Lecture 5 The seasons and temperature

- Sun doesn't heat as much when low in the sky, because then the same solar energy is spread over a larger area.

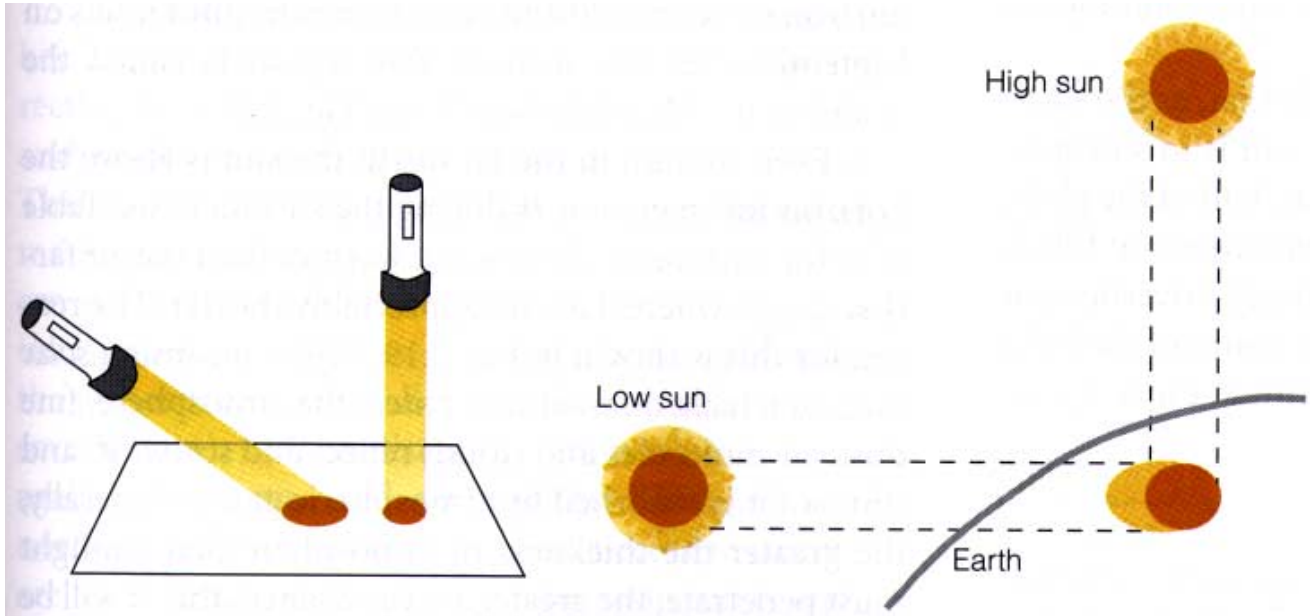
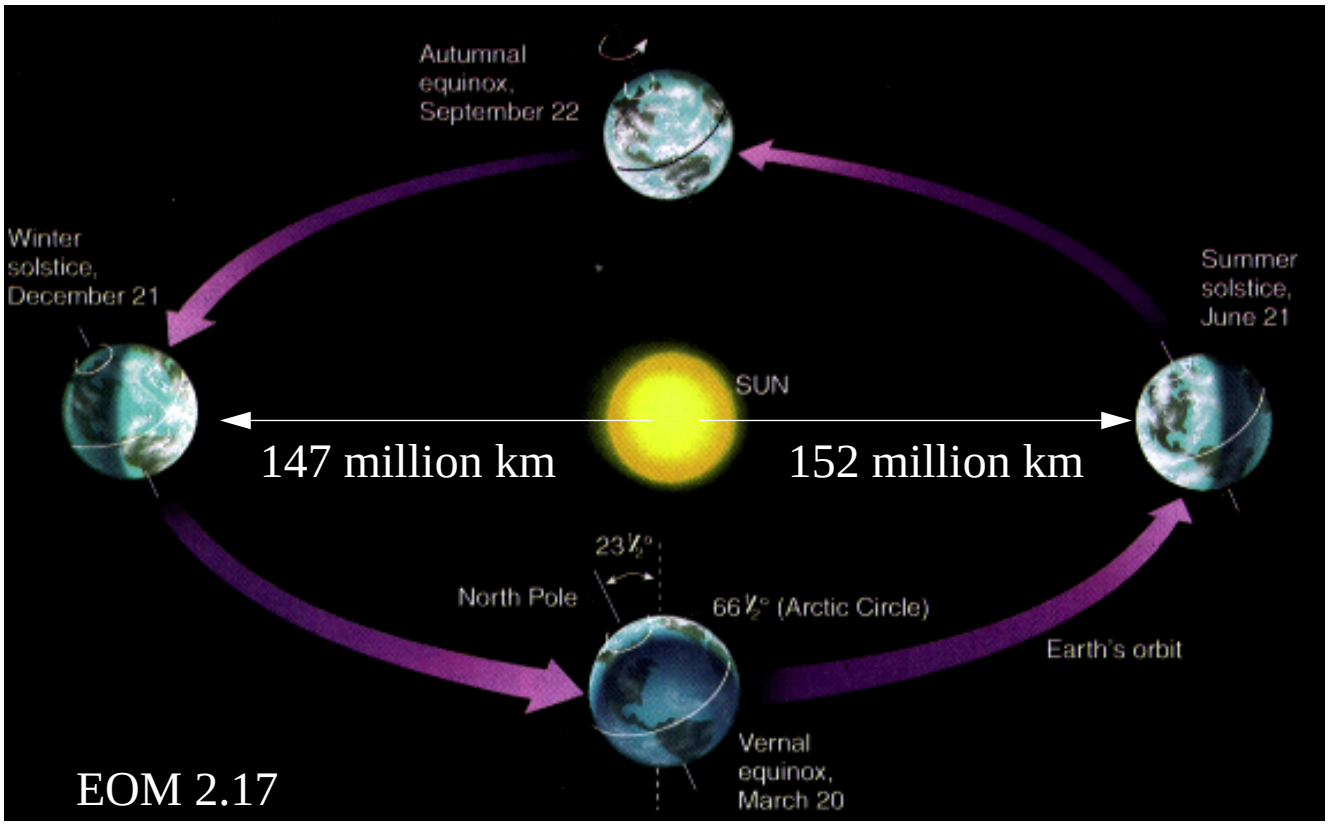


