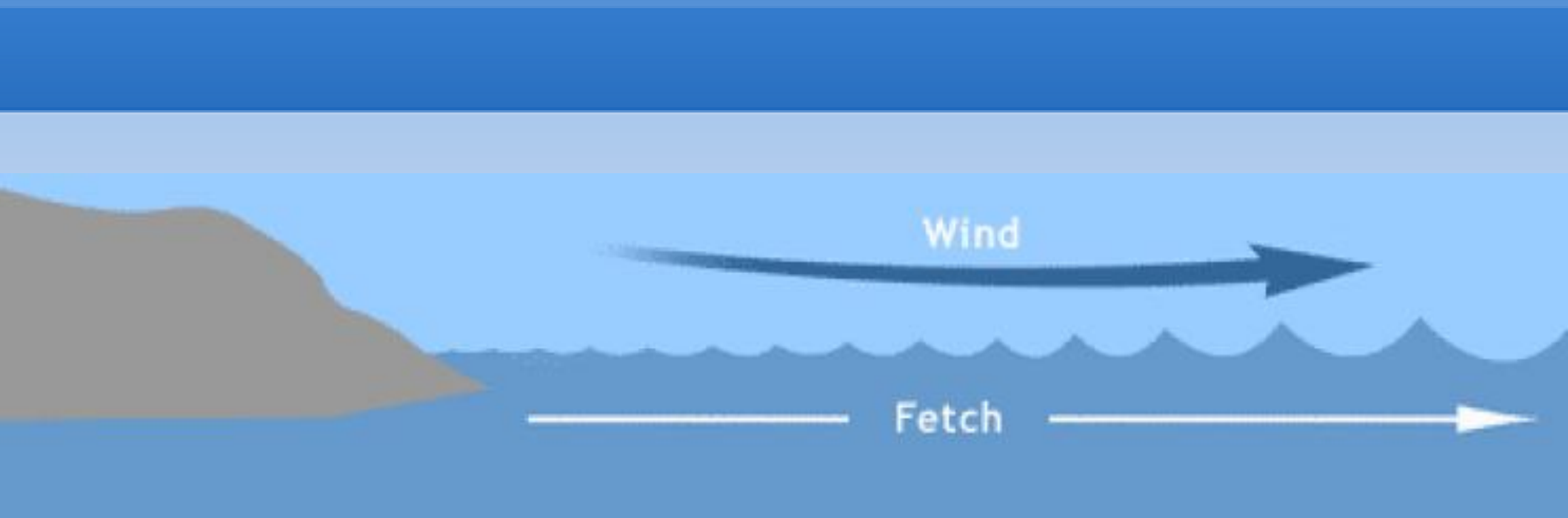


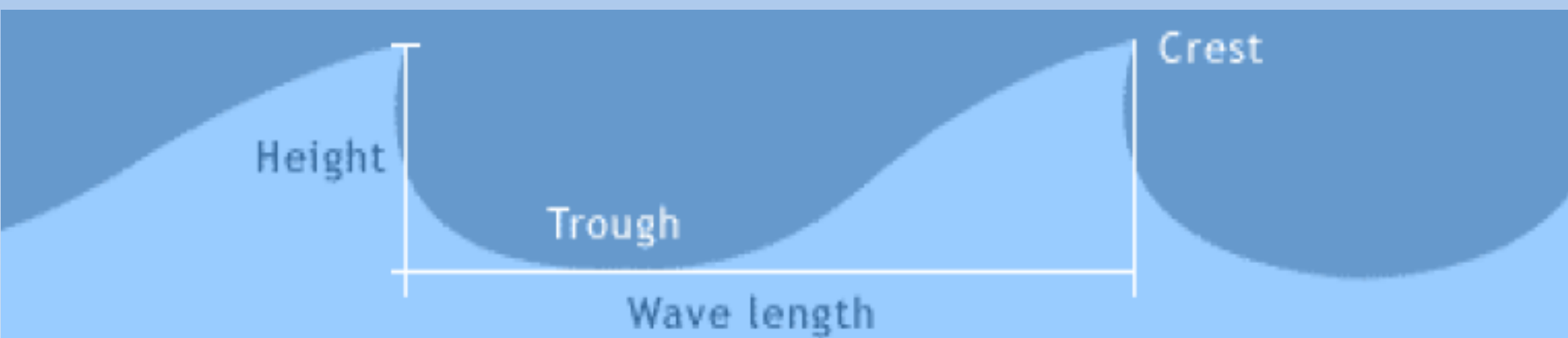
- What is sand?
- Where does it come from?
- Waves and wave energy
- How global climate change will influence waves and wave transport
- Dune types and formation
- Natural dune communities
- Introduced beachgrass and influence on beach and dunes
- Surf zone and sand dwelling organisms and food web
- Snowy plover biology
- Oregon beach law
- Field trip

