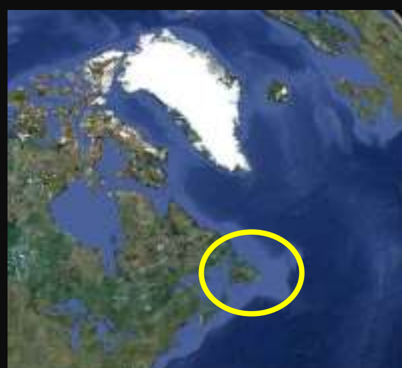
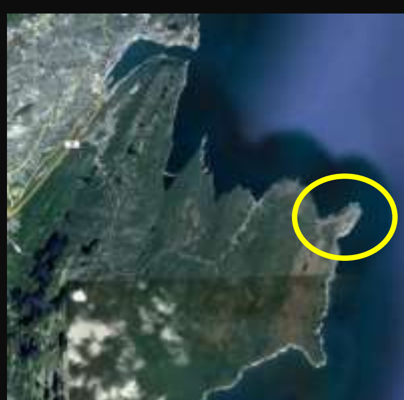
Beautiful Snow drifts
on
Cape Spear National Historic Site

It is 6 km from the entrance to the St. John’s, harbour and is the most easterly point in North America and one of the most famous tourist sites the most popular part of the stunning 265km East Coast hiking trail. In fact, in 2010, National Geographic ranked the East Coast trail as the No 1 coastal destination in the world – regardless of the season.





Cape Spear 6 km in the distance (far left) barely visible in the fog (which it often is) as viewed from atop Signal Hill. Below is Fort Amherst lighthouse at the entrance to St. John's Harbour and a couple of remains of once giant Icebergs.

Photo: Alexander Robertson
http://www.windandlandscape.com

The north side of Cape Spear and Signal Hill in the distance (arrow). The most severe in winter winds on Cape spear are from the north. The cape is some what shelter northeast by the cliffs. While winds are from the southwest are pleasant enough – but only marginally for the tree. However, vegetation benefits immensely from the protection of snow drifts.

Photo: Alexander Robertson

http://www.windandlandscape.com

This part of Cape Spear lighthouse built in 1839 and restored to its original appearance and is The oldest surviving lighthouse in Newfoundland and Labrador and has exhibits on the history of lighthouses and the tradition of light keeping. The site is surrounded by spectacular scenery and wildlife such as whales, seabirds and icebergs in season. It is also on the windiest spot on the Cape.

Photo: Alexander Robertson
http://www.windandlandscape.com

The severe ice-laden winds have rounded off rock on this magnificent cliff. Someone long ago had stuck an anchor into the rock which is was probably to anchor a radio mast rather than for a climbing rope. Ice is still visible around the lighthouse.

Photo: Alexander Robertson

http://www.windandlandscape.com

The relatively smooth snow cover suggests a rather benign low wind speed from right to left (i.e., onshore easterly winds with no serious turbulence).

Photo: Alexander Robertson
http://www.windandlandscape.com

One of the great attraction of Cape Spear is the sights and sounds of powerful waves crashing crashing on the steep rocky shore - beautiful fluid dynamics to say the least.

Photo: Alexander Robertson
http://www.windandlandscape.com

Because of the long “fetch” across the ocean, the north winds create spectacular wave action - especially when the waves crash against the rock shore. Unfortunately, a few careless souls have gotten too close too close to a “rouge” wave and were never seen again.

Photo: Alexander Robertson
http://www.windandlandscape.com

In 2012, modern navigational equipment have made lighthouses redundant in coastal Canada – and many have been put up sale. The exception is the original lighthouse built. Nevertheless, the melodious foghorn still sings out over the ocean. Quite often, in winter, brisk salty onshore winds melts the snow cover to reveal grasses shaped by brisk westerly winds during the summer and fall.

Photo: Alexander Robertson

http://www.windandlandscape.com

Cape Spear in Spring showing the remnants of persistent deep snow drifts on the sheltered areas and wind shaped tree.

Photo: Alexander Robertson
http://www.windandlandscape.com

Photo: Alexander Robertson
http://www.windandlandscape.com

Photo: Alexander Robertson
http://www.windandlandscape.com

Photo: Alexander Robertson
http://www.windandlandscape.com

At Cape Spear moderately strong winds lift the salty mist to great heights and transport it over long distances. The result is severely flagged trees. On the plus side, sea mist tends to fertilized the soil while keeping diseases and foraging insects populations low (which explains why the foliage on these wind-shaped balsam fir and the grasses retain a healthy color on the lee side.