FIGURE 2.16
Sunlight that strikes a surface at an angle is spread over a larger area than sunlight that strikes the surface directly. Oblique sun rays deliver less energy (are less intense) to a surface than direct sun rays.

EOM 2.16

Why do we have seasons?

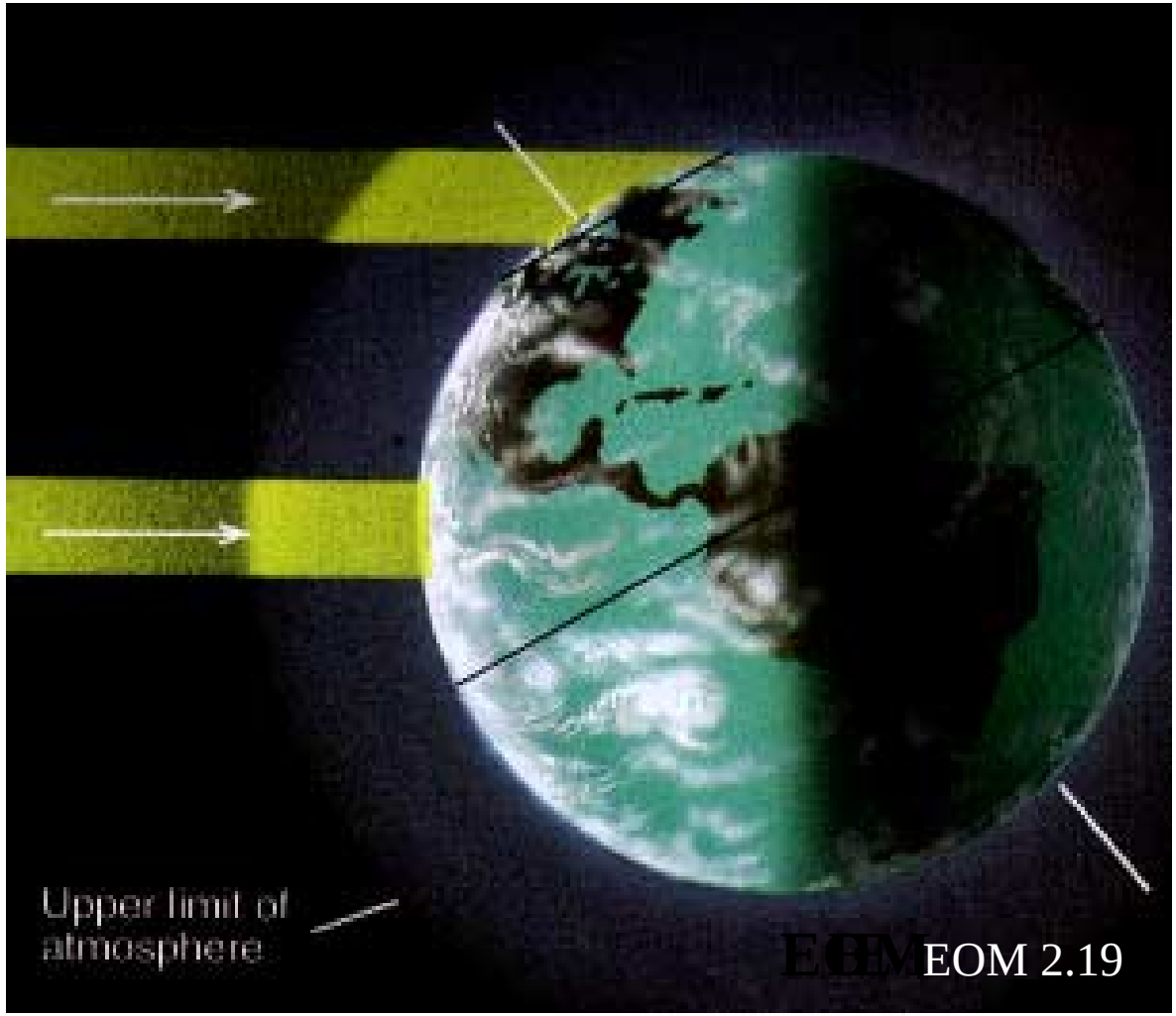
- Earth spins about an axis tilted 23.5° with respect to its orbit. In summer, North Pole tilts toward sun, while in winter, North Pole tilts away from sun.
- At latitudes within 23.5° of the North Pole (N of Arctic Circle), the sun shines throughout the day at the summer solstice; at other latitudes north of the equator, the day is longer and the sun higher in the sky during summer.
- Earth further from sun and receives 6% less energy in June than December.



EOM 2.17

Solar radiation vs. latitude

- In (Northern) summer, daytime is long but sun is low in Northern latitudes. All latitudes north of 20°N receive similar solar energy during a day.
- In winter, northern latitudes receive no energy; tropical latitudes get almost as much as in summer.
- At low sun angles, sunlight takes a longer path through the atmosphere and more is absorbed or scattered (redder sky, less sunburn potential)