Waves and wave energy

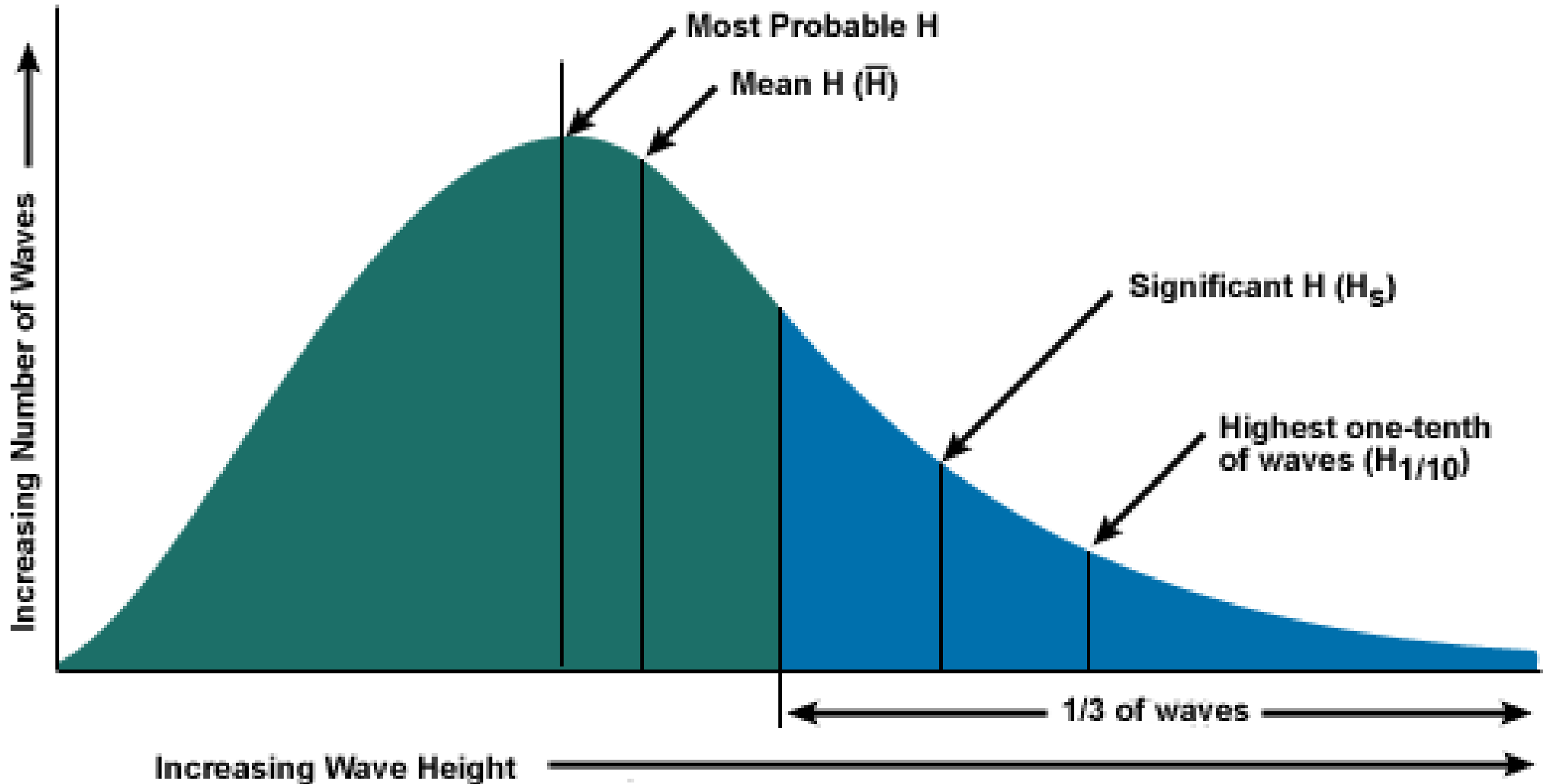
- Winds
- Tides

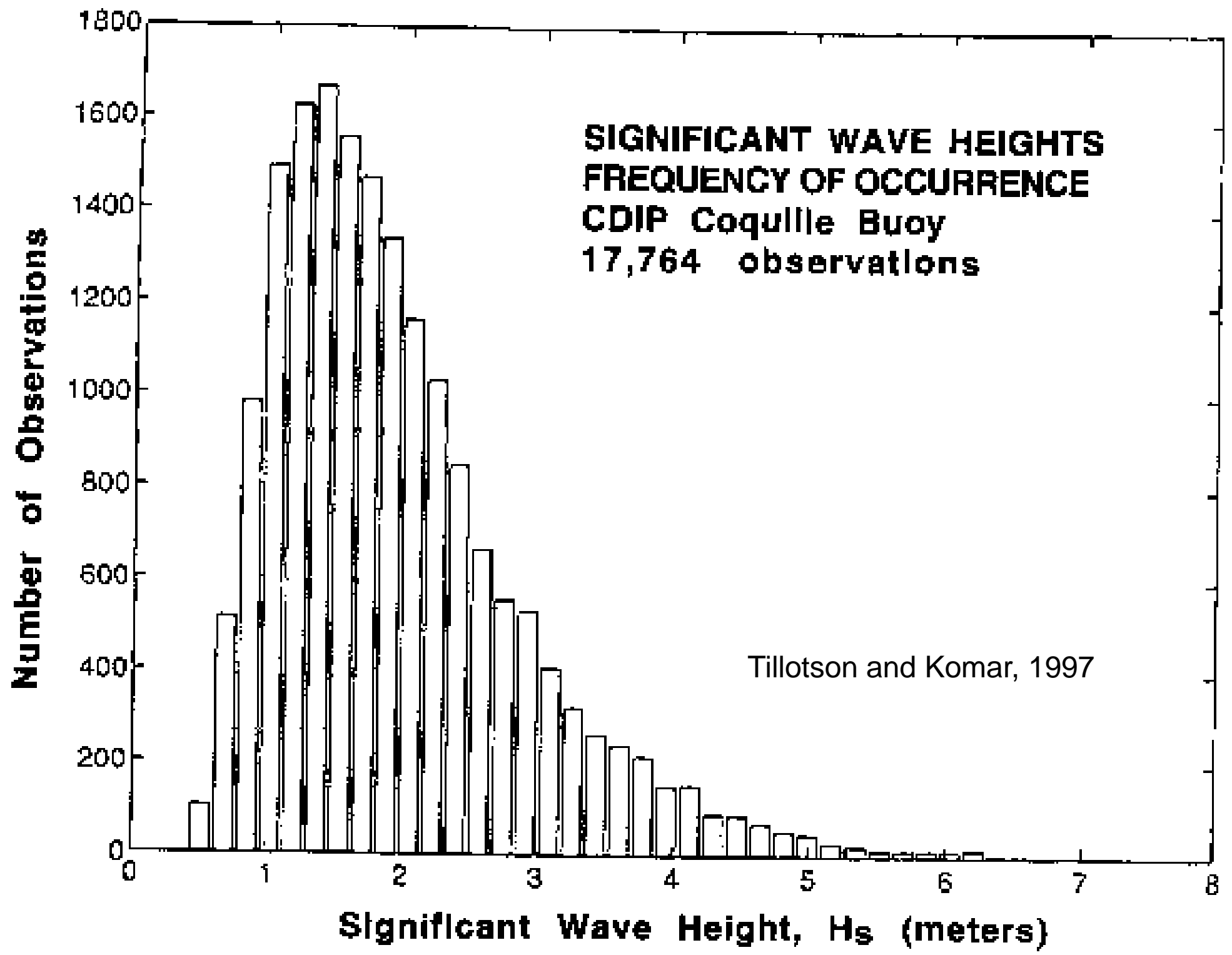


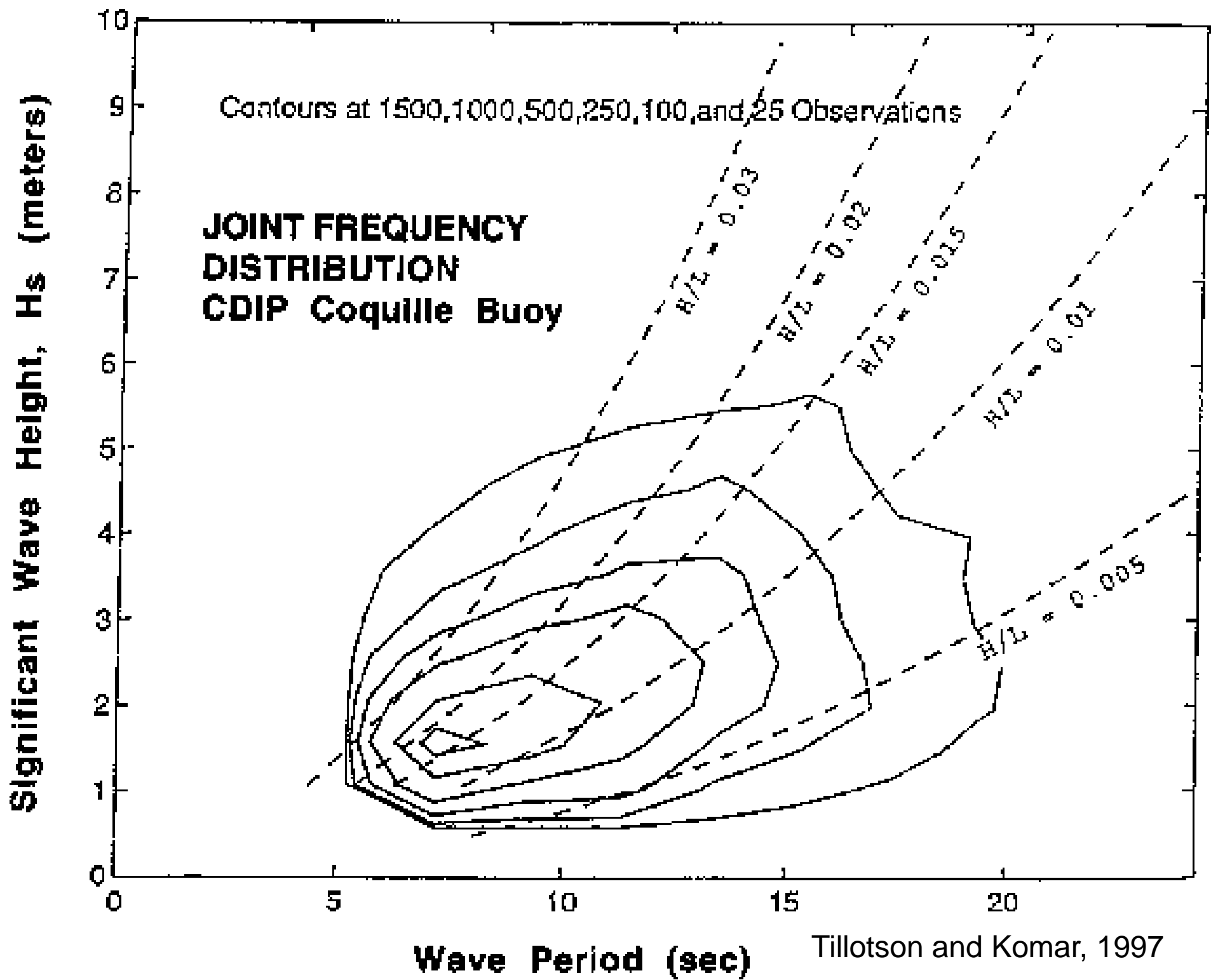




Statistical Wave Distribution







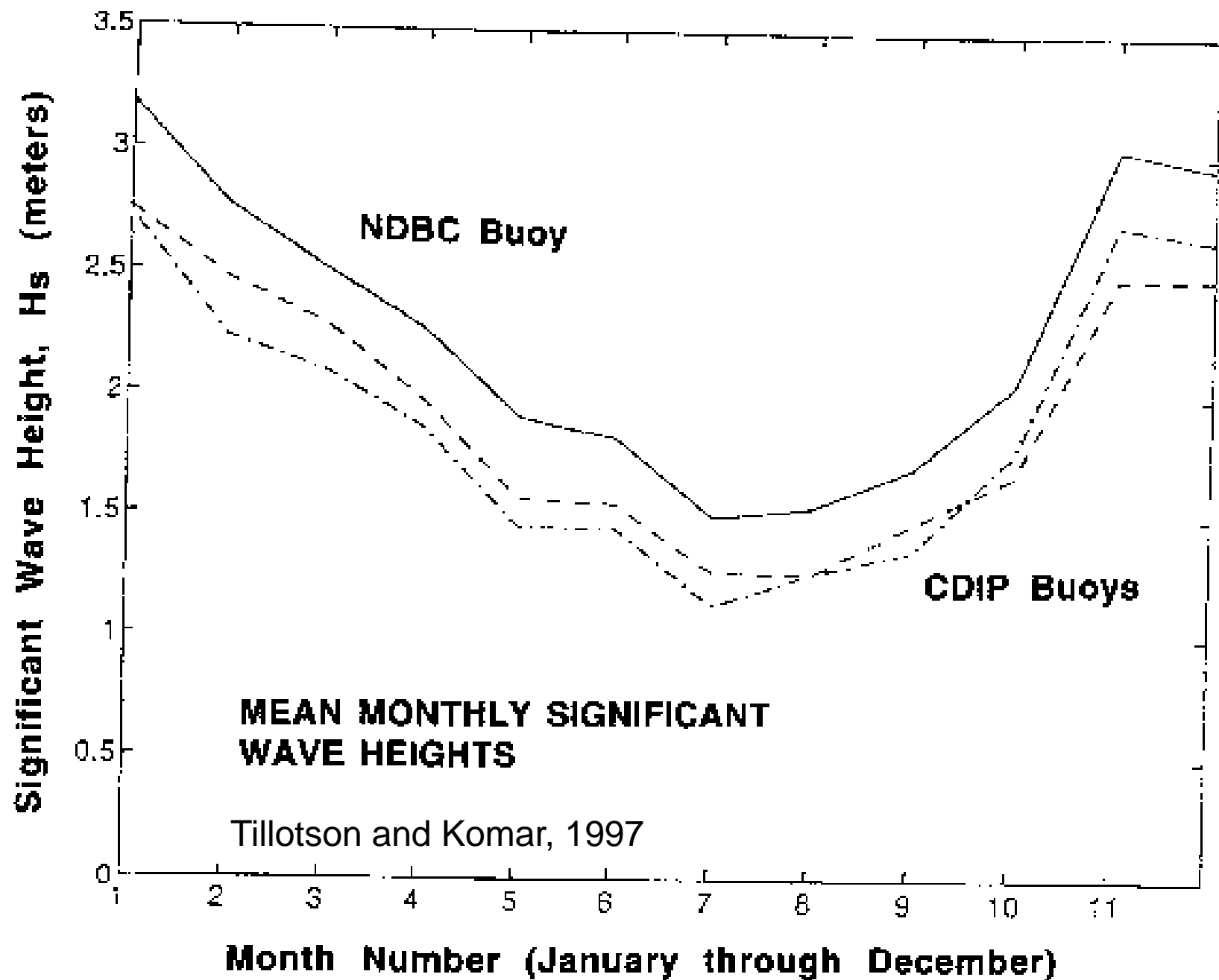


Figure 4. Seasonality of the mean monthly deep-water significant wave heights as measured by the CDIP Coquille and Grays Harbor buoys, and by the NDBC buoy offshore from Newport.

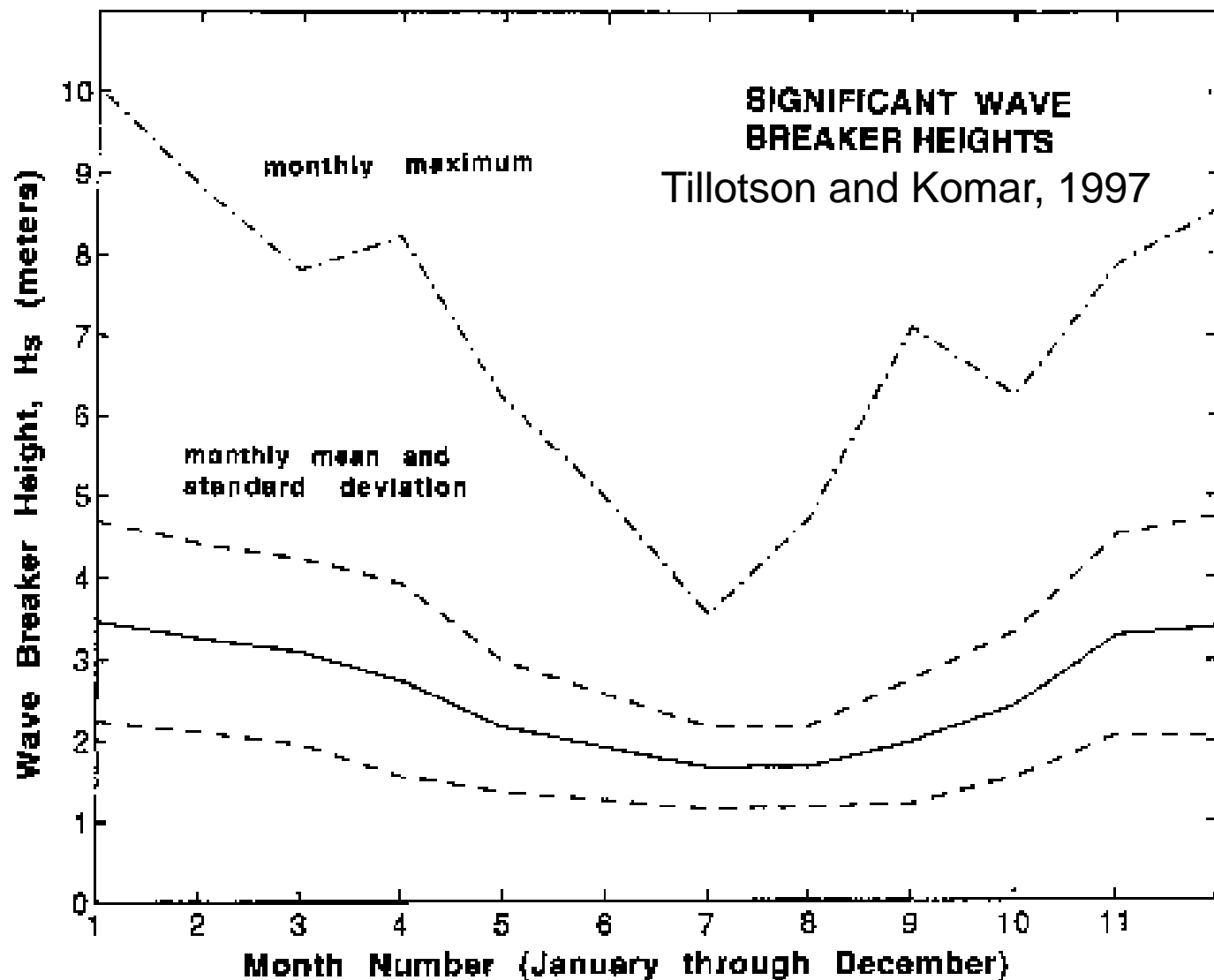
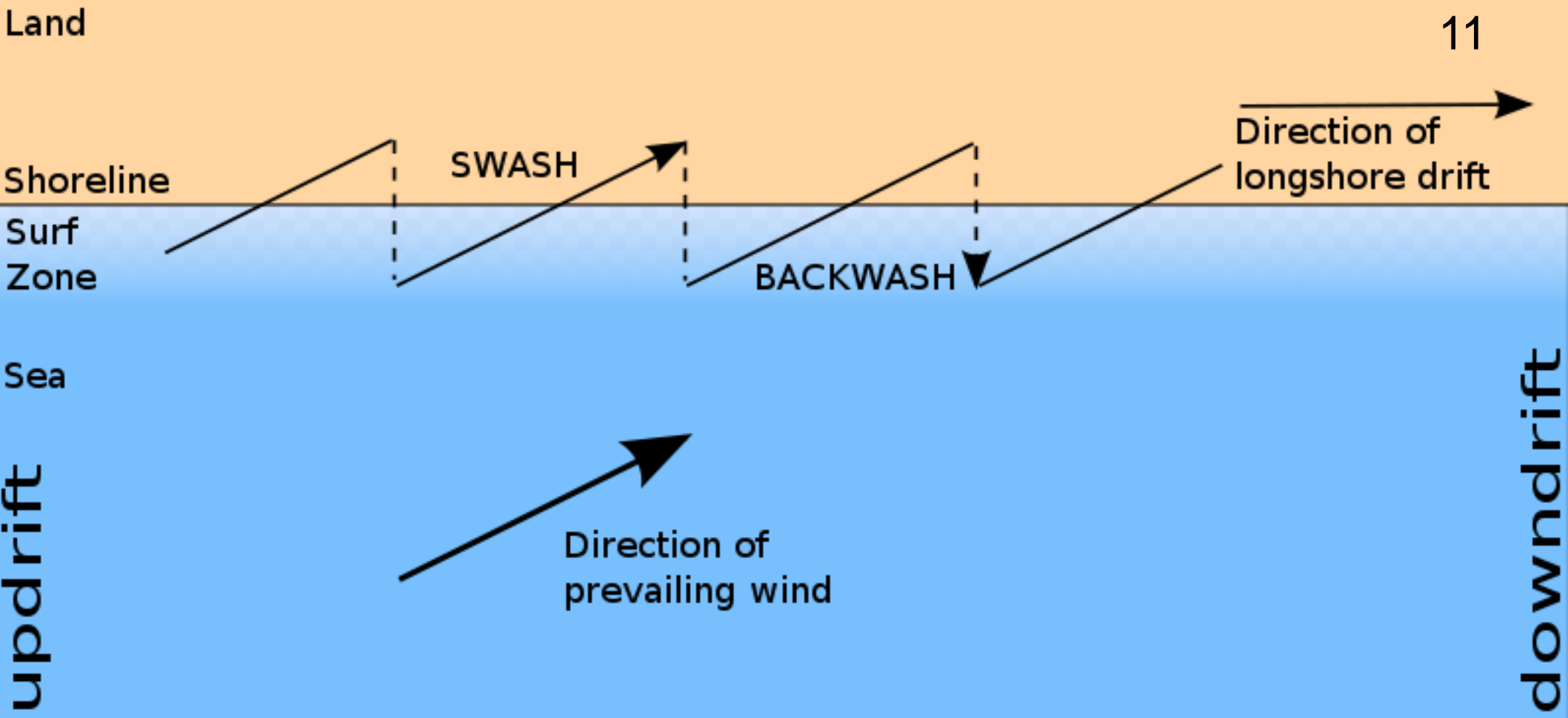


Figure 8. Monthly variations in wave breaker heights, calculated with equation (3) using the deep-water wave measurements from the CDIP-Coquille buoy which began operation in December 1981. The monthly mean values for the 13 years of daily measurements are given by the solid curve, while one standard deviation about the mean is given by the dashed curve. The dot-dashed curve represents the maximum monthly breaker heights calculated from the most extreme wave conditions that have been measured by the deep-water buoy.



