

Lecture 18 Condensation and Fog

Cloud Formation by Condensation

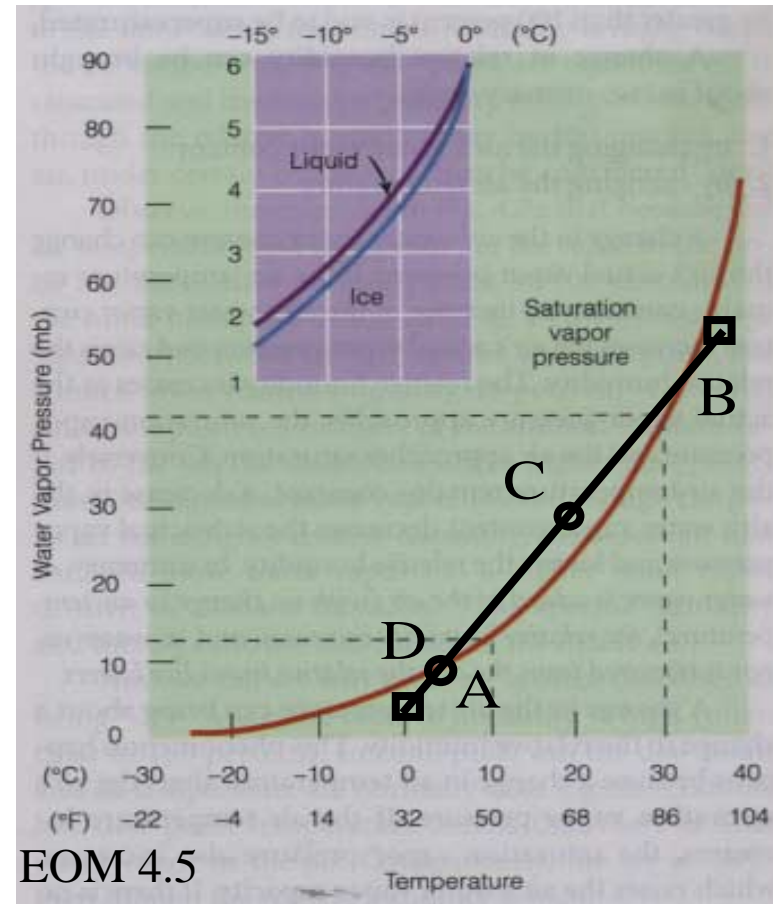
- Mixed into air are myriad submicron particles (sulfuric acid droplets, soot, dust, salt), many of which are attracted to water molecules. As RH rises above 80%, these particles bind more water and swell, producing *haze*.
- When the air becomes supersaturated, the largest of these particles act as *condensation nuclei* onto which water condenses as cloud droplets.
- Typical cloud droplets have diameters of 2-20 microns (diameter of a hair is about 100 microns).
- There are usually 50-1000 droplets per cm^3 , with highest droplet concentrations in polluted continental regions.

Why can you often see your breath?

Condensation can occur when warm moist (but unsaturated air) mixes with cold dry (and unsaturated) air (also contrails, chimney steam, steam fog).

	Temp.	RH	SVP	VP
cold air (A)	0 C	20%	6 mb	1 mb (clear)
breath (B)	36 C	80%	63 mb	55 mb (clear)
50% cold (C)	18 C	140%	20 mb	28 mb (fog)
90% cold (D)	4 C	90%	8 mb	6 mb (clear)