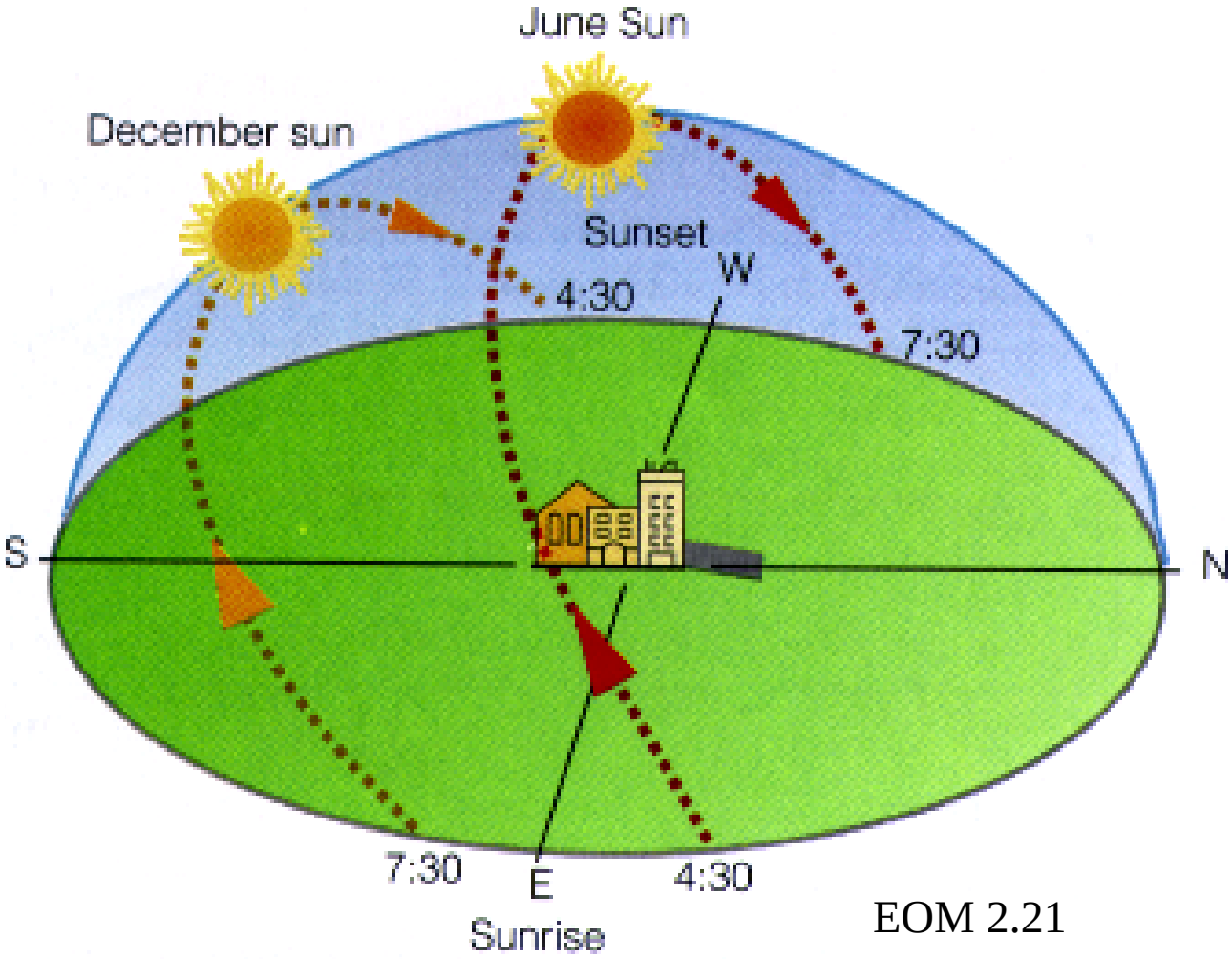


Sun Path in Different Seasons

- For Seattle (47.5°N):