Photo Courtesy of Julie Hendricks



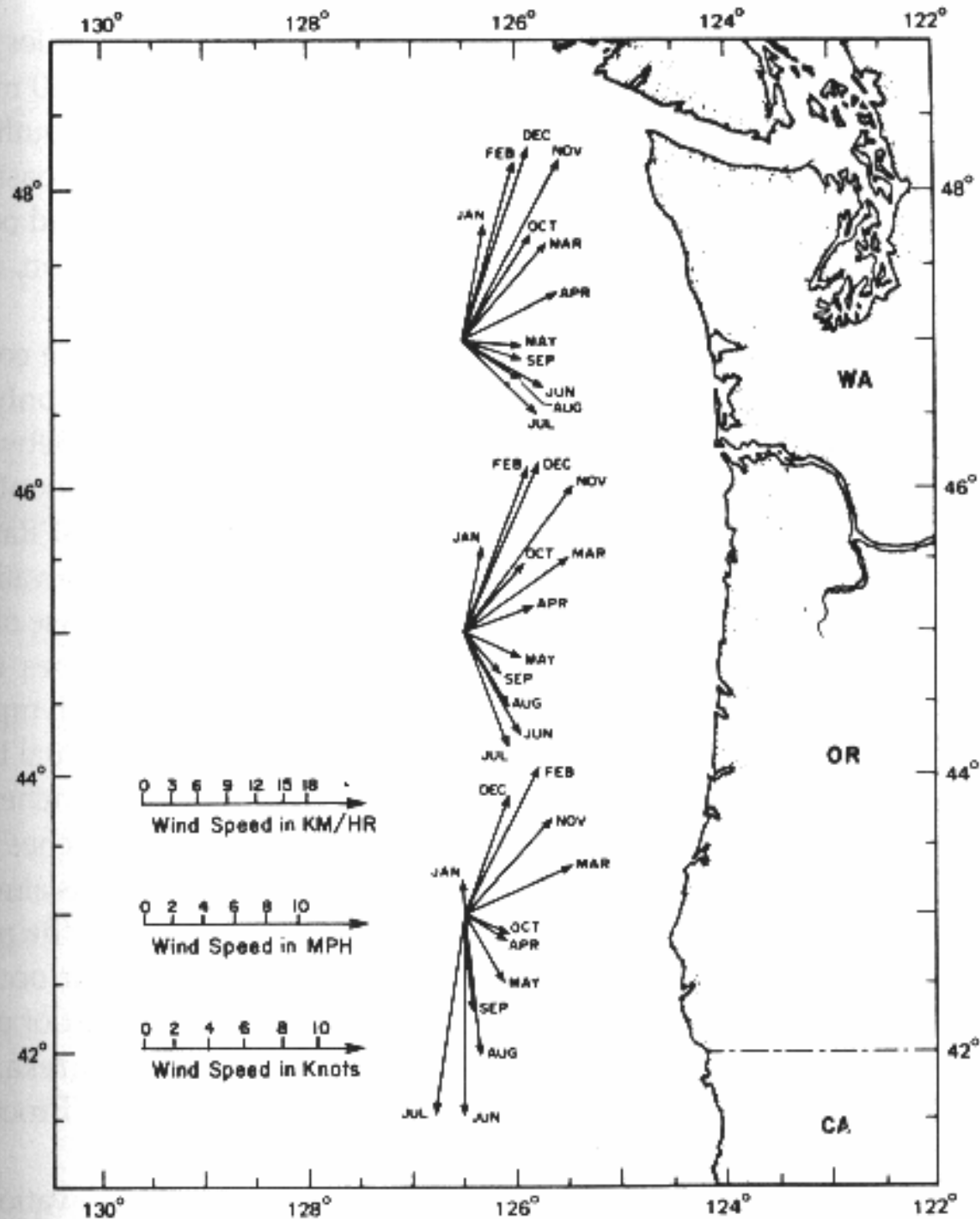
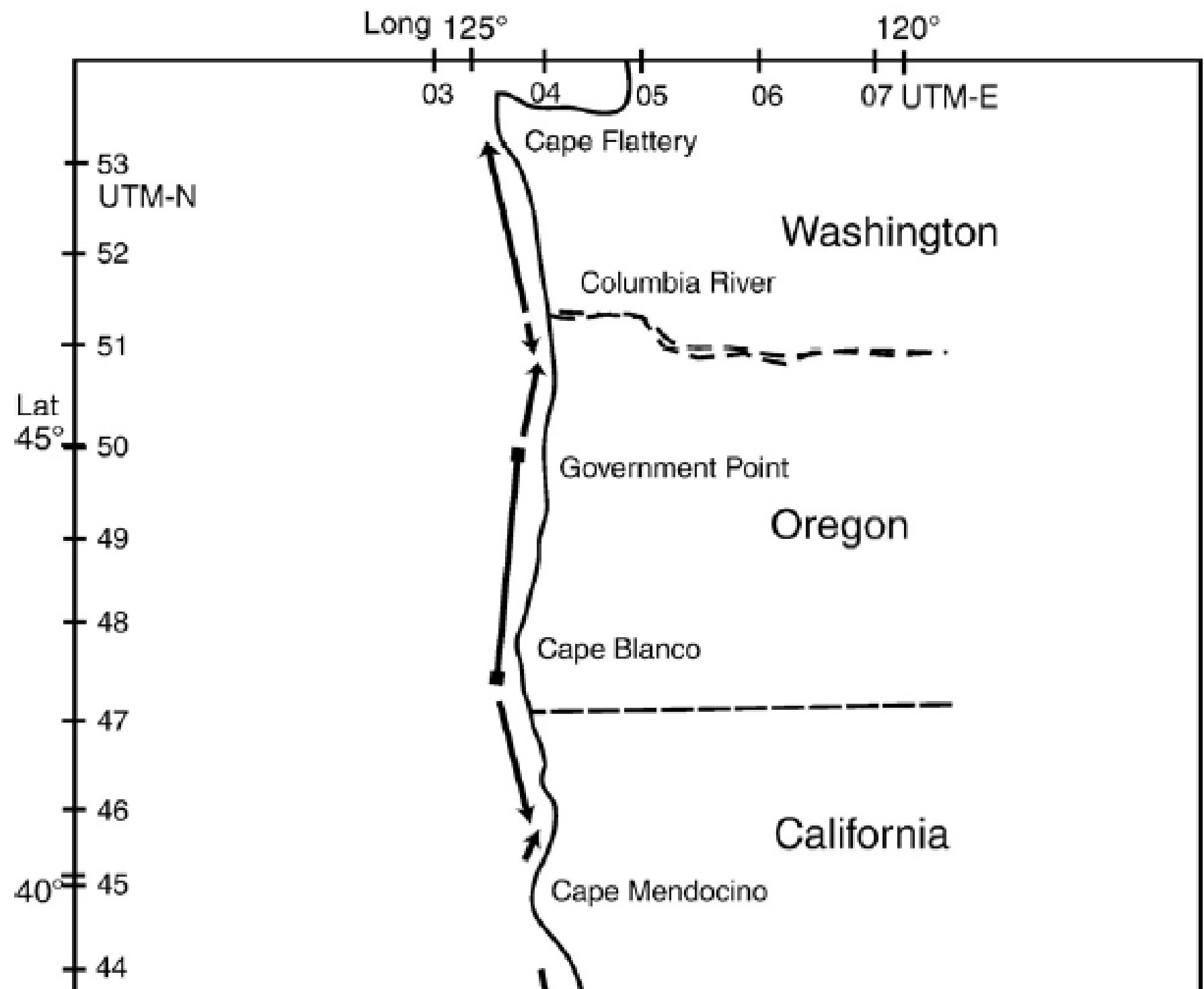
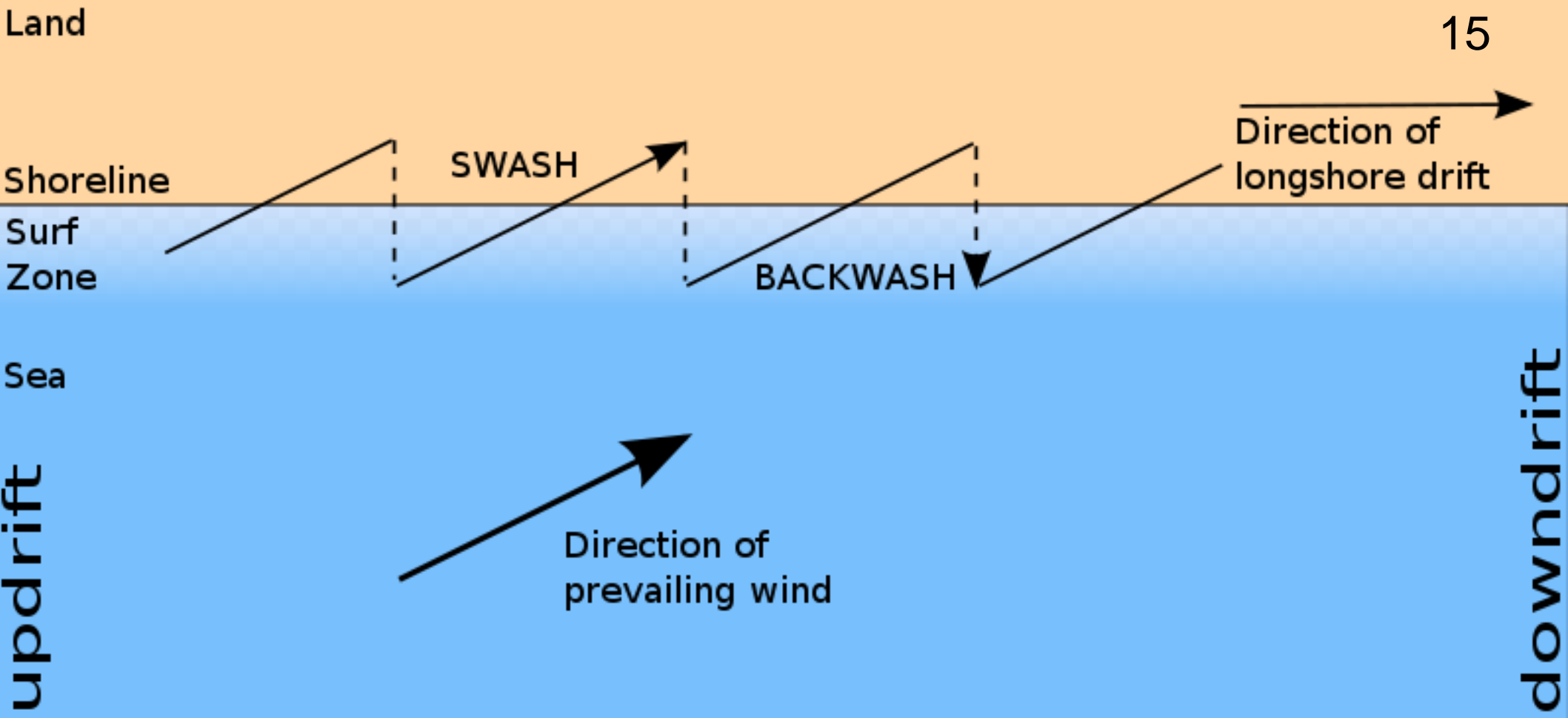
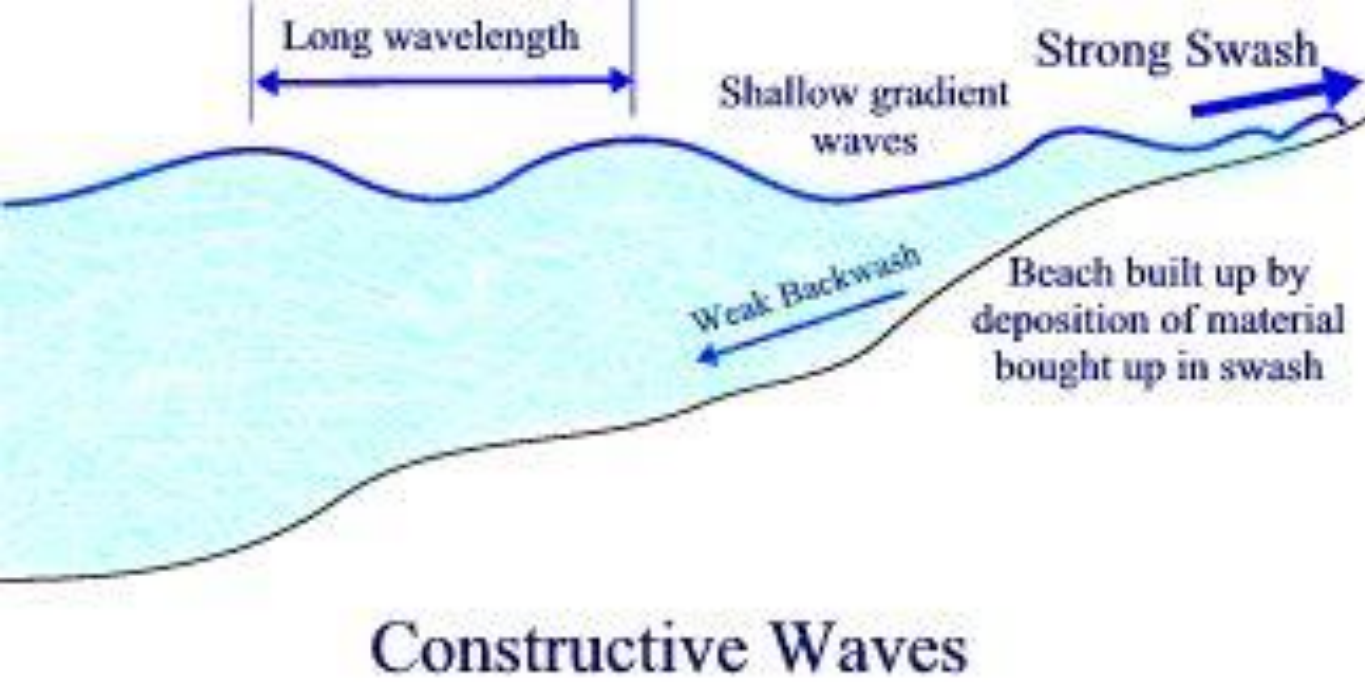


Figure 9. Average Direction and Velocity of Monthly Winds for 1961-1963. (From Duxbury *et al.*, 1966.)





