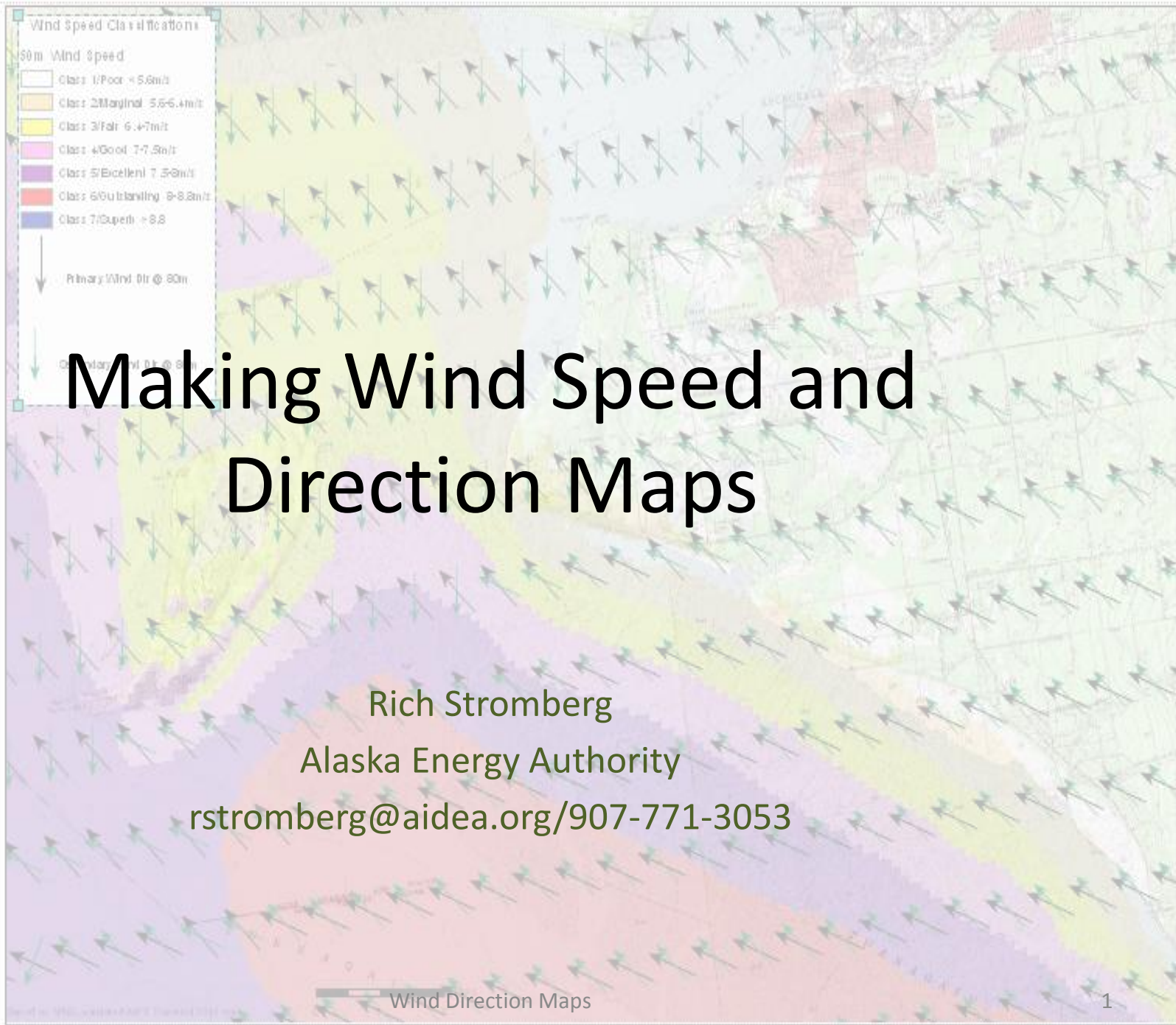




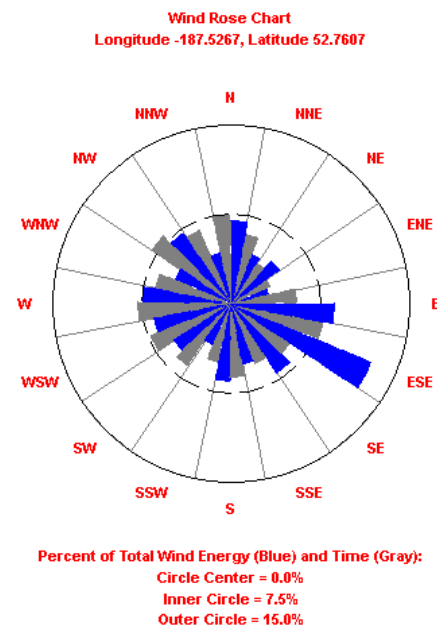
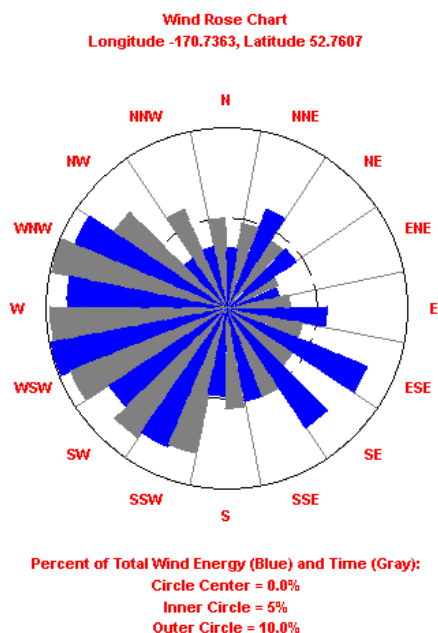
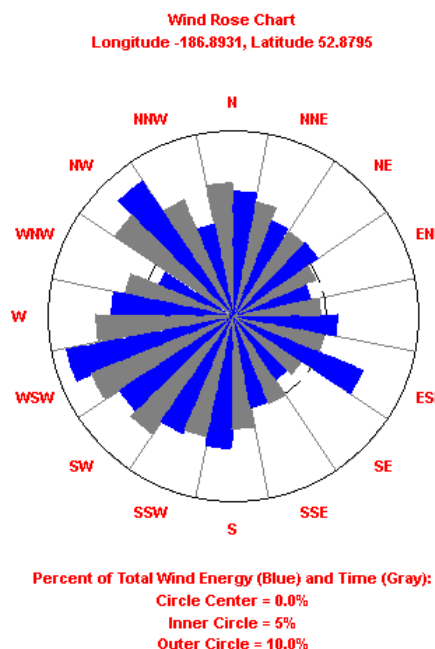
Making Wind Speed and Direction Maps

Rich Stromberg

Alaska Energy Authority

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Wind rose data comes in the form of >200,000 wind rose images across Alaska

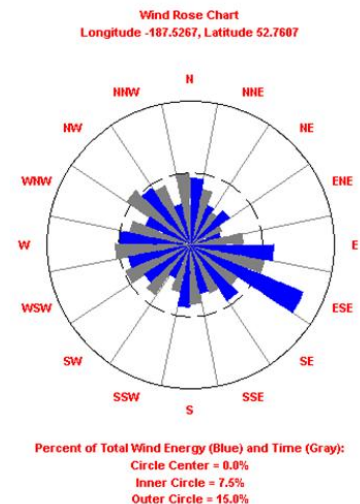


Wind rose data is quantified in very large Excel™ spreadsheets for each region of the state