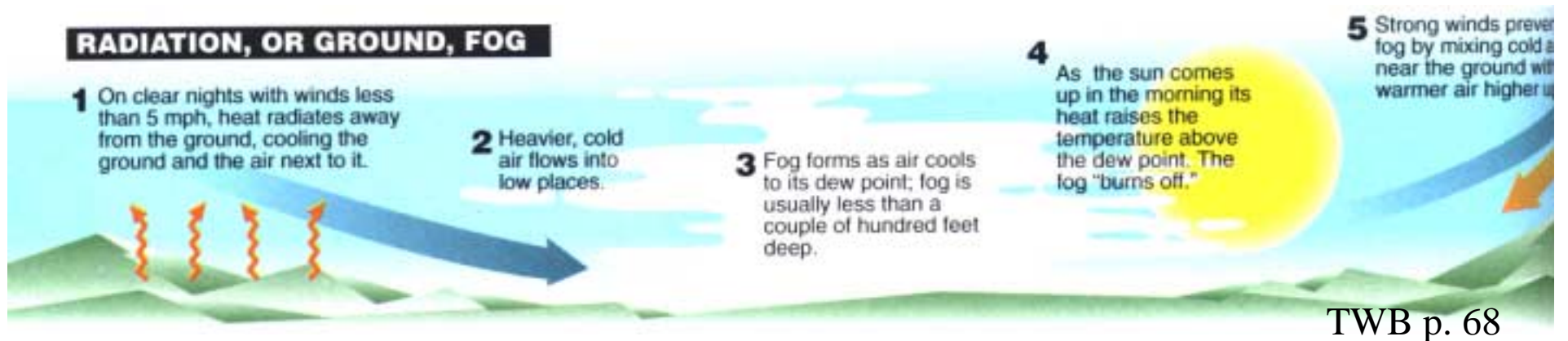
- The 50-50 mix visibly condenses into a short-lived cloud, but evaporates as breath is diluted.



Fog

Fog: cloud at ground level

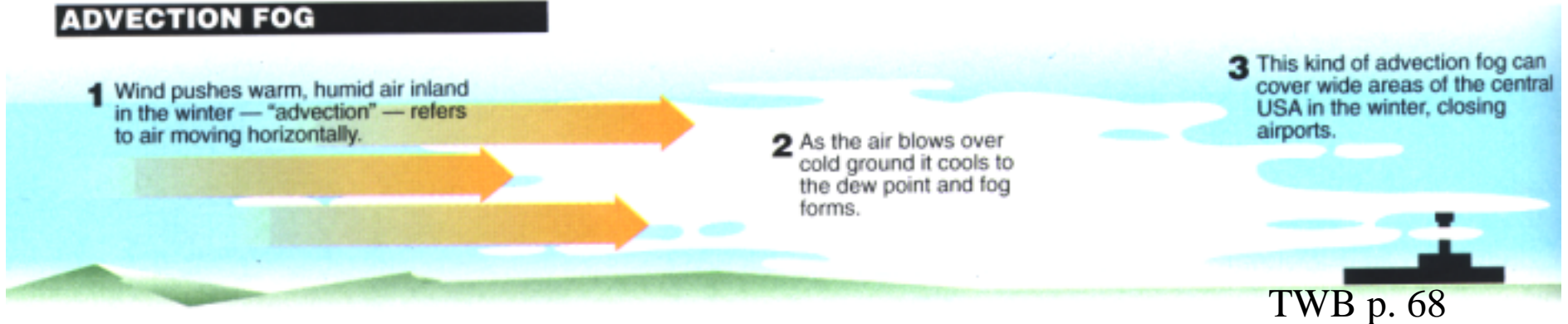
Four main types: radiation fog, advection fog, upslope fog, steam fog.



- Forms due to nighttime longwave cooling of surface air below dew point.
- Promoted by clear, calm, long nights. Common in Seattle in winter.
- Daytime warming of ground and air 'burns off' fog when temperature exceeds dew point.
- Fog may lift into a low cloud layer when it thickens or dissipates.
- In mountain valleys during winter, radiation fog can thicken and persist for days (e.g. Salt Lake City)