	June	Dec
Day length	8.3 hrs	15.7
At noon sun from horizon	19°	66°

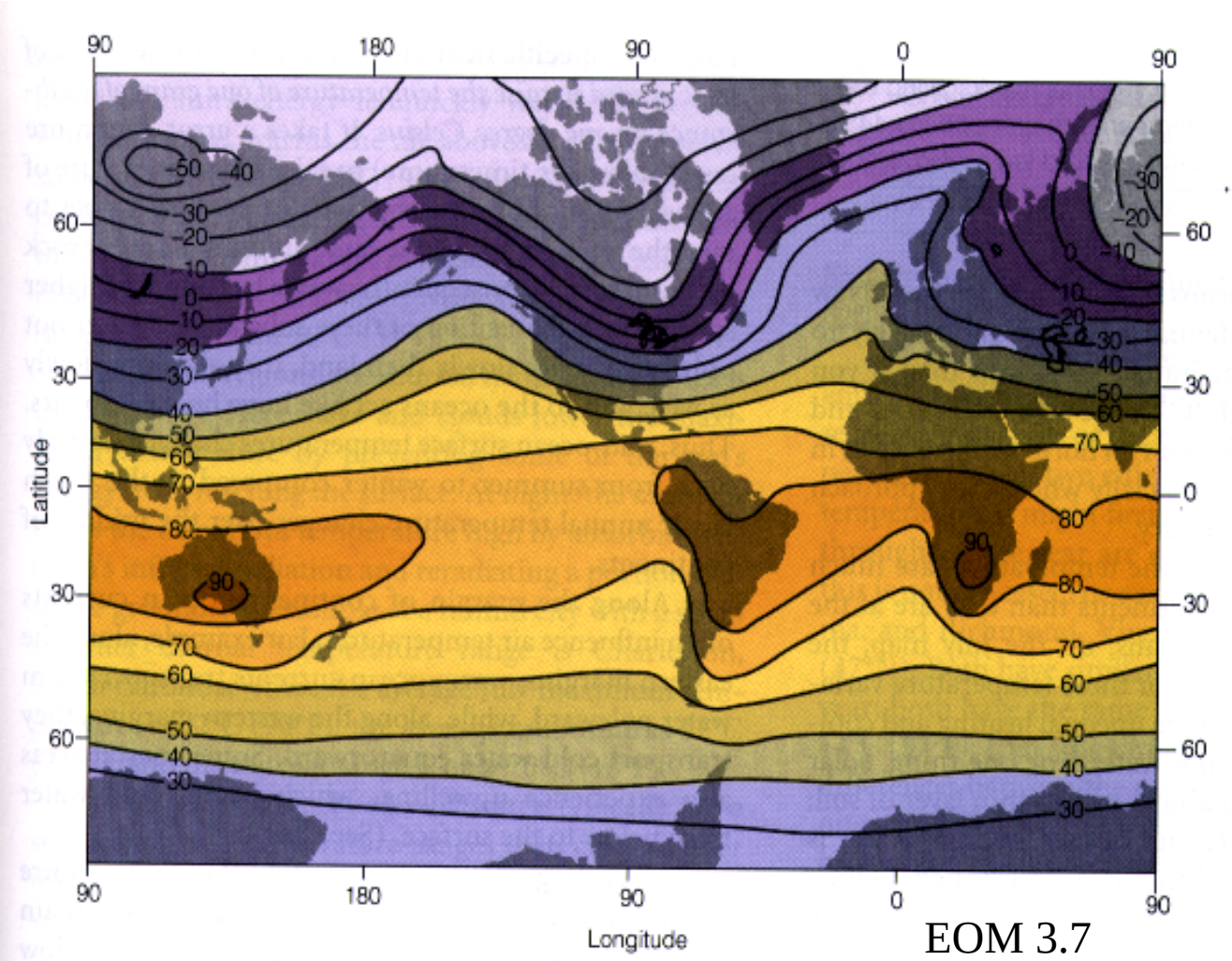
- Winter noon sun angle is degrees of latitude south of the Arctic Circle (66.5-47.5 = 19° for Seattle).