Photo: Alexander Robertson

http://www.windandlandscape.com

Snow drifts protect foliage on the leeward side of this hard living hard-living balsam fir. Blasting by surface ice crystals + plus salty sea mist is killing the windward side.

Photo: Alexander Robertson
http://www.windandlandscape.com

While vegetation under the snow is protected, ice crystals blown across the icy surface of the snow, tend to shot-blast balsam fir foliage above the snow. The result is a lopsided (flagging) growth and increasing number of dead branches on the windward side. Deciduous trees and shrubs don’t suffers as much damage in winter, but suffer from abso9rption of salty in the leafy season

Photo: Alexander Robertson
http://www.windandlandscape.com

This photo illustrates beautiful snow drifts created by well-defined, roughly linear, turbulent patterns in the upslopeupslope (i.e., onshore) winds.

Photo: Alexander Robertson
http://www.windandlandscape.com

Like the trees, solid obstacles such as boulders also give some hints on the relative distance of shelter effects at a miniature scale. Overall, this is not a windy site but the boulder in the foregrounds indicates light winds at the surface.

Photo: Alexander Robertson

On the same site as previous photo, showing that much of the snow is blown over the coastal ridges and sometimes forming over-hanging cornices which conceals treacherous cliff’s edge shown in the next slide. Wisely, there are no footprints across on the edge.

Photo: Alexander Robertson

This photo taken close to the old Cape Spear Lighthouse shows the steep cliffs along the coast typical of the much of Newfoundland's coastline. As shown in previous slide, the vegetated edge is often hidden by snow which, when disturbed, can slide off the cliff like a miniature avalanche.

Photo: Alexander Robertson
http://www.windandlandscape.com

Underneath the is mostly heathland with a few scrubby trees and shrubs and rocky outcrops. The wind has blown most the snow over the cliffs. Which makes for fantastic hiking with short boots along this short section of the famous East Coast Trail.

Photo: Alexander Robertson

http://www.windandlandscape.com

Most of the famous East Coast trail is suitable for pleasant walking along the majestic cliffs, occasionally it passes through sheltered gullies and scrub woodlands (which we Tuckamore) where the snow is soft and waist deep. Marching through this a fantastic workout for almost every muscle in the body.

Photo: Alexander Robertson
http://www.windandlandscape.com

Wind penetrates penetrates the top edge of the tuckamore, but only over a short distance judging from the short, sharp edged snow drifts – otherwise, the broad, smooth section of snow is indicative of a sheltered area with very little snow drifting. In fact, the deeper the snow, particularly piling up on trees on the leeward (downwind) side indicates a sheltered zone.

Photo: Alexander Robertson

http://www.windandlandscape.com

Snow reveals scaling down to shrubs produces the same shelter effect as scaling up to trees. This example illustrates the general rule the deeper the snow, the less windy it is. This shows deciduous drwarf shrubs have created a highly organized series of down-slope linear bands of turbulence. What is not so obvious is a finer, perpendicular series of wind-shaped rills the flat surface caused by a change in and weaker wind direction

Photo: Alexander Robertson

http://www.windandlandscape.com

Experts often argue about the effective distance of shelter provided by a windbreak – be it trees, fences or other structures. This valiant group of weather-battered group of stunted balsam fir throws a monkey wrench into conventional shelterbelt theory. Obviously, by the sheer depth and length of the band of snow, indicates this weather beaten dwarf tree exerts a shelter effects ove r a long, narrow distance. Of course, that fact the shelter is a factor when considering effect shelter

Photo: Alexander Robertson

http://www.windandlandscape.com

The same tree as in previous slide, the slide also hints at the influence of a shallow gully on the patterning (shelter effect) on the length of the snow drift.

Photo: Alexander Robertson

http://www.windandlandscape.com

At a smaller scale (but with no gully), are dwarf shrubs showing basically the same shape proportionally the same height & distance. Foot prints have obscured parts of the natural drift, nevertheless, there are faint traces of a weak cross-wind at the bottom right.