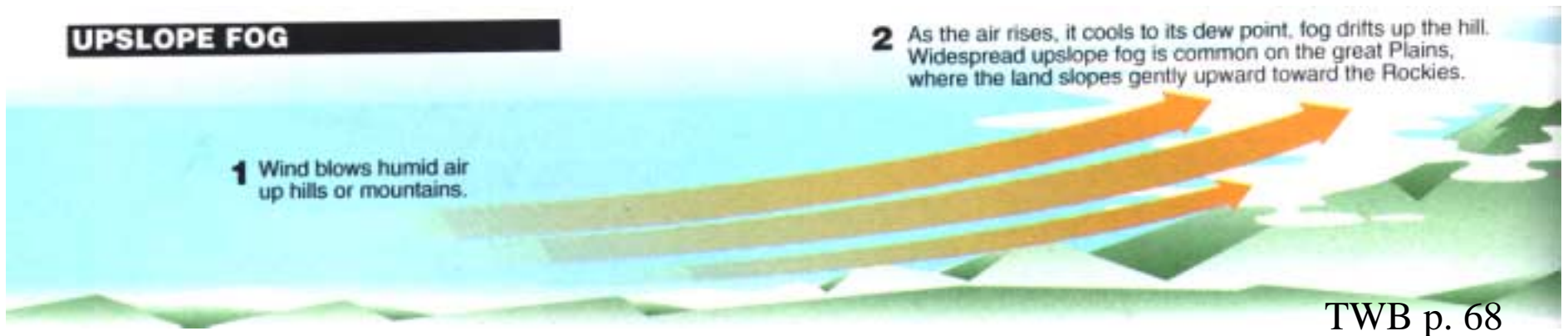
Advection and Upslope Fog

ADVECTION FOG



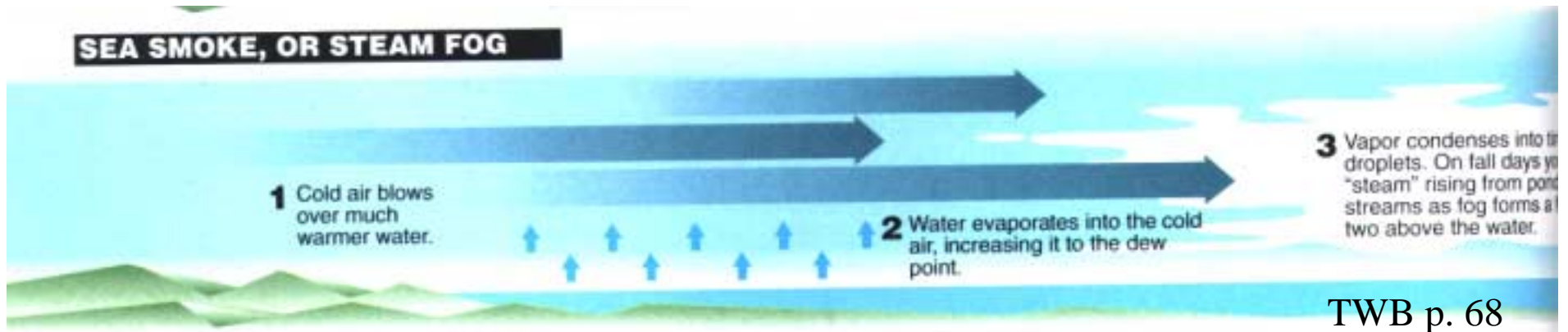
- Warm humid air is pushed over a colder surface, chilling it below its dew point.
- Common in Midwest in winter; also common over the cold water off the W Coast and off New England during the summer.

UPSLOPE FOG



- Humid air is lifted up mountains (Cascades), cooling it to the dew point.

Steam Fog (Sea Smoke)



- Air next to water surface becomes warm, nearly saturated.
- Cold air blows above and mixes with warm moist surface air.
- Mixing produces condensation just like you see your breath.
- Convection patterns the fog into plumes.

