and Coastal Bend compared with other semi-tropical locations along the Gulf coast from Houston to Tampa Bay, Florida. In all of these areas, the two most common types of fog are radiation fog and advection fog. Advection fog forms when warm, humid air overrides cool to cold ocean water and condenses into a cloud. The cloud can literally be immediately above the sea surface. Advection fog is generally less frequent along the South Texas coast than other Gulf coast communities due to a lower contrast of nearshore and offshore water temperatures, which help maintain just enough wind over the water to disrupt the formation process.


Photo Credit: South Padre Island Travel Web Cams

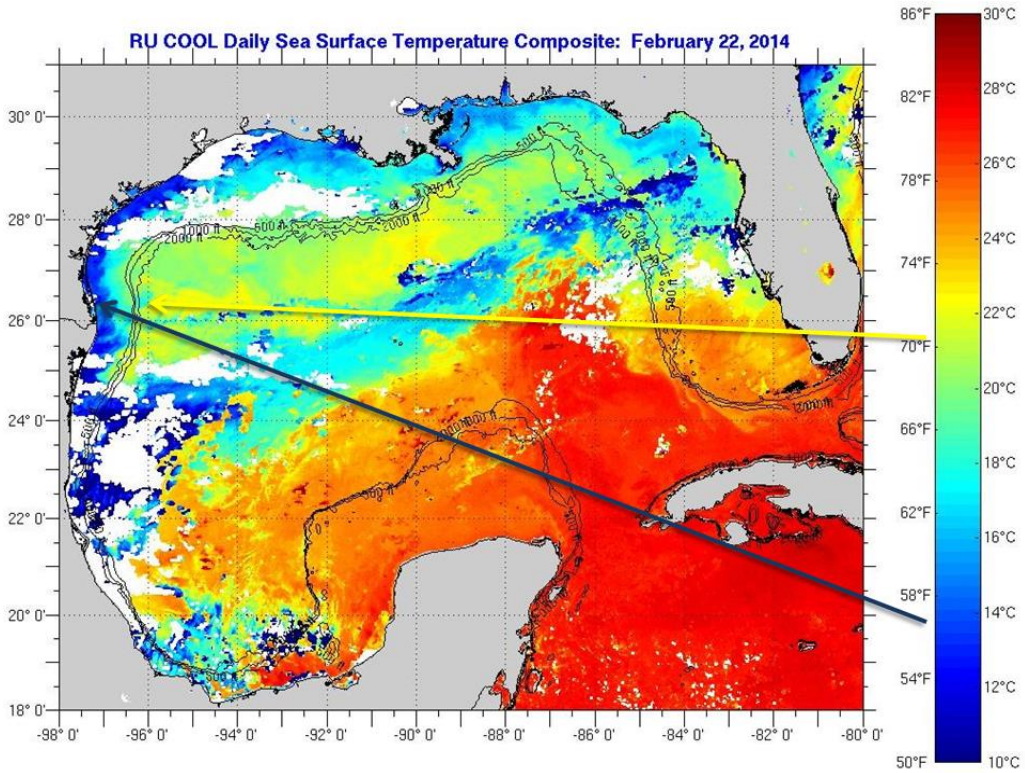
Such was not the case in late February, 2014. The first prolonged sea fog episode kept the resort City of South Padre Island in "pea soup" (right) for a majority of time between the late afternoon of February 22nd and early morning of February 26th, when another of the 2013/2014 Winter's sharp cold fronts whisked away the warm, humid air mass.

The sharp cold fronts played a significant role in creating the environment conducive to a prolonged dense fog event on the beach and across the nearshore waters of the southwest Gulf.