- Fields: X Y X_1 Y_1 FILE
FREQ1 FREQ2 FREQ3 FREQ4 FREQ5 FREQ6 FREQ7 FREQ8
FREQ9 FREQ10 FREQ11 FREQ12 FREQ13 FREQ14 FREQ15
FREQ16
SPEED1 SPEED2 SPEED3 SPEED4 SPEED5 SPEED6 SPEED7
SPEED8 SPEED9 SPEED10 SPEED11 SPEED12 SPEED13
SPEED14 SPEED15 SPEED16
POWER1 POWER2 POWER3 POWER4 POWER5 POWER6
POWER7 POWER8 POWER9 POWER10 POWER11 POWER12
POWER13 POWER14 POWER15 POWER16
WEIBC1 WEIBC2 WEIBC3 WEIBC4 WEIBC5 WEIBC6 WEIBC7
WEIBC8 WEIBC9 WEIBC10 WEIBC11 WEIBC12 WEIBC13
WEIBC14 WEIBC15 WEIBC16
WEIBK1 WEIBK2 WEIBK3 WEIBK4 WEIBK5 WEIBK6 WEIBK7
WEIBK8 WEIBK9 WEIBK10 WEIBK11 WEIBK12 WEIBK13
WEIBK14 WEIBK15 WEIBK16

Data set is thinned down to wind power density

- Fields: X Y
- POWER1 POWER2 POWER3
POWER4 POWER5 POWER6 POWER7
POWER8 POWER9 POWER10 POWER11
POWER12 POWER13 POWER14 POWER15
POWER16
- Power1 is the wind power density coming from the north (0 degrees). Power 2 is wind power from 22.5 deg.,...Power 9 is south (180 deg.), etc...



Spreadsheet calculations

X	Y	POWER1	POWER2	POWER3	POWER4	POWER5	POWER6	POWER7	POWER8	POWER9	POWER10	POWER11	POWER12	POWER13	POWER14	POWER15	POWER16	Max	Wind Dir Prim	2nd	Wind Dir Sec
-132.7365	54.4833	0.643	0.767	1.911	4.083	5.494	15.192	23.004	8.04	5.188	5.424	6.188	4.411	5.368	6.353	6.233	1.701	23.004	135	15.192	112.5
-132.7167	54.4833	0.666	0.771	1.833	3.973	5.425	14.706	23.348	8.682	5.366	5.21	6.219	4.32	5.383	6.584	5.871	1.641	23.348	135	14.706	112.5
-132.6969	54.4833	0.674	0.779	1.8	3.927	5.402	14.416	23.483	9.044	5.551	5.129	6.203	4.209	5.379	6.697	5.718	1.588	23.483	135	14.416	112.5
-132.6771	54.4833	0.678	0.781	1.791	3.919	5.372	14.308	23.559	9.187	5.597	5.061	6.187	4.197	5.389	6.749	5.653	1.572	23.559	135	14.308	112.5
-132.6573	54.4833	0.681	0.777	1.801	3.947	5.31	14.342	23.648	9.19	5.523	4.981	6.138	4.279	5.426	6.786	5.588	1.582	23.648	135	14.342	112.5
-132.6375	54.4833	0.688	0.761	1.773	4.009	5.054	14.163	24.167	9.73	5.479	4.61	5.871	4.373	5.512	7.056	5.192	1.56	24.167	135	14.163	112.5
-132.8751	54.5031	0.589	0.677	1.751	4.541	6.234	17.314	19.654	5.866	5.922	7.162	5.747	4.256	5.276	5.078	7.694	2.228	19.654	135	17.314	112.5
-132.8553	54.5031	0.572	0.701	1.879	4.534	6.014	17.138	20.18	6.184	5.642	6.925	5.768	4.244	5.274	5.333	7.541	2.06	20.18	135	17.138	112.5
-132.8355	54.5031	0.554	0.71	1.959	4.489	5.997	16.967	20.716	6.451	5.455	6.637	5.74	4.21	5.247	5.519	7.429	1.909	20.716	135	16.967	112.5
-132.8157	54.5031	0.548	0.71	1.978	4.485	6.02	16.935	20.81	6.498	5.431	6.584	5.71	4.195	5.237	5.557	7.409	1.881	20.81	135	16.935	112.5
-132.7959	54.5031	0.559	0.716	1.983	4.467	5.936	16.828	20.979	6.538	5.39	6.522	5.763	4.247	5.265	5.603	7.311	1.884	20.979	135	16.828	112.5
-132.7761	54.5031	0.58	0.735	1.997	4.319	5.782	16.131	21.959	7.177	5.303	6.04	5.849	4.276	5.29	5.965	6.831	1.76	21.959	135	16.131	112.5
-132.7563	54.5031	0.607	0.75	1.964	4.213	5.631	15.665	22.508	7.598	5.276	5.755	5.976	4.323	5.333	6.17	6.509	1.718	22.508	135	15.665	112.5
-132.7365	54.5031	0.633	0.763	1.91	4.105	5.521	15.196	22.946	8.091	5.327	5.498	6.085	4.314	5.359	6.366	6.211	1.673	22.946	135	15.196	112.5
-132.7167	54.5031	0.666	0.771	1.818	3.961	5.426	14.609	23.379	8.843	5.481	5.207	6.17	4.249	5.38	6.636	5.788	1.614	23.379	135	14.609	112.5