Photo: Alexander Robertson

http://www.windandlandscape.com

This slide illustrates contrasting difference between shelter effect (the same tree as in slide 21) and no trees at all. On the left side the snow blown right off the cliffs by virtually laminar (straight) flow with relatively little patterning other than scouring. But around the tree (same as in slides 21 & 22) the rich patterns of drifts indicate a wonderful array of turbulent dynamics

Photo: Alexander Robertson

http://www.windandlandscape.com

The most curious humpback pattern of drifting reminiscent of a pod of porpoise. It is difficult, if not impossible, to describe the geometry of the basic turbulent forces that created this pattern. Obviously, that the dynamics of wind curling over the cliff edge is responsible.

Photo: Alexander Robertson
http://www.windandlandscape.com

Slight gaps in bands of shrubs colonizing slopes transforms random micro-gusts into linear turbulent streaks that organizes snow drifts into well-defined linear drifts.

Photo: Alexander Robertson

http://www.windandlandscape.com

A broad view of onshore winds transporting snow off the bog, up a steep bank and in beautiful patterns of linear drifts on a short plateau. The wind are not gale force, but somewhat brisk nevertheless; i.e., roughly in the range 7-10 m/sec.

Photo: Alexander Robertson

http://www.windandlandscape.com

Upslope winds are necessarily gale-force to shift huge amounts of snow off the bogs and up steep hills – with scrubby alders and birch that have been shaped by salty summer winds. On the left there is obviously an obstacle such as a large rock on a steep bank blocking the wind and creating strong vortices that gouged out the snow across the main direction of wind

Photo: Alexander Robertson
http://www.windandlandscape.com

When the has been shifted up the slope and onto level ground turbulence shifts the snow drifts develop into longer, linear and beautiful patterns. The flow is Interrupted by a boulders and then by shrubs (right) and at a smaller scale by clumps of grass (foreground).

Photo: Alexander Robertson
http://www.windandlandscape.com

Sometimes the wind creates curly snow drifts

Photo: Alexander Robertson
http://www.windandlandscape.com

And here's the reason for curly snow drifts; i.e., the snow has been divert when the snow drifts across a slope and down into a depression or whenit encounters a roadside bank.

Photo: Alexander Robertson
http://www.windandlandscape.com

Regardless of the season or the weather, Cape Is very popular with tourists and residents

Photo: Alexander Robertson
http://www.windandlandscape.com

Beautiful snow drifts on Cape Spear

Photo: Alexander Robertson
http://www.windandlandscape.com

The spray on top of the waves give a clue of the wind direction (left-right). The wind has shifted all the snow over the rock knoll into a depression. But the broad, smooth drift is the result of cornering winds around the far end of the knoll.

Photo: Alexander Robertson
http://www.windandlandscape.com

This the end of the same knoll in the previous slide when a slight change in wind direction (sometimes referred to as “the angle of attack” had shifted redirecting the shifted a huge amount of snow – leaving only a series of small drifts in place of one large, smooth one in the previous slide. This dramatic change occurred within an hour or so.

Photo: Alexander Robertson

http://www.windandlandscape.com

Snow drifting across a landscape provides a natural laboratory for wind engineering and shelterbelt design insofar as it can provide an insight on the nature of surface wind flowing across landscapes with obstacles and variable topography.

Photo: Alexander Robertson

http://www.windandlandscape.com

Turbulent patterns in rivers have similarities to patterns in drifting snow at Cape Spear; i.e., the they obey the same basic principle laws of fluid dynamics

Photo: Alexander Robertson
http://www.windandlandscape.com

We can also simulate turbulent patterns with a dry-ice demonstration; such as simulating wind flow or over a model of Mt. Esja, Iceland. Note the linear turbulence at a fine scale (top) when it flows over a smooth surface, then dams up against the mountain, or is diverted around it.