Which is stronger, swash or backwash?



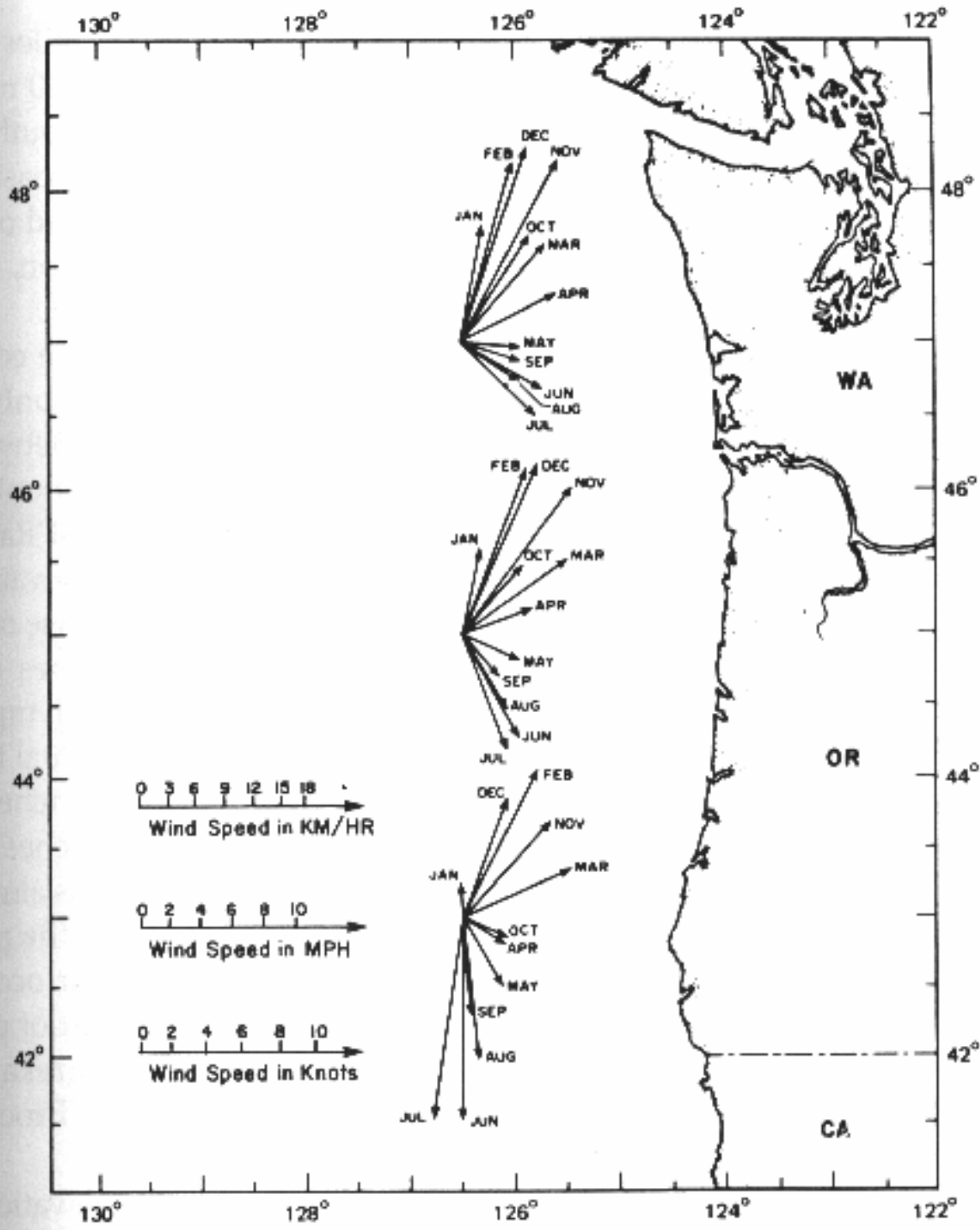


Figure 9. Average Direction and Velocity of Monthly Winds for 1961-1963. (From Duxbury et al., 1966.)

Winter



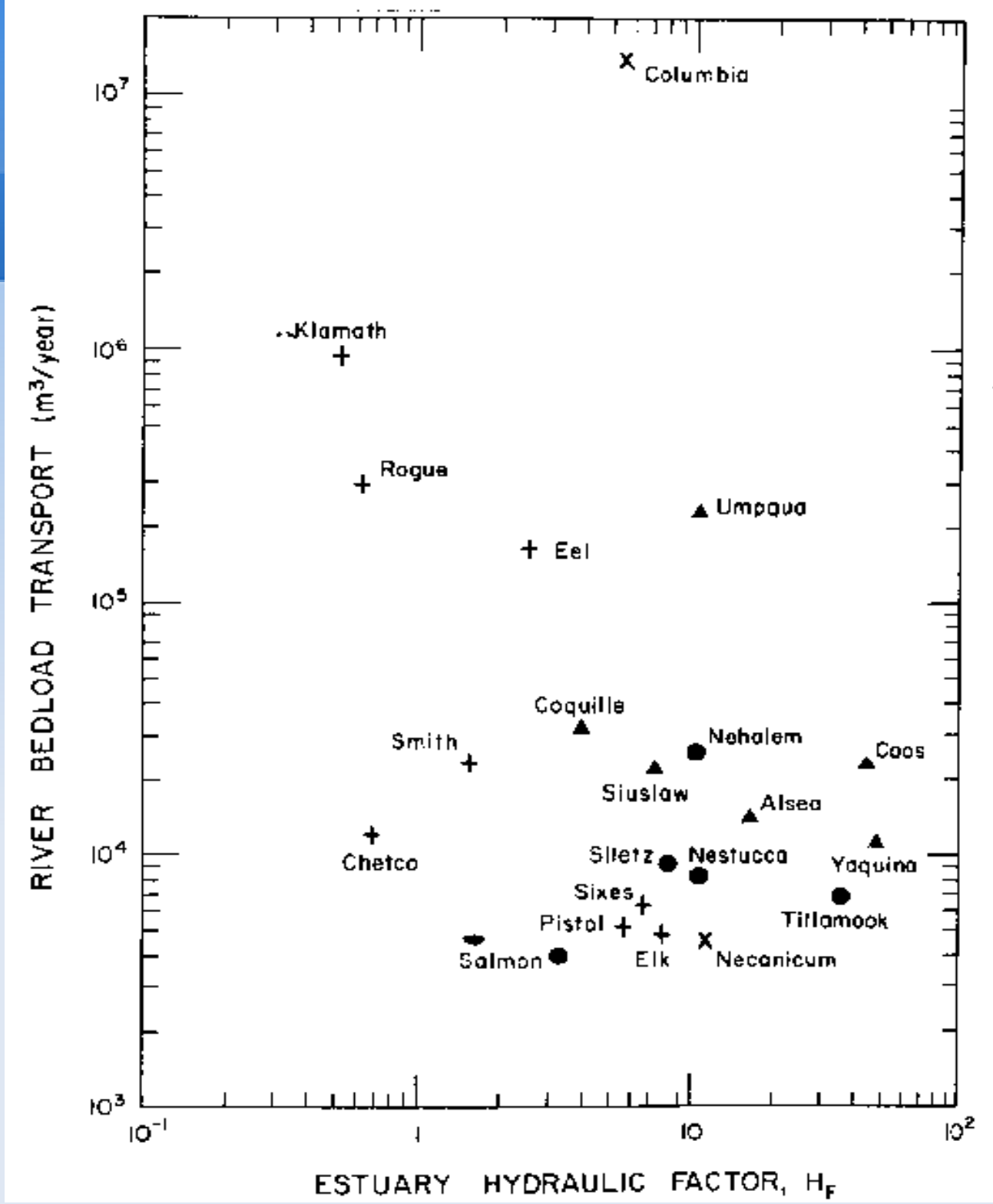
Summer



Waves and wave energy

- Winds
- Tides





Winter



Summer



Table 2. *Total shoreline change due to combinations of processes.*

| | Port | |
|---|-----------------------------|--------------------------------|
| | Orford (S = 0.06) (m) | Tillamook (S = 0.04) (m) |
| Seasonal Averages | | |
| Monthly mean water-level change (0.3 m) | 5 | 7 |
| Seasonal increase in wave heights and runup | 9 | 12 |
| Beach elevation change (1 m) | 17 | 25 |
| Total | 31 | 44 |

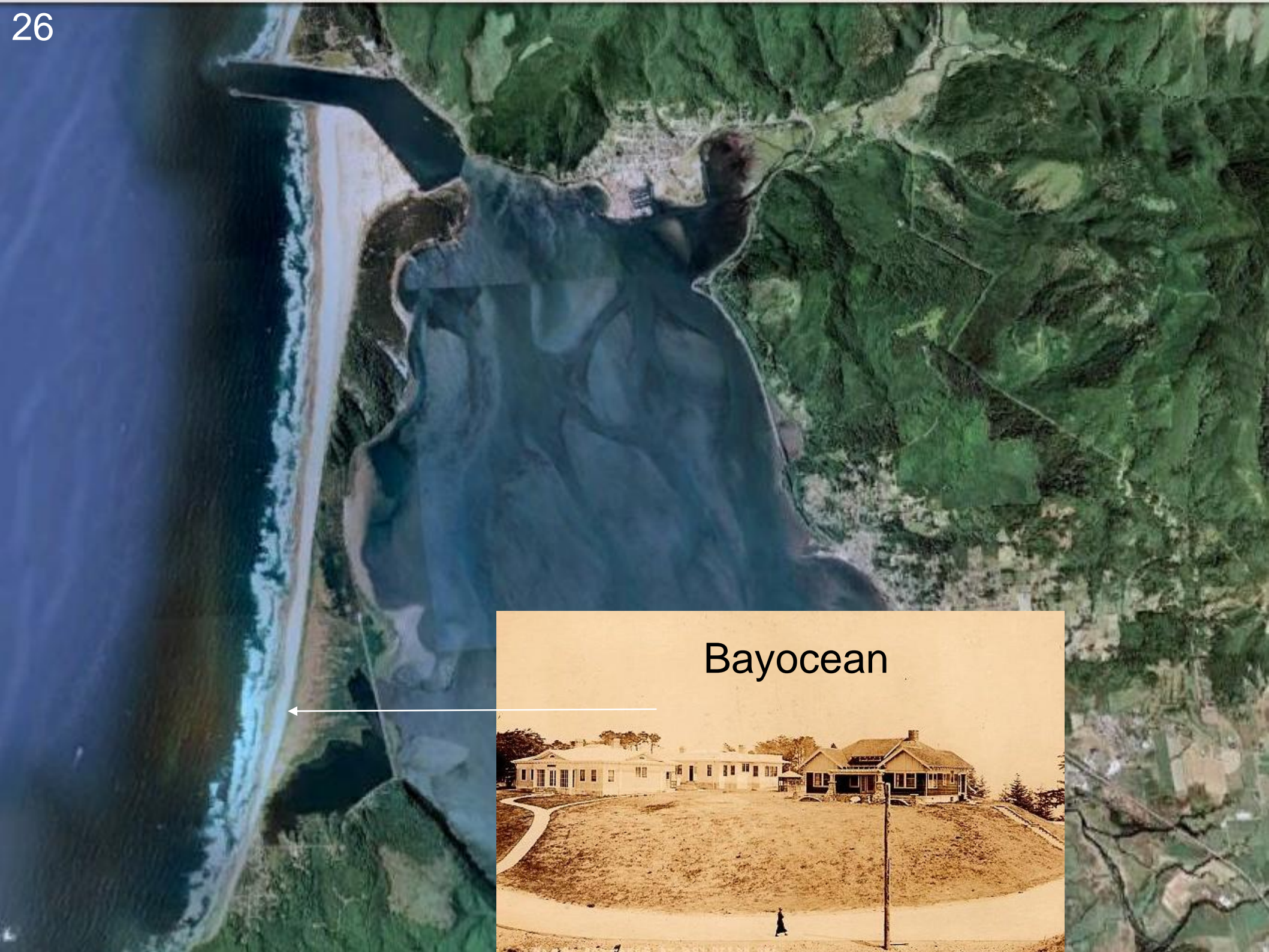
Table 2. *Total shoreline change due to combinations of processes.*

| | Port | |
|--|-----------------------------|--------------------------------|
| | Orford (S = 0.06) (m) | Tillamook (S = 0.04) (m) |