EOM 2.21

Average Sea Level Air Temperature- January

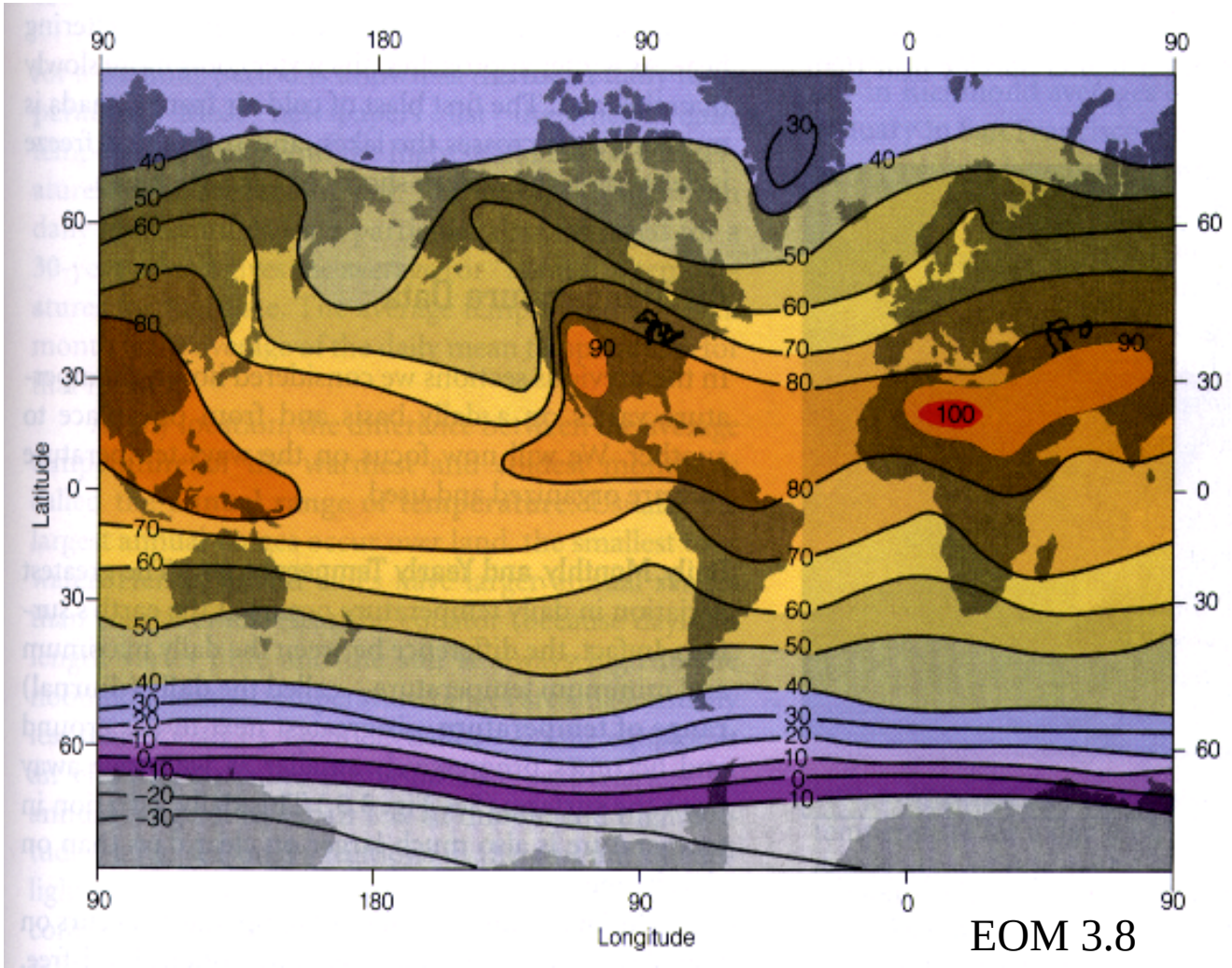
- Stronger temperature contrasts in winter hemisphere.
- Ocean warmer than land in winter hemisphere.
- Land warmer than ocean in summer hemisphere, due to large heat capacity of oceans.
- Hottest temperatures not at equator, but in the S Hemisphere deserts, where sunshine is highest and dry sandy ground has low heat capacity.



EOM 3.7

Average Sea Level Air Temperature- July

- Reversed trends to January.
- On the equator, seasonal temperature differences are small (5°F or less).
- Winter-summer contrast largest in high-latitude continents (Siberia's annual range is over 100°F).
- West coasts (e. g. Seattle) more equable than east coasts (e. g. Boston), since prevailing west winds are from ocean in Seattle and continent in Boston.



EOM 3.8

Record Heat

Dallol, Ethiopia - mean annual temperature of 34°C (94°F). Average high exceeds 100°F 10 mos. a year.