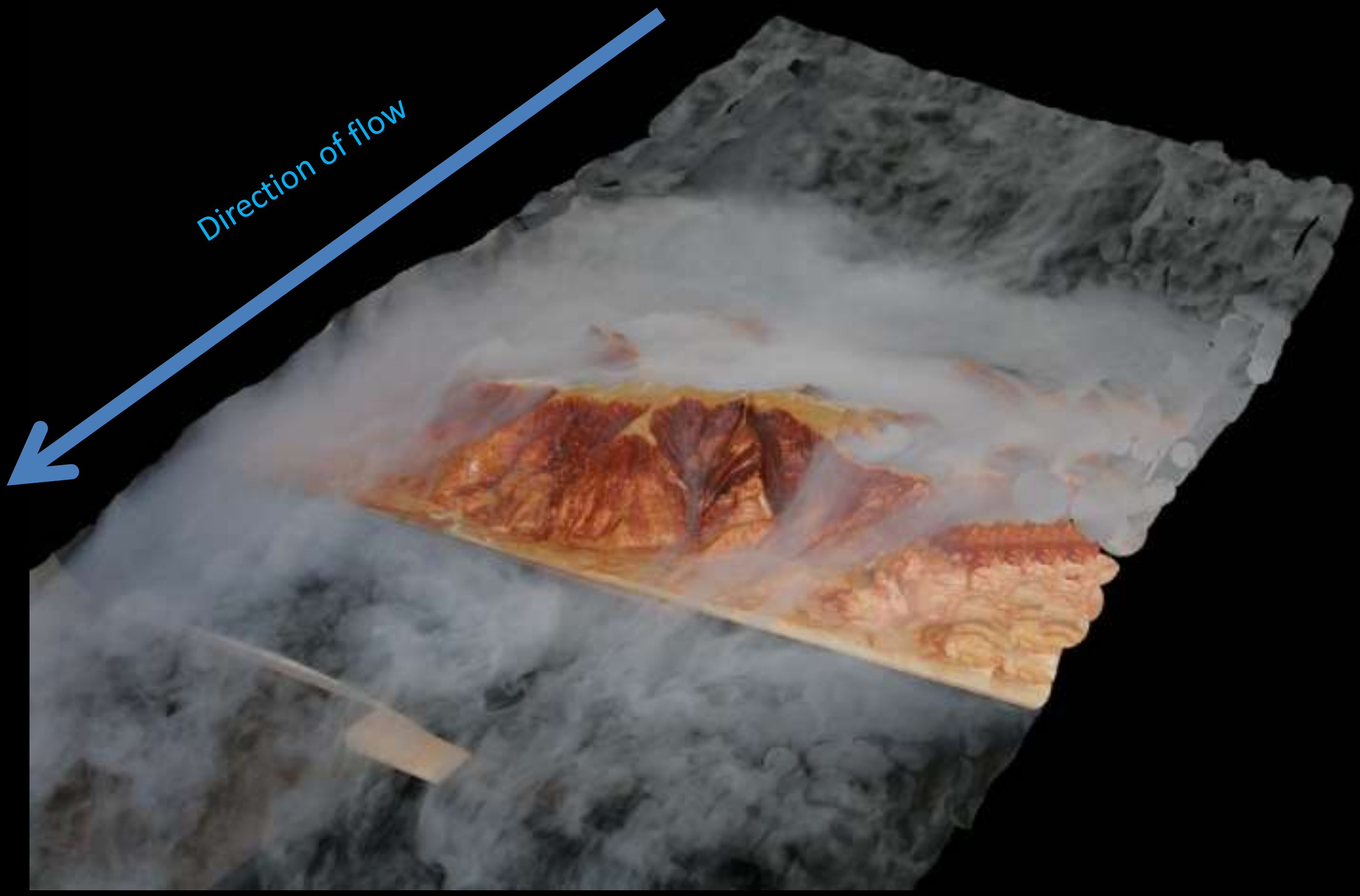


Photo: Alexander Robertson
http://www.windandlandscape.com

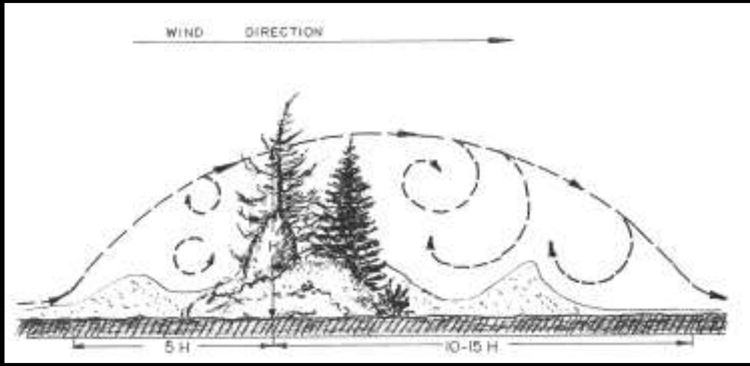
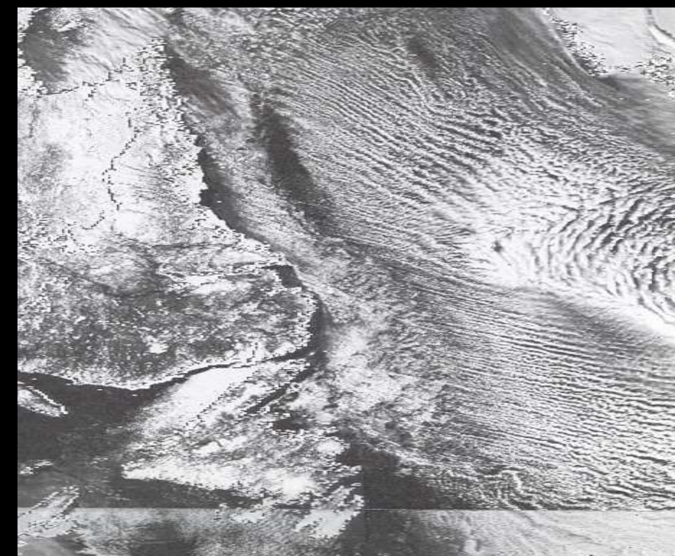