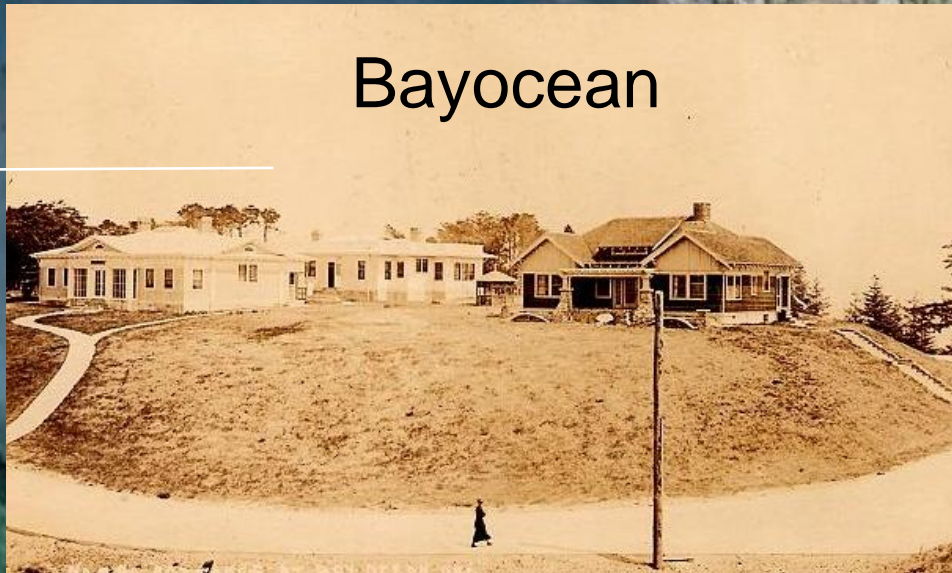
| Seasonal Averages | | |
|---|----|----|
| Monthly mean water-level change (0.3 m) | 5 | 7 |
| Seasonal increase in wave heights and runup | 9 | 12 |
| Beach elevation change (1 m) | 17 | 25 |
| Total | 31 | 44 |

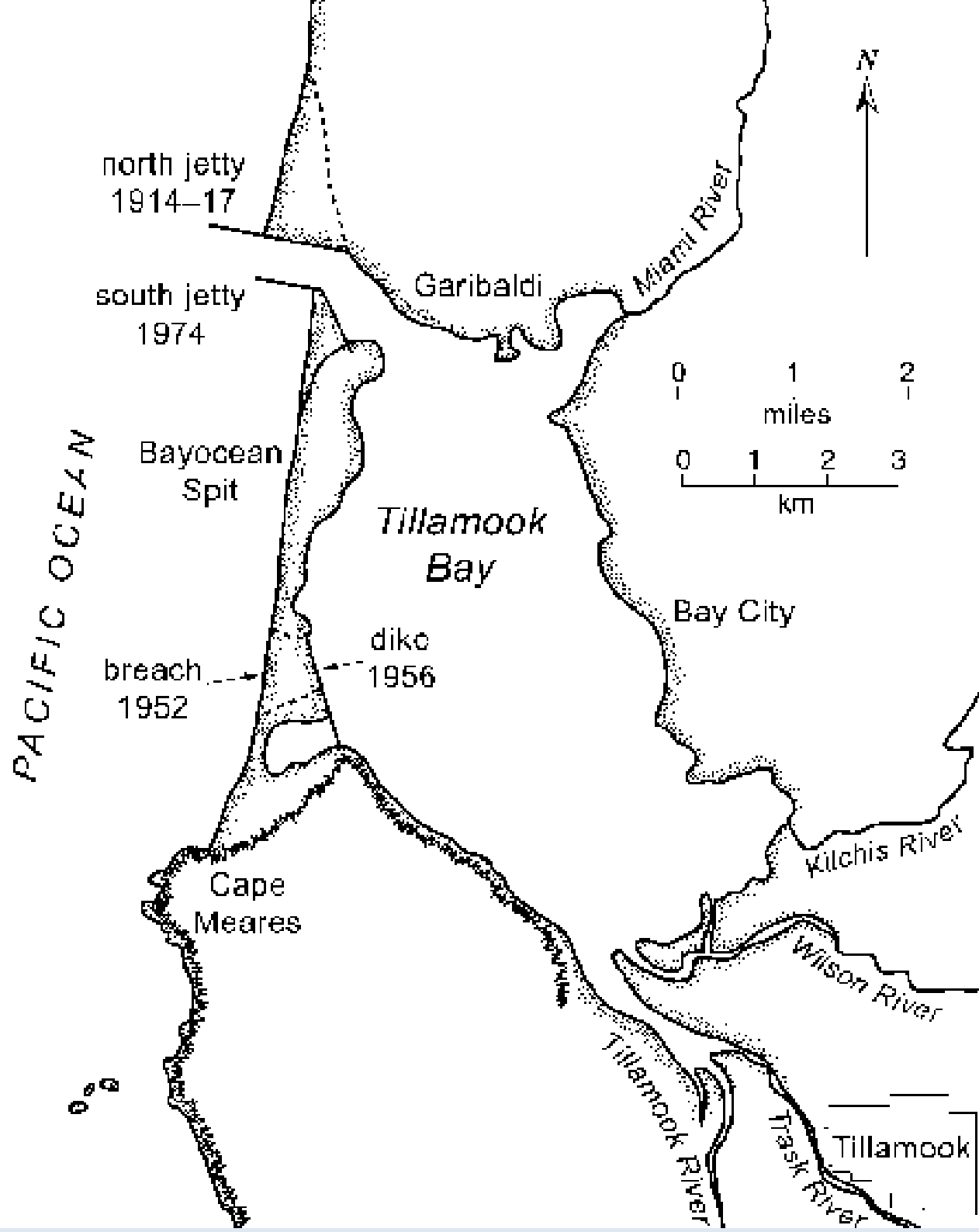
| Seasonal Averages with a Storm | | |
|---|-------|--------|
| Monthly mean water-level change (0.3 m) | 5 | 7 |
| Storm wave heights and runup | 23 | 28 |
| Storm surge (0.5–1.0 m) | 8–17 | 12–25 |
| Beach elevation change (1–2 m) | 17–33 | 25–50 |
| Total | 53–78 | 72–110 |