EOM, Ch. 3

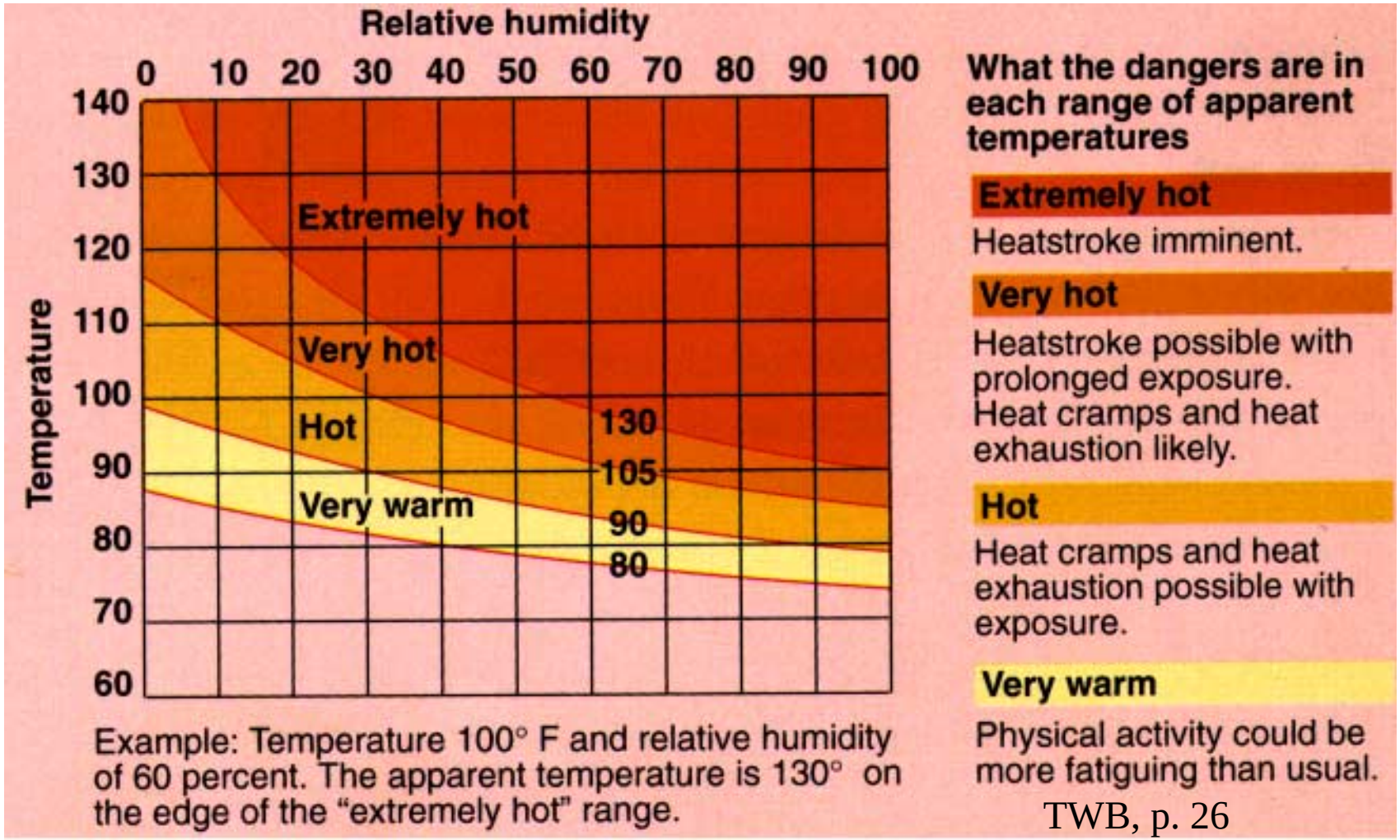
Location (Latitude)	Record High Temperature (°C)	(°F)	Record for:	Date
El Azizia, Libya (32°N)	58	136	The world	September 13, 1922
Death Valley, Calif. (36°N)	57	134	Western Hemisphere	July 10, 1913
Tirat Tsvi, Israel (32°N)	54	129	Middle East	June 21, 1942
Cloncurry, Queensland (21°S)	53	128	Australia	January 16, 1889
Seville, Spain (37°N)	50	122	Europe	August 4, 1881
Rivadavia, Argentina (35°S)	49	120	South America	December 11, 1905
Midale, Saskatchewan (49°N)	45	113	Canada	July 5, 1937
Fort Yukon, Alaska (66°N)	38	100	Alaska	June 27, 1915
Pahala, Hawaii (19°N)	38	100	Hawaii	April 27, 1931
Esparanza, Antarctica (63°S)	14	58	Antarctica	October 20, 1956
Seattle	38	100		1994

Record cold

South Pole station (9000 ft): Annual mean -49°C
(Record -83°C)
July mean -59 C

Location (Latitude)	Record Low Temperature (°C)	(°F)	Record for:	EOM Ch. 3 Date
Vostok, Antarctica (78°S)	–89	–129	The world	July 21, 1983
Verkhoyansk, Russia (67°N)	–68	–90	Northern Hemisphere	February 7, 1892
Northice, Greenland (72°N)	–66	–87	Greenland	January 9, 1954
Snag, Yukon (62°N)	–63	–81	North America	February 3, 1947
Prospect Creek, Alaska (66°N)	–62	–80	Alaska	January 23, 1971
Rogers Pass, Montana (47°N)	–57	–70	U.S. (excluding Alaska)	January 20, 1954
Sarmiento, Argentina (34°S)	–33	–27	South America	June 1, 1907
Ifrane, Morocco (33°N)	–24	–11	Africa	February 11, 1935
Charlotte Pass, Australia (36°S)	–22	–8	Australia	July 22, 1949
Mt. Haleakala, Hawaii (20°N)	–10	14	Hawaii	January 2, 1961
Seattle	-18	0		1950