- Again, Power1 is the wind power density coming from the north (0 degrees). Power 2 is wind power from 22.5 deg.,...Power 9 is south (180 deg.), etc...
- Max is the highest value of Power1-Power16. 2nd is second highest value. These fields will determine the compass direction assigned to the primary and secondary wind values.

Spreadsheet calculations

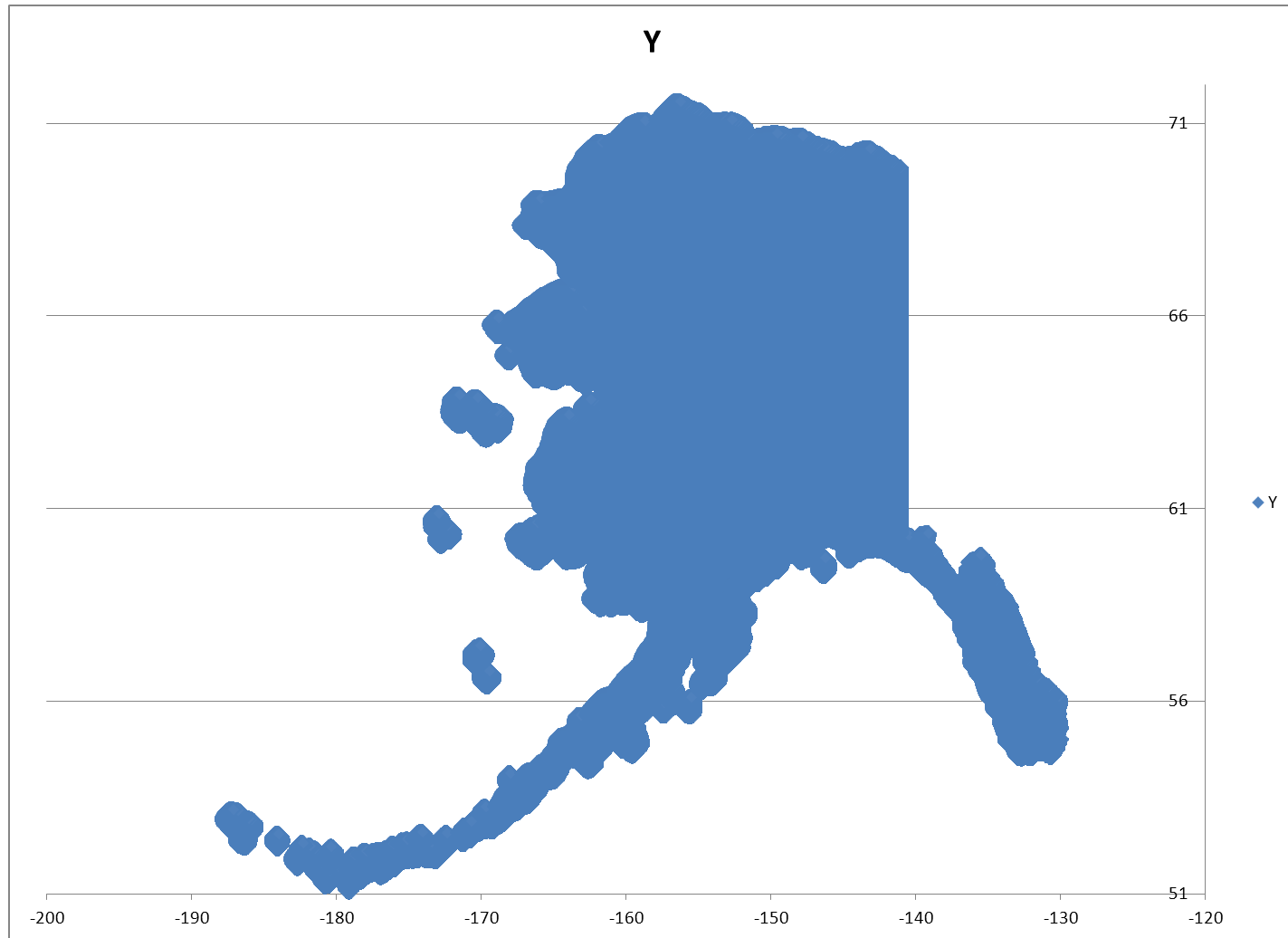
- =MAX(C2:R2) and =LARGE(C2:R2,2) determine the largest and second largest value in Power1 thru Power16.
- =IF(C2=S2,0,(IF(D2=S2,22.5,(IF(E2=S2,45,(IF(F2=S2,67.5,(IF(G2=S2,90,(IF(H2=S2,112.5,(IF(I2=S2,135,(IF(J2=S2,157.5,(IF(K2=S2,180,(IF(L2=S2,202.5,(IF(M2=S2,225,(IF(N2=S2,247.5,(IF(O2=S2,270,(IF(P2=S2,292.5,(IF(Q2=S2,315,(IF(R2=S2,337.5,0)))))))))))))))))))))) Is the formula to assign the geographic degrees to the primary and secondary wind directions.