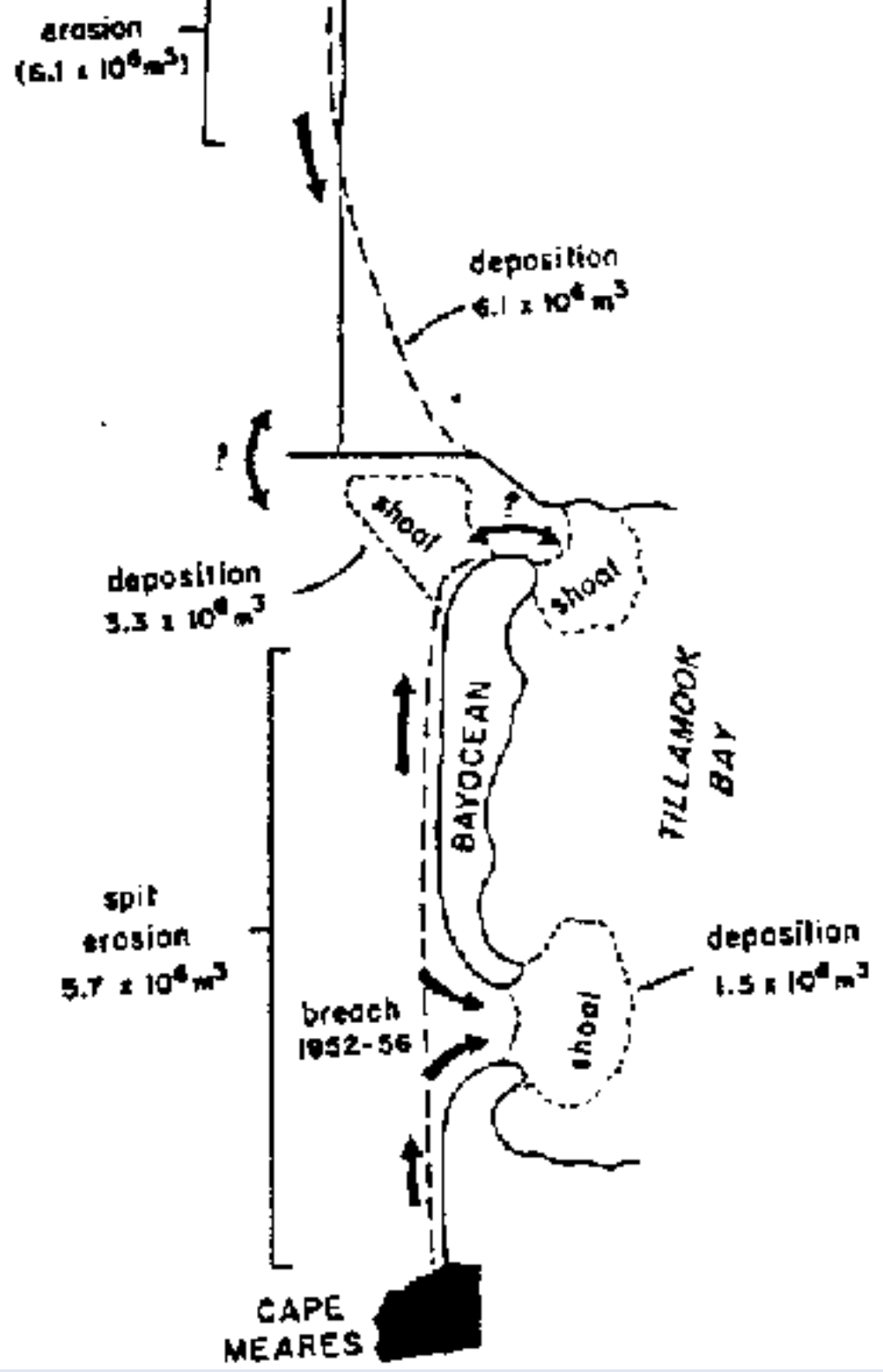


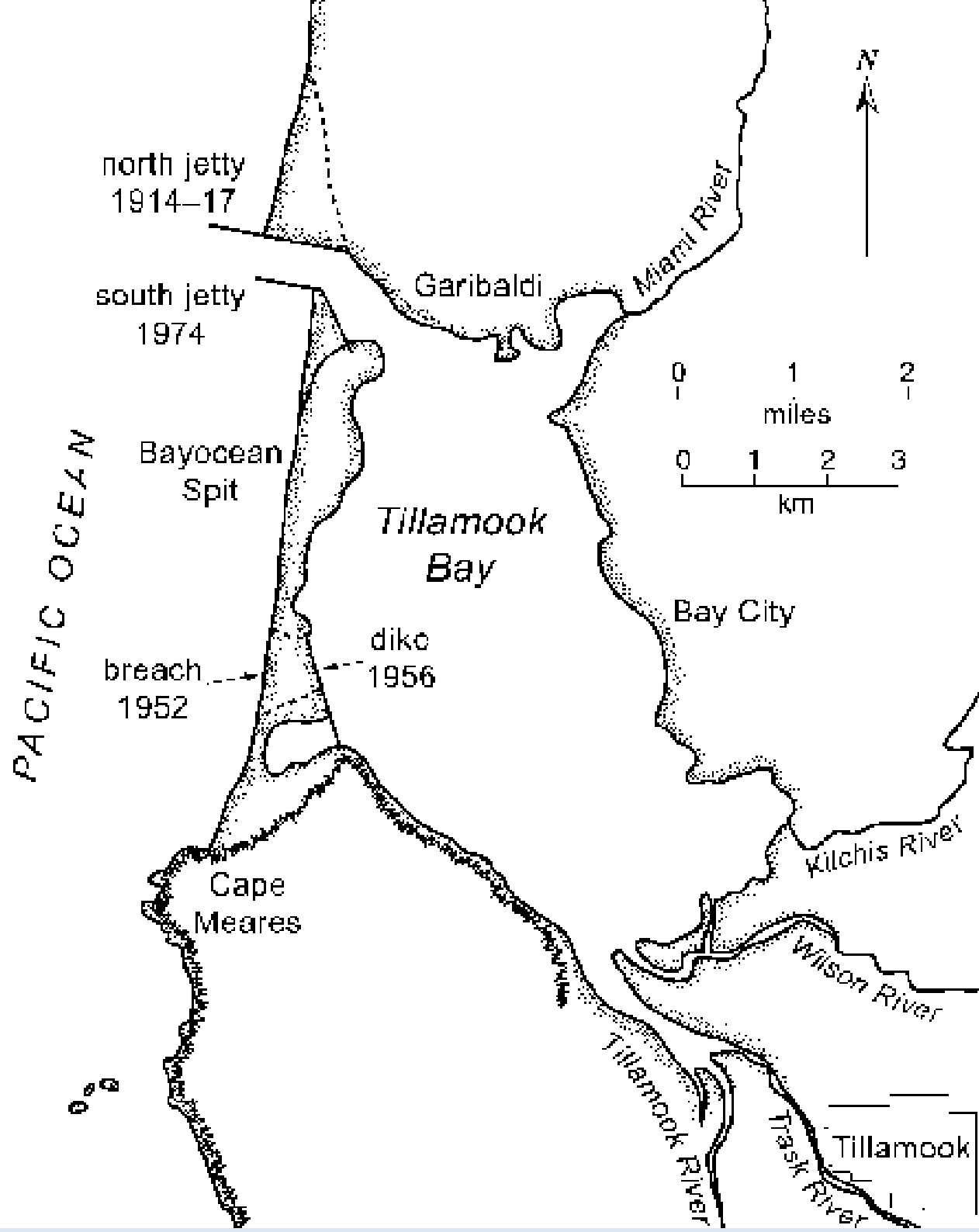


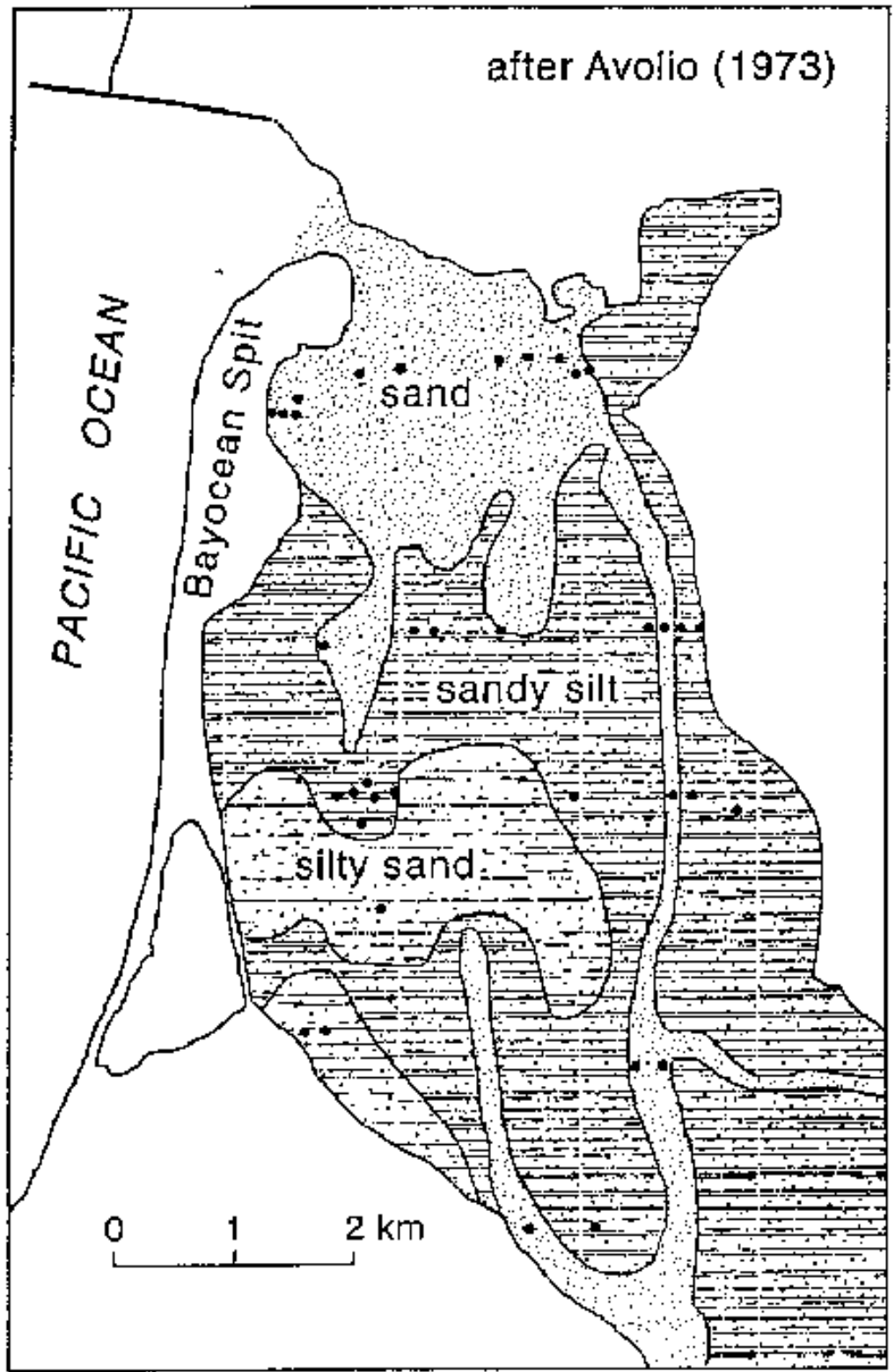
Bayocean

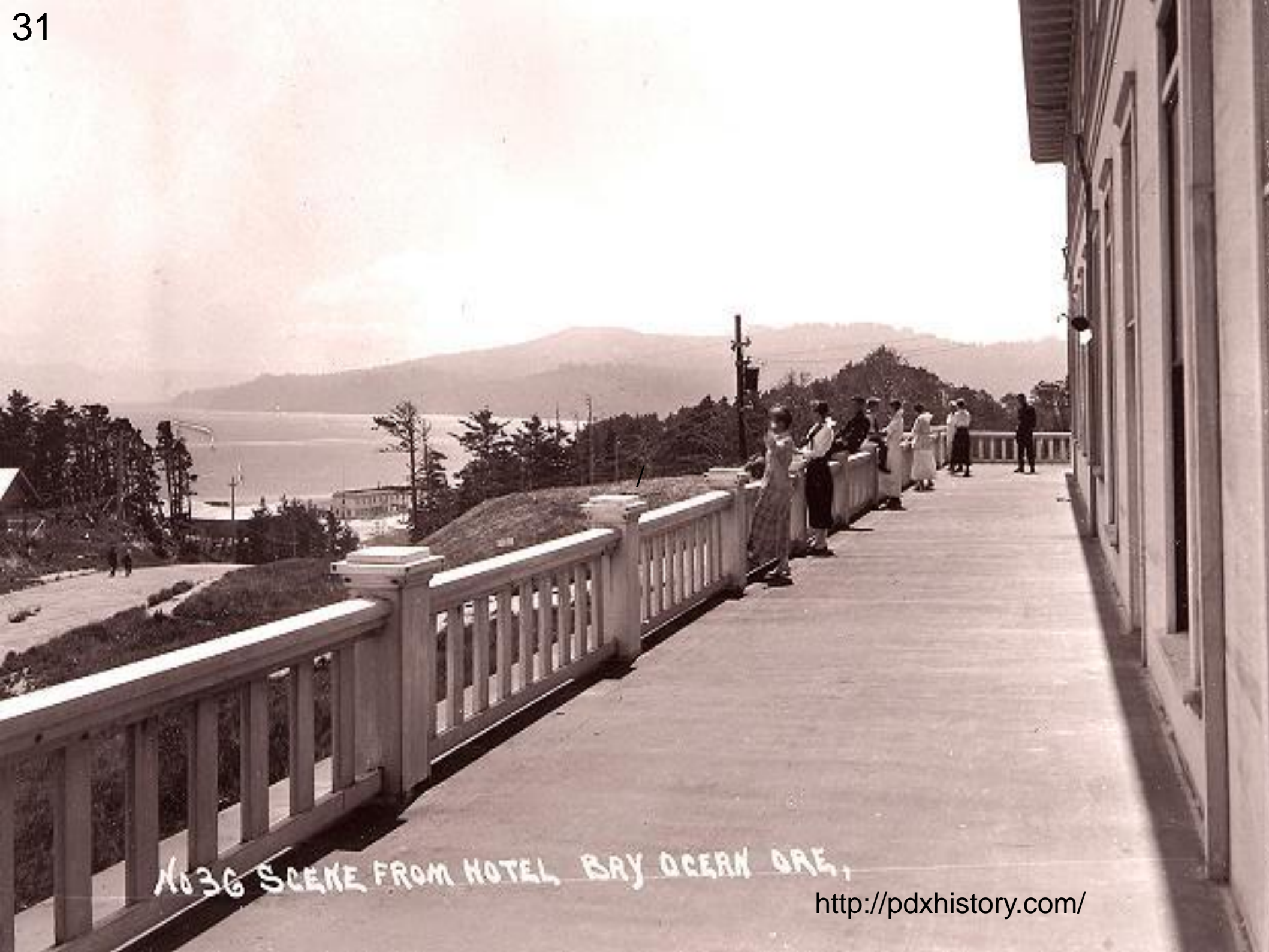












NO 36 SCENE FROM HOTEL BAY OCEAN ORE,





No 2,93 NATATORIUM & DANCE HALL BAY OCEAN ORE.



ARTIFICIAL SURF BATHING NATATORIUM AT BAYOCEAN

Photo courtesy of Dave Elston







HOTEL BAY OCEAN ANNEX
BAY OCEAN, ORE.
TILLAMOOK BAY,



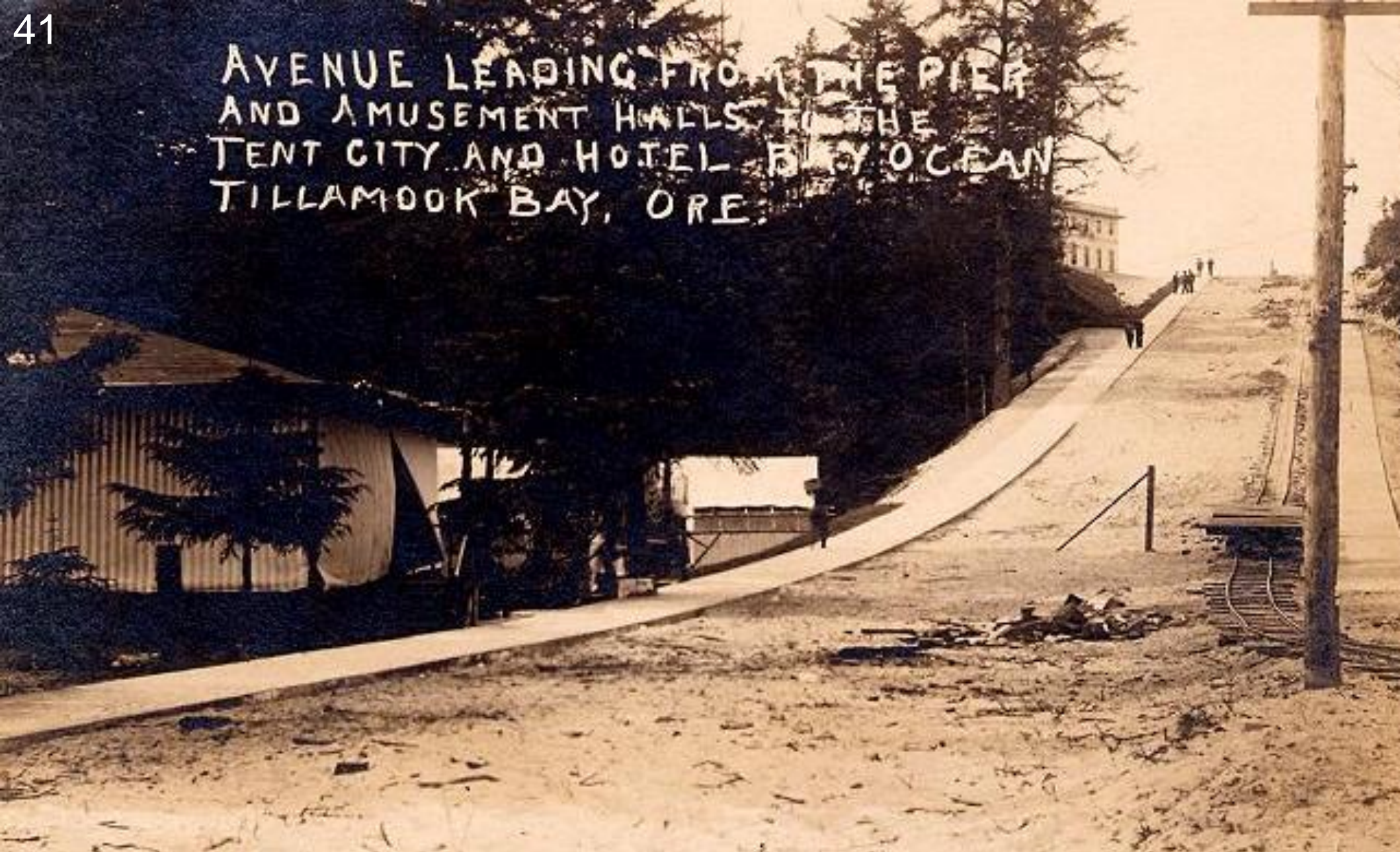


NO 49. HOTEL & COAST VIEW BAY OCEAN ORE



No 38 DINING ROOM. BAYOCEAN HOTEL, BAY OCEAN, ORE.

AVENUE LEADING FROM THE PIER
AND AMUSEMENT HALLS TO THE
TENT CITY AND HOTEL BY THE OCEAN
TILLAMOOK BAY, ORE.





No 285, NATATORIUM BAY OCEAN OREGON.