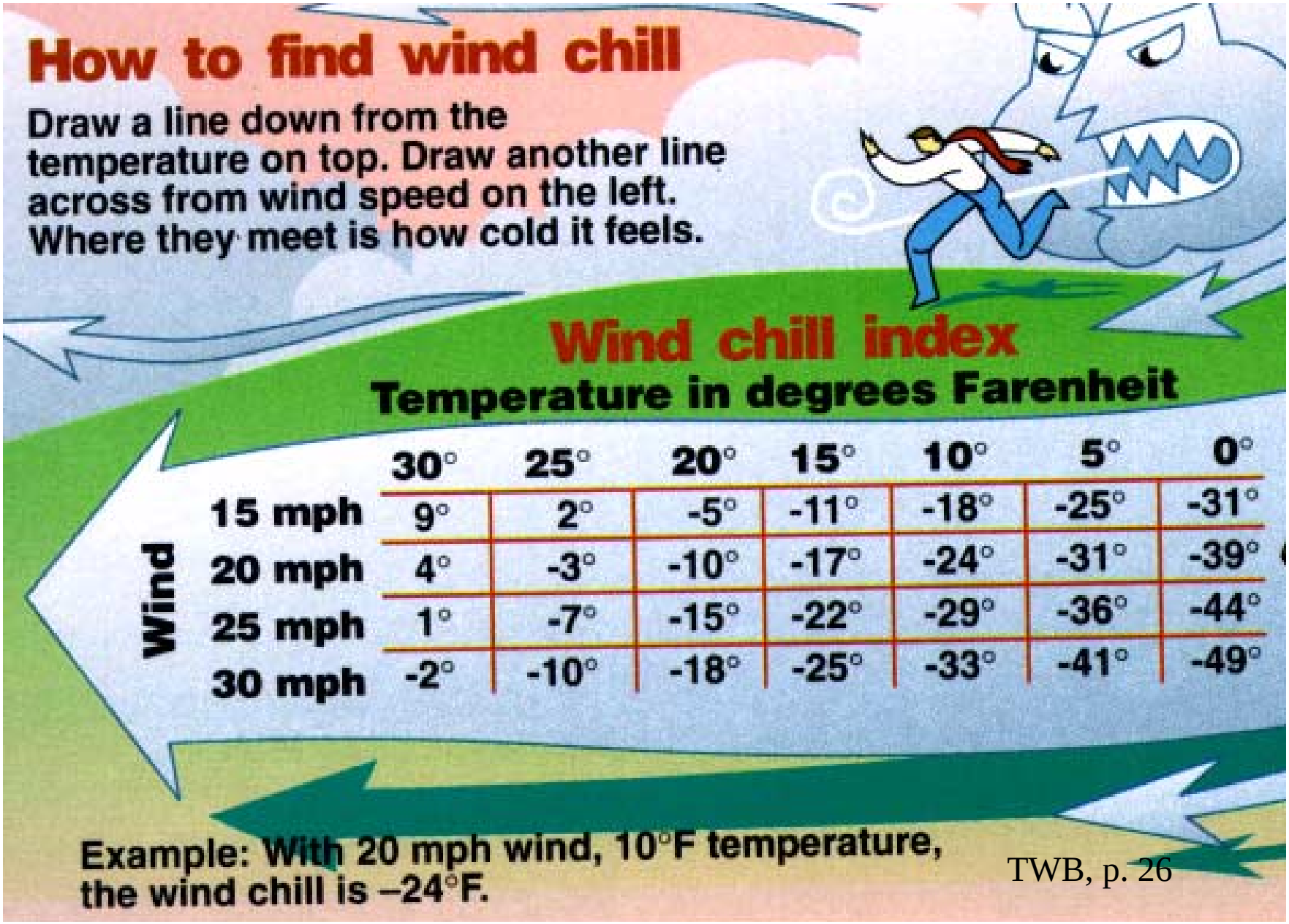
‘Apparent Temperature’ - humidity adds to perceived heat



TWB, p. 26

- Scorching dry heat in Death Valley (130°F at 10% RH) is no more uncomfortable than a hot muggy day in New York (95°F at 70% RH), since sweat evaporates and cools better when air is dry.

Wind Chill - due to wind-enhanced convection of heat from skin



TWB, p. 26