Photo: Alexander Robertson
http://www.windandlandscape.com

A severe case of saltation (sand creep) on Skeiðárasandur which transports large volumes of sand,

Photo: Alexander Robertson
http://www.windandlandscape.com

Linear vortex streaks are common on Quidi Vidi Lake, St. John’s, Newfoundland. They occur when there is a prevailing wind and a difference in temperature between the warmer air and cooler water or vice-versa. They are the signature Görtlers *(longitudinal helical roll vortices)* which are a boundary-layer form of gravity waves caused by bouyancy and gravitation. The same principle applies to sea Ice off the coast of Newfoundland and Labrador and cloud streaks over Finland and most remarkable of all in wave forests on the Northern Peninsula of Newfoundland.



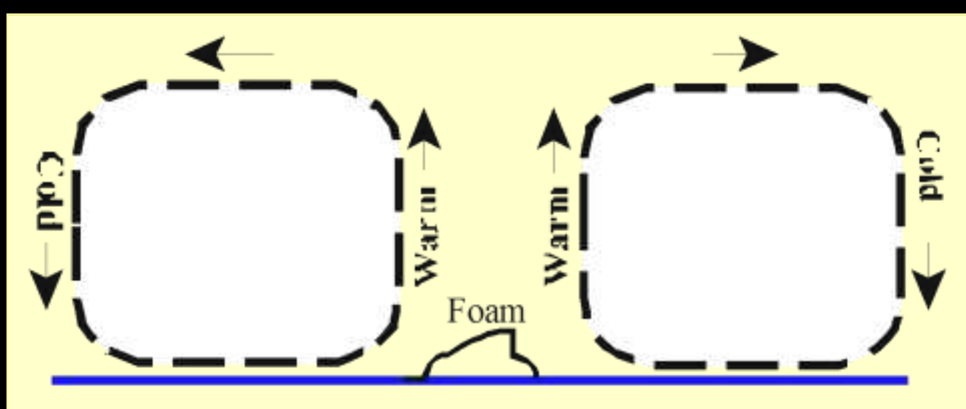


Photo: Alexander Robertson

http://www.windandlandscape.com

The fluid dynamics of flood waters have much in common with clouds as revealed by their turbulent signatures on flood plains, sand on deserts and dry-ice models shown elsewhere in this chapter. However, particularly violent flood sediment loaded waters from a Grimsvötn volcanic eruption under a Vatnajókull glacier. tend to leave a much more dramatic array of turbulent patterns similar to particularly severe snow drifts.

Photo: Alexander Robertson
http://www.windandlandscape.com

Stable gravity waves shifting snow on ice on Skorradalsvatn, Iceland, cloud streets over Finland and sandunes on the Sahara.

Photo: Alexander Robertson
http://www.windandlandscape.com

Turbulence are common in many landscapes around the world and can be seen from the air such on the volcanic deserts and the more complicated flow of some rivers in Iceland

Alexander Robertson

http://www.windandlandscape.com

Surface winds can be a powerful mechanism for shifting heavy gravel upslope as this example near Mt. Hekla *(top)*, and shift volcanic soil that can overburden stout fences as in this example north of the Westman Islands in Iceland.

Photo: Alexander Robertson
http://www.windandlandscape.com

Hopefully, this slide show will give you a better appreciation of the role of in creating beautiful snow drifting patterns and, throughout the year, the effect of wind on the landscape through the year. And perhaps on a very windy day, if you listen carefully, you may hear these two ancient rocks whistling in the wind to each other.

Photo: Alexander Robertson

http://www.windandlandscape.com