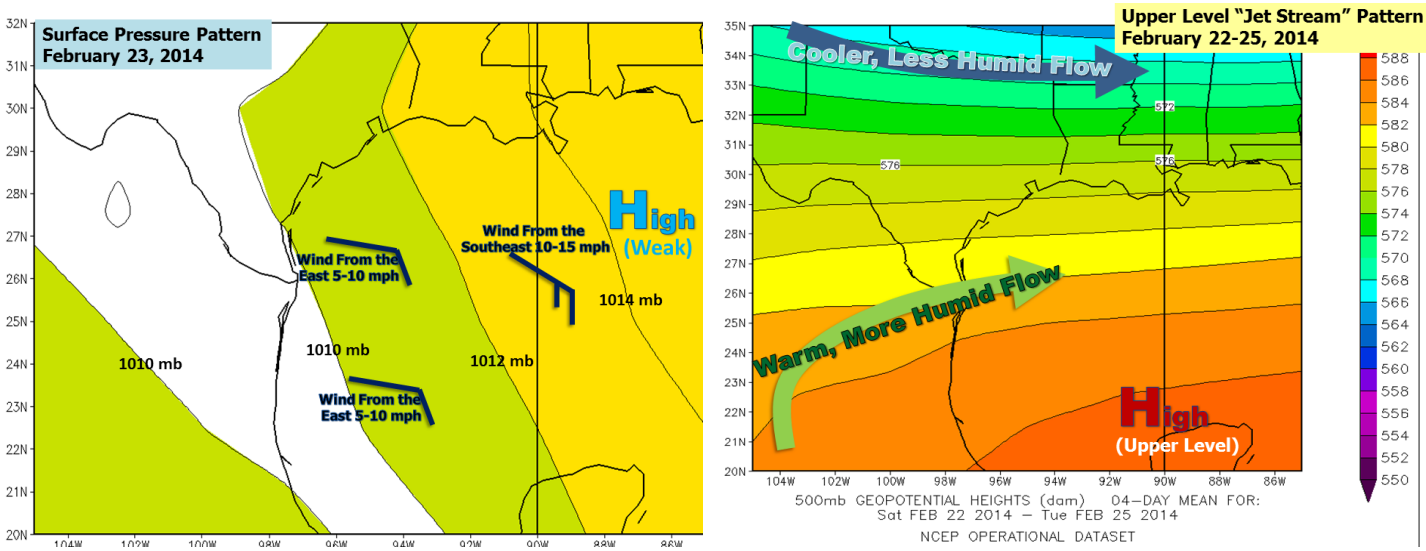
Puzzle Pieces Align

The image at the top of this article provides the three primary reasons for the prolonged period of dense fog. Details of each follow.

- ***Cold Nearshore Waters.*** At least ten significant fronts – generally defined as a 20°F difference between the previous day's maximum temperature and the temperature at 2 PM the following day – brought routine chill-downs to the Rio Grande Valley during the winter of 2013/2014. Winds from the northwest spread across the shallower shelf waters, bringing cold temperatures (often down in the 30s and 40s) which cooled the shelf waters substantially. The winds also stirred up colder water from below the sea surface (known as upwelling), adding to the chill. Nearshore water temperatures averaged in upper 50s from mid-December 2013 through the end of February 2014. Values bottomed out in the lower and mid 50s between the 6th and 16th of February.
- ***Sharply Warmer Offshore Waters.*** Deeper waters toward the edge of the shelf have a greater heat capacity and are less influenced by the cold air flowing over them, and the ability for upwelling is reduced. Two buoys, maintained by Texas A&M University and funded by the Texas General Land Office Oil Spill Prevention and Response Program, tell the tale. Station 42044, 8 miles east of South Padre Island, is in relatively shallow waters (72 feet); Station 42045, 42 miles east of South Padre Island, is in deeper waters (207 feet). During the weeks prior to the fog episode, the difference in water temperatures between buoy station 42045 and station 42044 was up to 13°F (colder), and typically ranged from 10 to 12°F (colder).
- ***Warm, Nearly Saturated Air Flowing Toward the Coast.*** Weak surface high pressure in the central Gulf combined with a warming atmosphere brought warm and very humid air toward the Lower Texas Gulf Coast beginning February 22, which continued until the early morning of the 26th. Air mass temperature was around 70°F; most importantly, the dewpoint was *also 70°F,* more than 10°F above the nearshore water temperature and already saturated. A weak cold front dissipated before reaching the Valley and Lower Texas coast on the 24th, but provided a reinforcement of light east/southeast winds perpendicular to the coast to ensure the fog machine regenerated.



Sea surface temperatures on Feb. 22, 2014. Dark blue arrow and yellow arrow indicate short distance contrast between much higher temperatures less than 70 miles apart.



Left: Surface pressure during second foggy day on South Padre Island (Feb 23). Note the light winds, generally perpendicular to the coast. Right: Mean 500 mb pattern, February 22-25. The "battle" between the warm and cooler flow, along with the position of the upper level pressure systems - high pressure in the Gulf, low pressure centered near the Great Lakes (not shown) – set up the near perfect scenario for prolonged fog along the Lower Texas coast.

24	09:55	E 8	0.15	Fog	VV000	64	64			100%	30.02	NA
24	09:35	E 12	0.15	Fog	VV000	64	64			100%	30.01	NA
24	09:15	E 10	0.15	Fog	VV000	64	64			100%	30.01	NA
24	08:55	E 6	0.15	Fog	VV000	NA	NA			NA	30.02	NA
24	08:35	Calm	0.15	Fog	VV000	64	64			100%	30.02	NA
24	08:15	E 3	0.15	Fog	BKN017	64	64			100%	30.01	NA
24	07:55	Calm	0.15	Fog	VV000	64	64			100%	30.00	NA
24	07:35	Calm	0.15	Fog	BKN017	64	64			100%	29.99	NA
24	07:15	E 3	0.15	Fog	OVC015	64	64			100%	29.98	NA
24	06:55	E 5	0.25	Fog	OVC015	64	64			100%	29.97	NA
24	06:35	E 5	0.15	Fog	VV000	64	64			100%	29.97	NA

Sample of observations from the South Padre Heliport near Isla Blanca Park, from February 24th in the morning (635 to 955 AM). Note the light east winds (column 3) and low visibility (column 4, in statute miles). VV000 indicates obscured vertical visibility on the ground – dense fog. Similar conditions prevailed overnight through early to mid-morning on the 23rd through 26th, with a few hours of light fog/haze each afternoon.