.Steam fog produced by geysers

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Frequency of foggy days

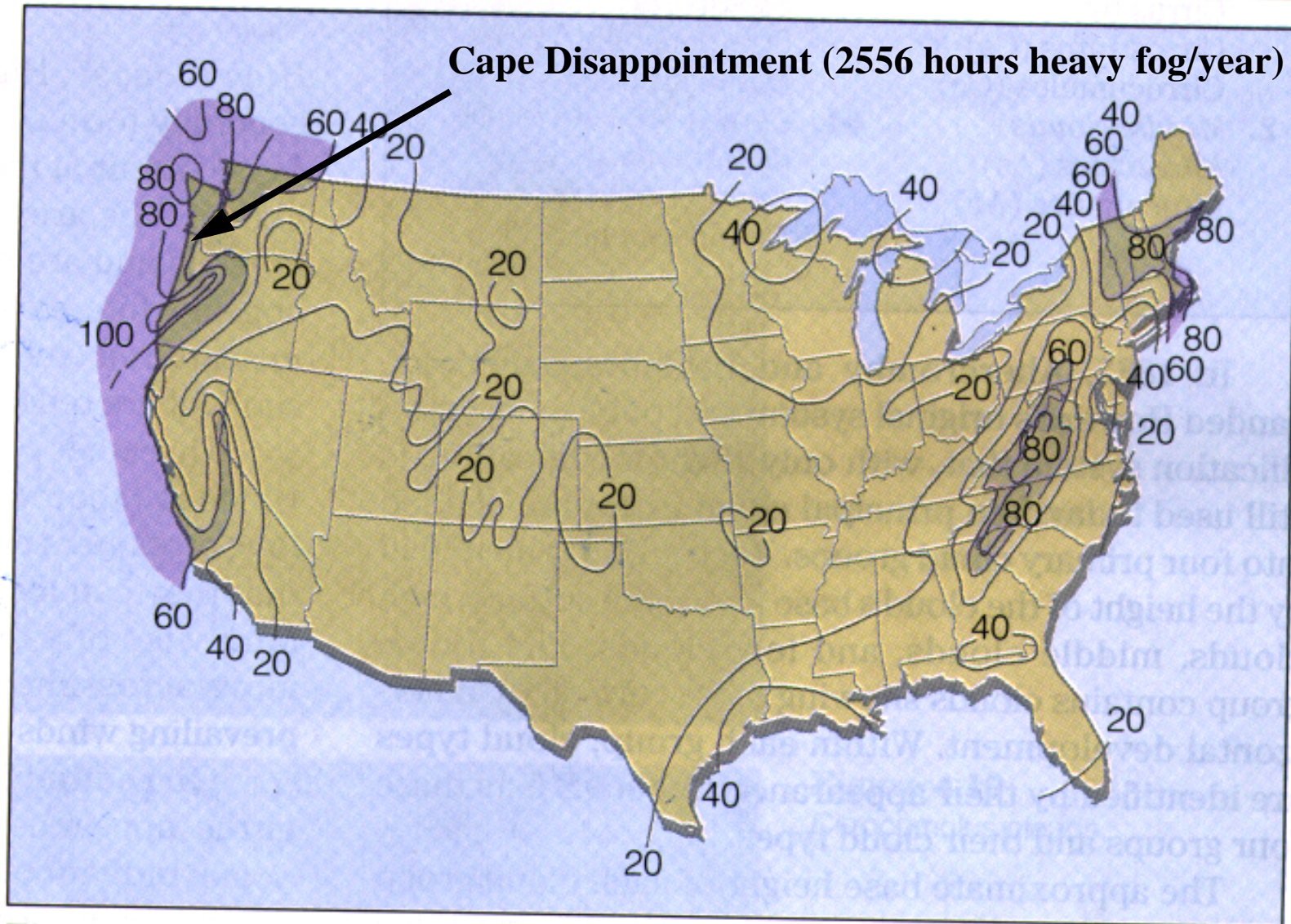


Figure 2

Average annual number of days with heavy fog throughout the United States.

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