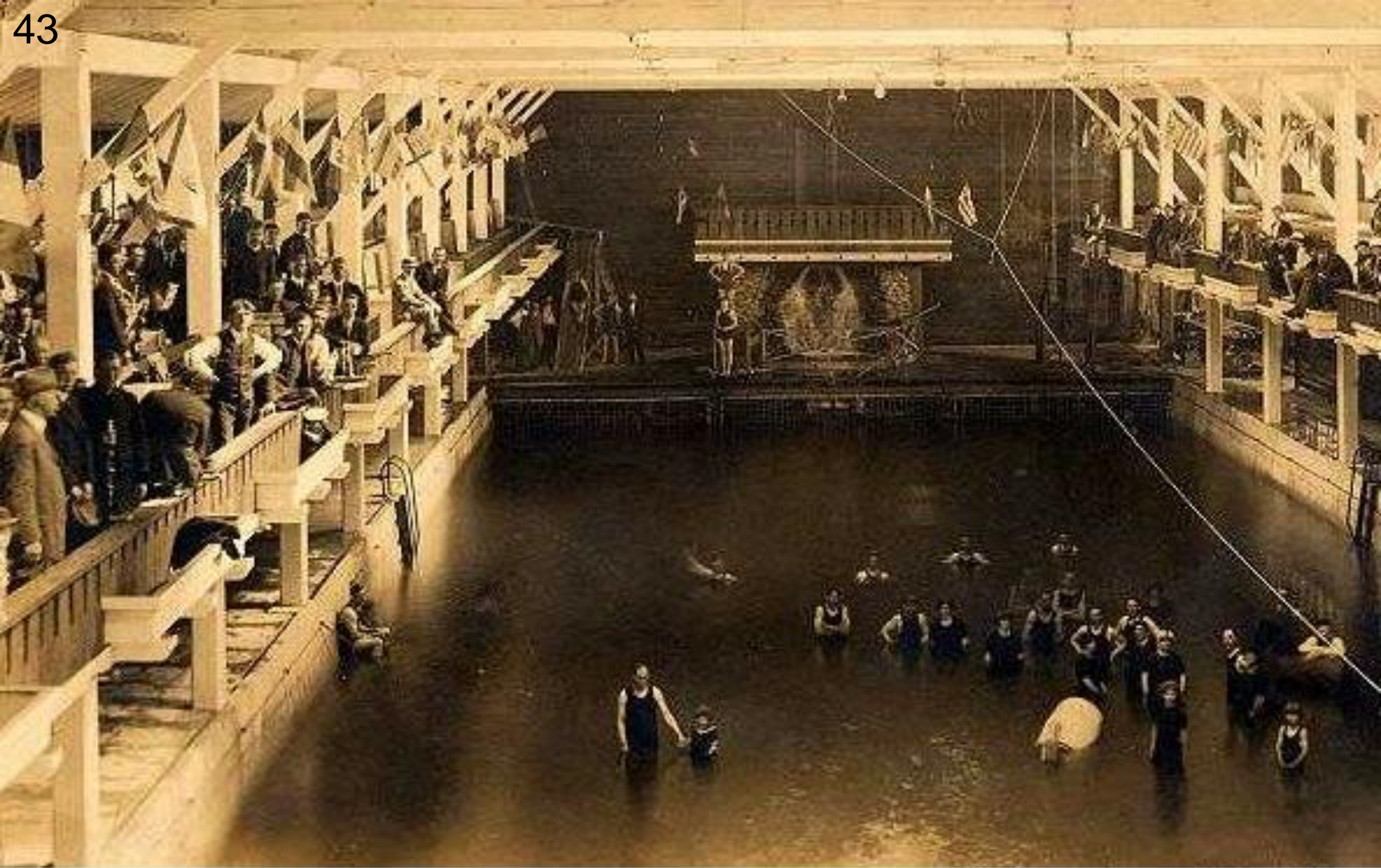


Photo courtesy of Dave Elston





16800 COAST SCENE AT DAY OCEAN DR.









No 39 LOOKING DOWN TO BAY AT BAY OCEAN ORE



Rates. Information and reservation: 722 Corbett Bldg. or any S.P. R.R. Agent



Photo Courtesy of Julie Hendricks



Photo Courtesy of Julie Hendricks

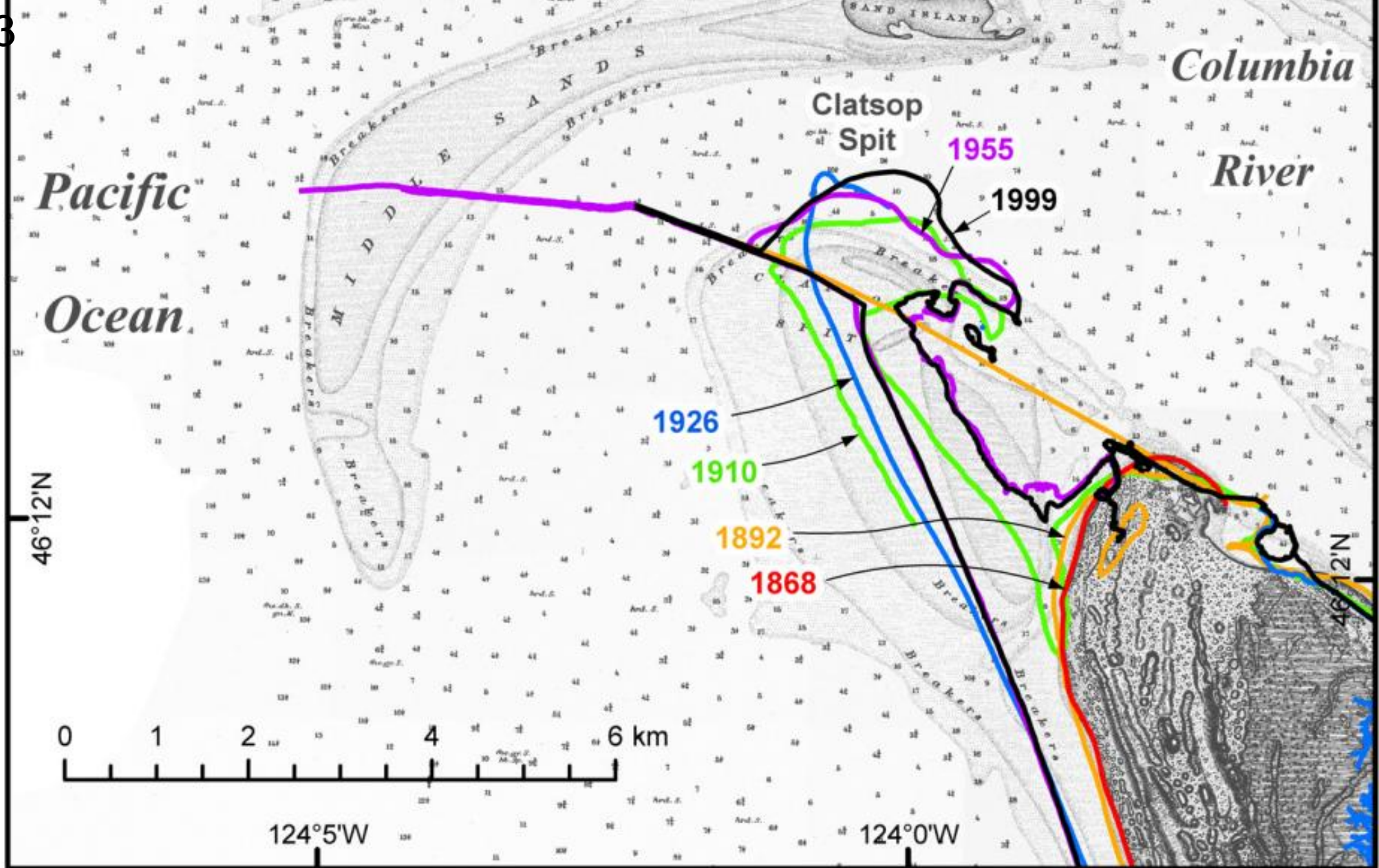
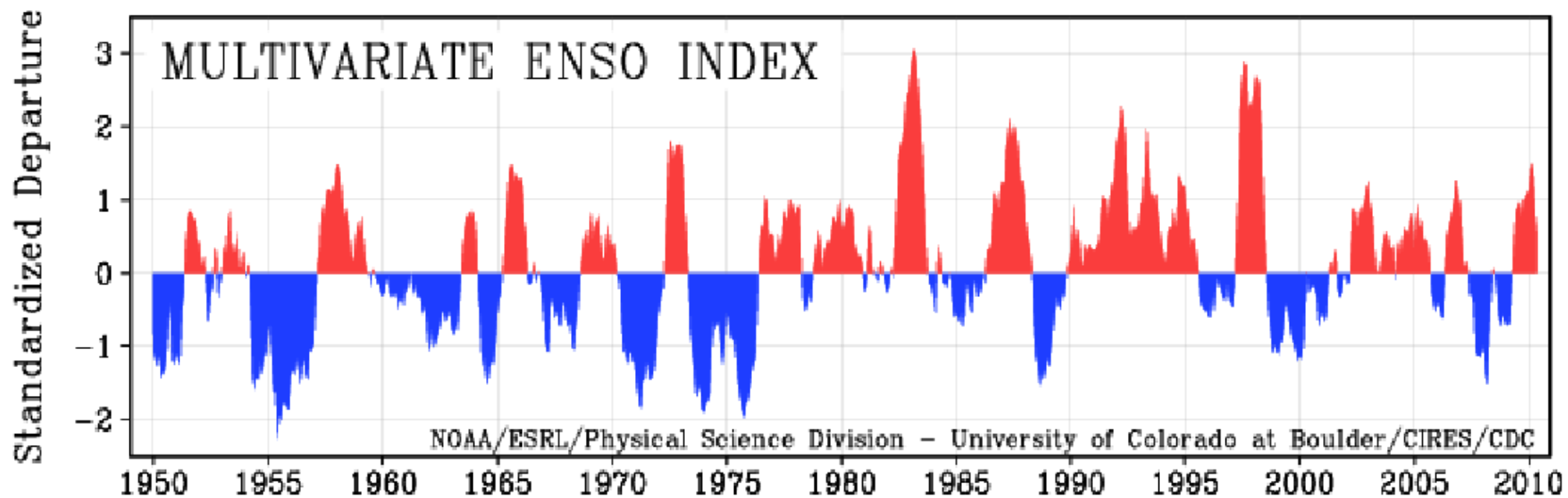
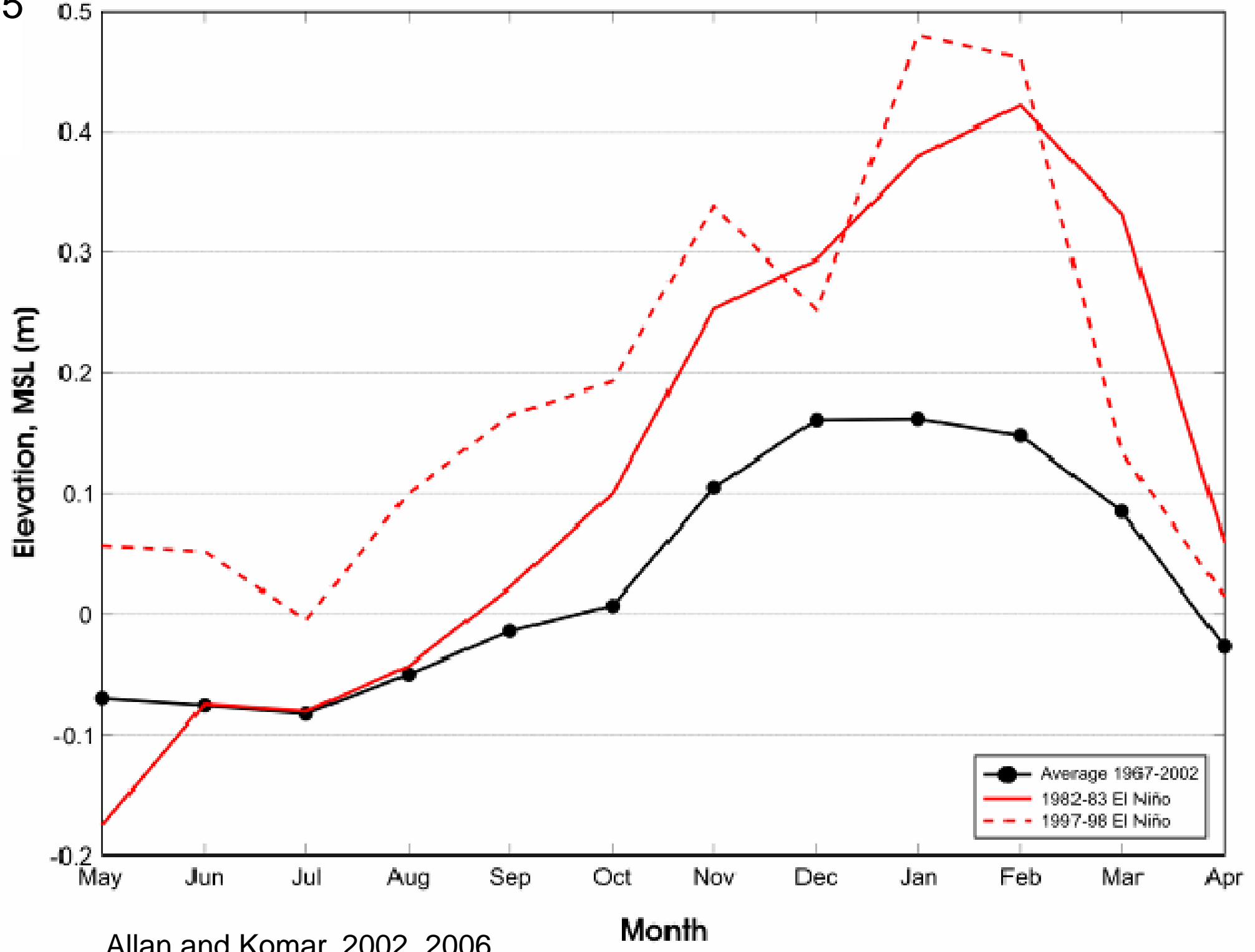


