

## T-S and Stability Example



- Need to account for both T & S to determine density
  - Need to determine density to assess stability

Depth, m	T °C	S ‰	$\sigma_t$	$\rho$ g/cm <sup>3</sup>
0	-1.5	34.8		
500	-0.5	34.6		
1000	-0.5	34.7		
2000	-0.5	34.8		
3000	-0.5	34.9		
4000	-0.5	35.0		

1

## T-S and Stability Example



- Looking at temperature alone, is this water column stable?
  - No, colder more dense water is at the surface

Depth, m	T °C	S ‰	$\sigma_t$	$\rho$ g/cm <sup>3</sup>
0	-1.5			
500	-0.5			
1000	-0.5			
2000	-0.5			
3000	-0.5			
4000	-0.5			

2

## T-S and Stability Example



- Looking at salinity alone, is this water column stable?
  - Yes, fresher, less dense water is at the surface

Depth, m	T °C	S ‰	$\sigma_t$	$\rho$ g/cm <sup>3</sup>
0		34.8		
500		34.6		
1000		34.7		
2000		34.8		
3000		34.9		
4000		35.0		

3

## T-S and Stability Example



- Which wins, T or S?
  - Vertically stable or unstable?
  - Need to determine density to assess stability

Depth, m	T °C	S ‰	$\sigma_t$	$\rho$ g/cm <sup>3</sup>
0	-1.5	34.8		
500	-0.5	34.6		
1000	-0.5	34.7		
2000	-0.5	34.8		
3000	-0.5	34.9		
4000	-0.5	35.0		

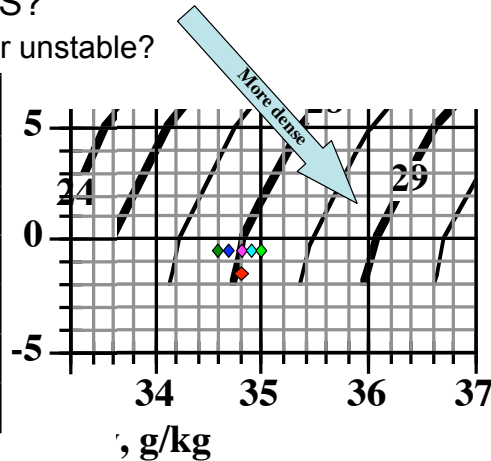
4

# T-S and Stability Example



- Which wins, T or S?
  - Vertically stable or unstable?

Depth,	T °C	S
0	-1.5	34.8
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5

# T-S and Stability Example



- It's a draw
  - T wins @ surface, vertically unstable 0–500 m
  - S wins below surface, vertically stable 500-4000 m

Depth, m	T °C	S ‰	$\sigma_t$	$\rho$ g/cm <sup>3</sup>
0	-1.5	34.8	28.10	1.02810
500	-0.5	34.6	27.70	1.02770
1000	-0.5	34.7	27.75	1.02775
2000	-0.5	34.8	27.80	1.02780
3000	-0.5	34.9	27.90	1.02790
4000	-0.5	35.0	28.00	10.2800

6

# T-S and Stability Example



- Overall, vertically unstable because of surface
  - Polar winter: Low T & High S at surface
  - 1 of 2 persistent locations of instability globally

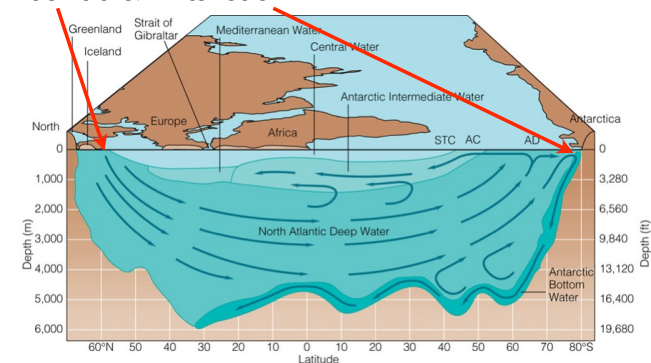
Depth, m	T °C	S ‰	$\sigma_t$	$\rho$ g/cm <sup>3</sup>
0	-1.5	34.8	28.10	1.02810
500	-0.5	34.6	27.70	1.02770
1000	-0.5	34.7	27.75	1.02775
2000	-0.5	34.8	27.80	1.02780
3000	-0.5	34.9	27.90	1.02790
4000	-0.5	35.0	28.00	10.2800

7

# Global Density-Driven Currents



- Sea ice formation at high latitudes in winter
  - Cold, high-salinity water sinks at surface
  - N. Atlantic & Antarctic



8