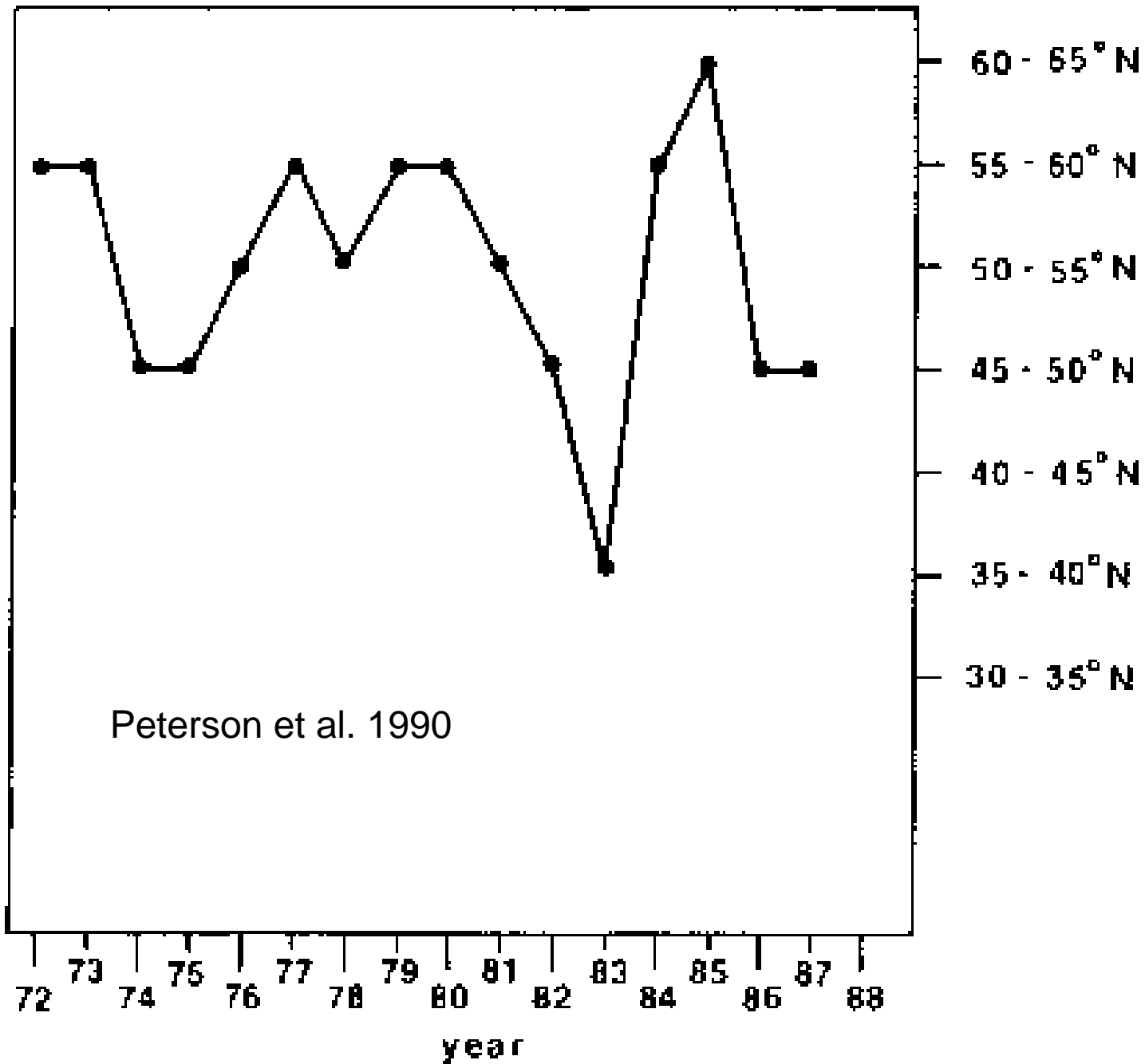
Fig. 6. 1870 U.S. Coast and Geodetic Survey – Mouth of the Columbia River, with historical shorelines.



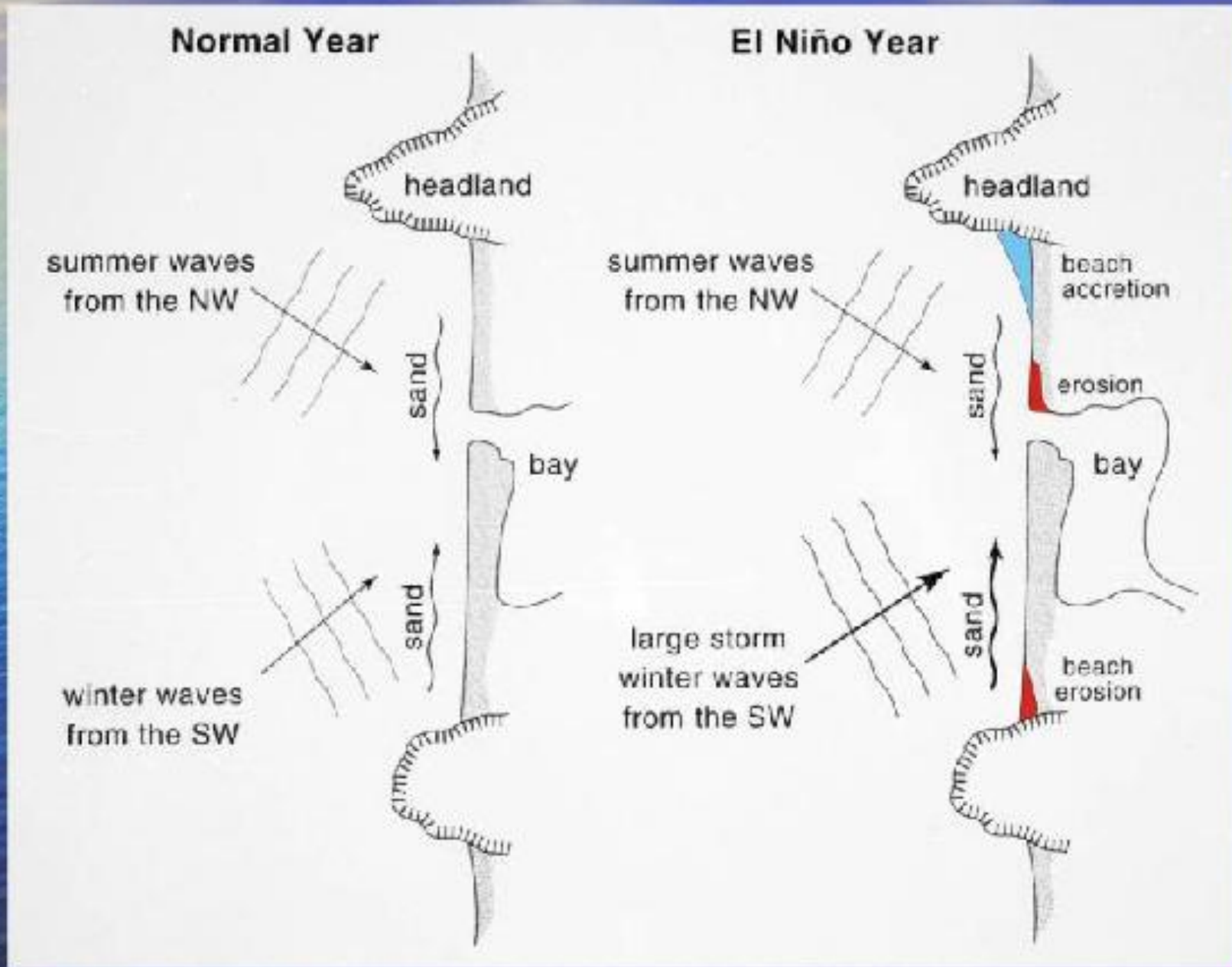
<http://www.esrl.noaa.gov/psd/people/klaus.wolter/MEI/index.html>



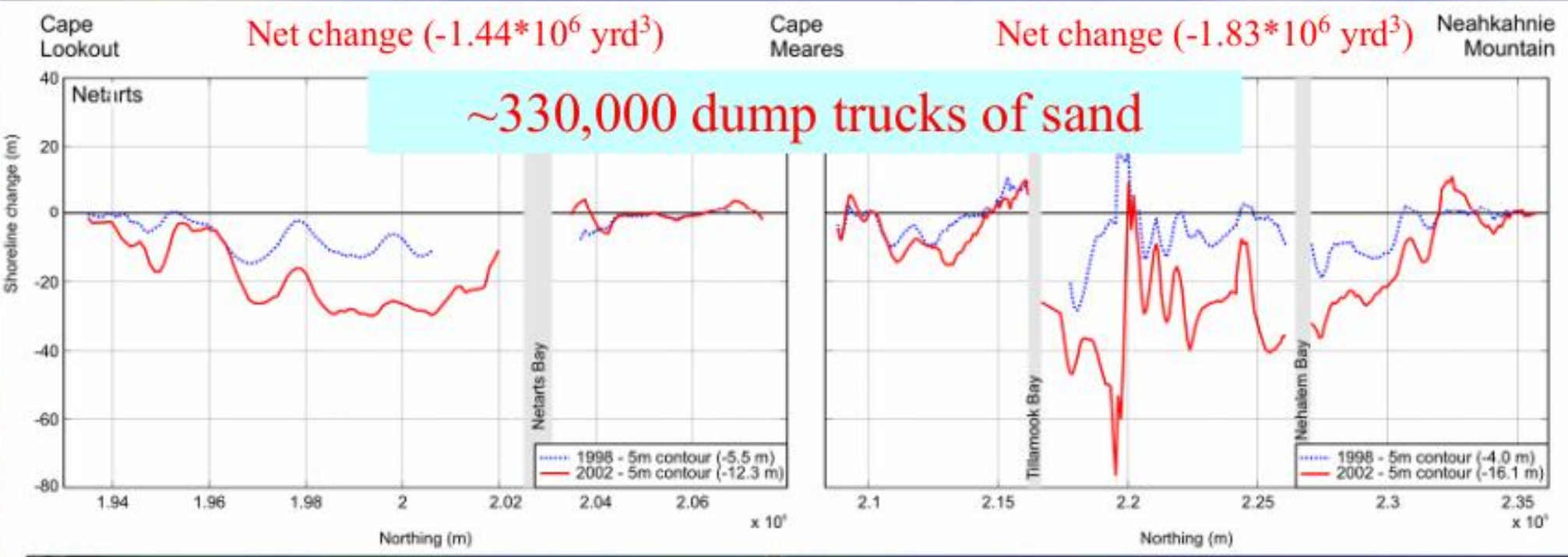
WINTER STORM TRAJECTORY (D,J,F) (average latitudinal zone of landfall)



Alongshore Movement of Beach Sediments ("Hot spot erosion" due to changes in storm tracks)



Shoreline Change (5 m contour elevation) – 1997 - 2002



Ten years on, beaches show no evidence of recovery.
Current monitoring efforts indicate that erosion is continuing along much of Tillamook County (may see breaching of Netarts Spit).



Table 2. *Total shoreline change due to combinations of processes.*

| | Port | |
|--|-----------------------------|--------------------------------|
| | Orford (S = 0.06) (m) | Tillamook (S = 0.04) (m) |

El Niño with Average Conditions

| | | |
|---|-----------|-----------|
| Monthly mean water-level change (0.6 m) | 10 | 15 |
| Seasonal increase in wave heights and runup | 9 | 12 |
| Beach elevation change (1 m) | 17 | 25 |
| Total | 31 | 52 |

Table 2. *Total shoreline change due to combinations of processes.*

| | Port | |
|--|-----------------------------|--------------------------------|
| | Orford (S = 0.06) (m) | Tillamook (S = 0.04) (m) |

El Niño with Average Conditions

| | | |
|---|----|----|
| Monthly mean water-level change (0.6 m) | 10 | 15 |
| Seasonal increase in wave heights and runup | 9 | 12 |
| Beach elevation change (1 m) | 17 | 25 |
| Total | 31 | 52 |

El Niño with a Storm

| | | |
|---|-------|--------|
| Monthly mean water-level change (0.6 m) | 10 | 15 |
| Storm wave heights and runup | 23 | 28 |
| Storm surge (0.5–1.0 m) | 8–17 | 12–25 |
| Beach elevation change (1–2 m) | 17–33 | 25–50 |
| Total | 58–83 | 80–118 |

Waves and wave energy

- Winds
- Tides



References

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Peterson, C.D., E. Stock, R. Hart, D. Percy, S.W. Hostetler, and J.R. Knott. 2010. Holocene coastal dune fields used as indicators of net littoral transport: West Coast, USA. *Geomorphology* 116 (1-2): 115-55.

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--2002. Extreme storms on the Pacific Northwest coast during the 1997-98 El Nino and 1998-99 La Nina. *Journal of Coastal Research* 18(1): 175-193.

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