Spreadsheet calculations

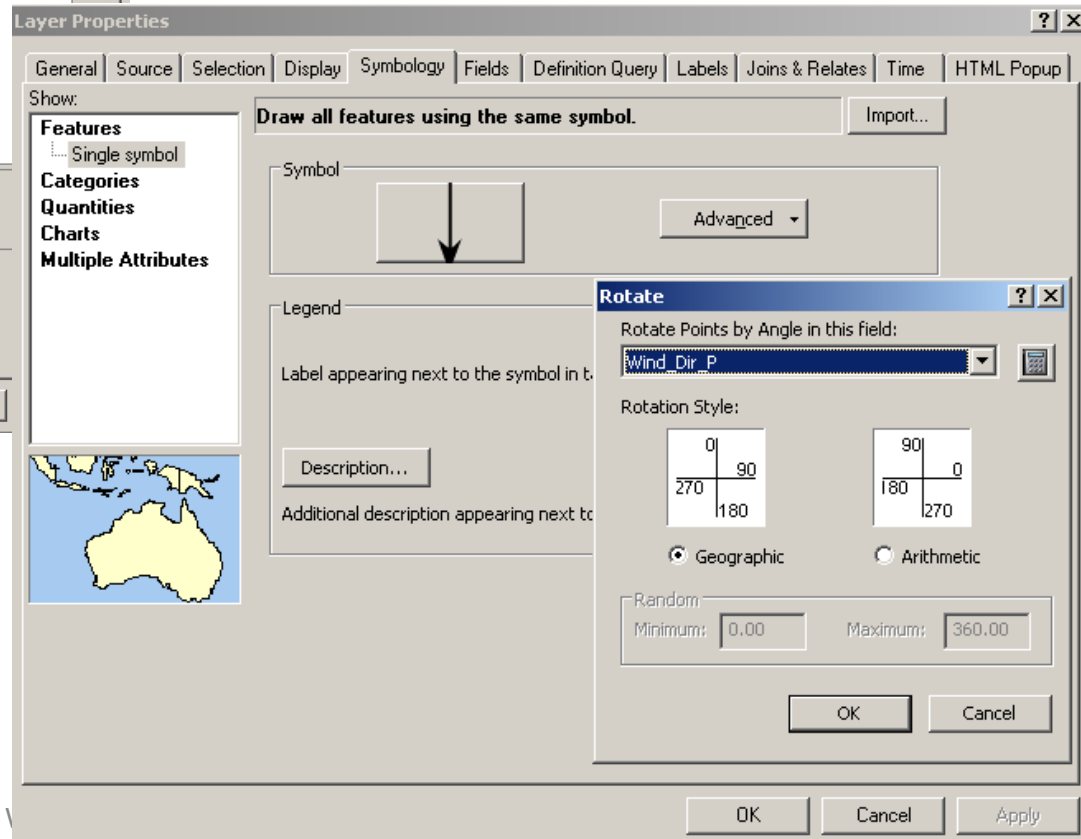
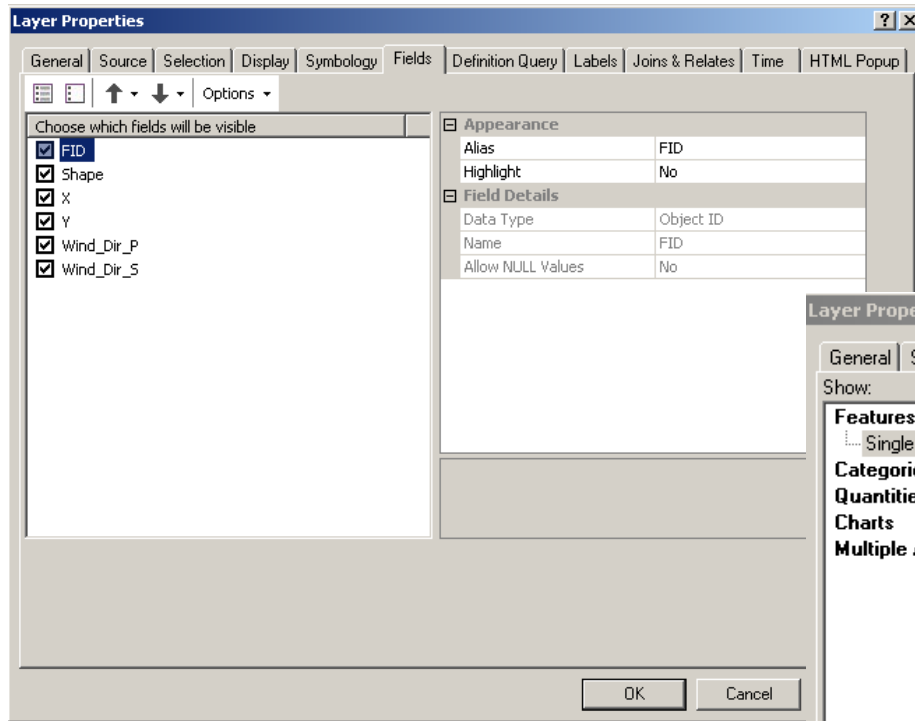
- Copy calculated values to new columns and delete any unnecessary data. (The entire State of Alaska file is 804,559 records long / 18.5MB.)

X	Y	Wind Dir Prim	Wind Dir Sec
-170.585	52.4331	135	292.5
-170.564	52.4331	135	292.5
-170.542	52.4331	135	292.5
-170.52	52.4331	135	292.5
-170.585	52.4547	135	112.5
-170.564	52.4547	135	292.5
-170.542	52.4547	135	292.5
-170.52	52.4547	135	292.5
-170.499	52.4547	135	292.5
-170.477	52.4547	135	292.5
-170.456	52.4547	135	292.5
-170.607	52.4763	135	112.5
-170.585	52.4763	135	112.5
-170.564	52.4763	135	112.5
-170.542	52.4763	135	112.5
-170.52	52.4763	135	292.5
-170.499	52.4763	135	292.5
-170.477	52.4763	135	292.5
-170.456	52.4763	135	292.5
-170.434	52.4763	135	292.5
-170.412	52.4763	135	292.5
-170.607	52.4979	135	112.5
-170.585	52.4979	135	112.5
-170.564	52.4979	135	112.5

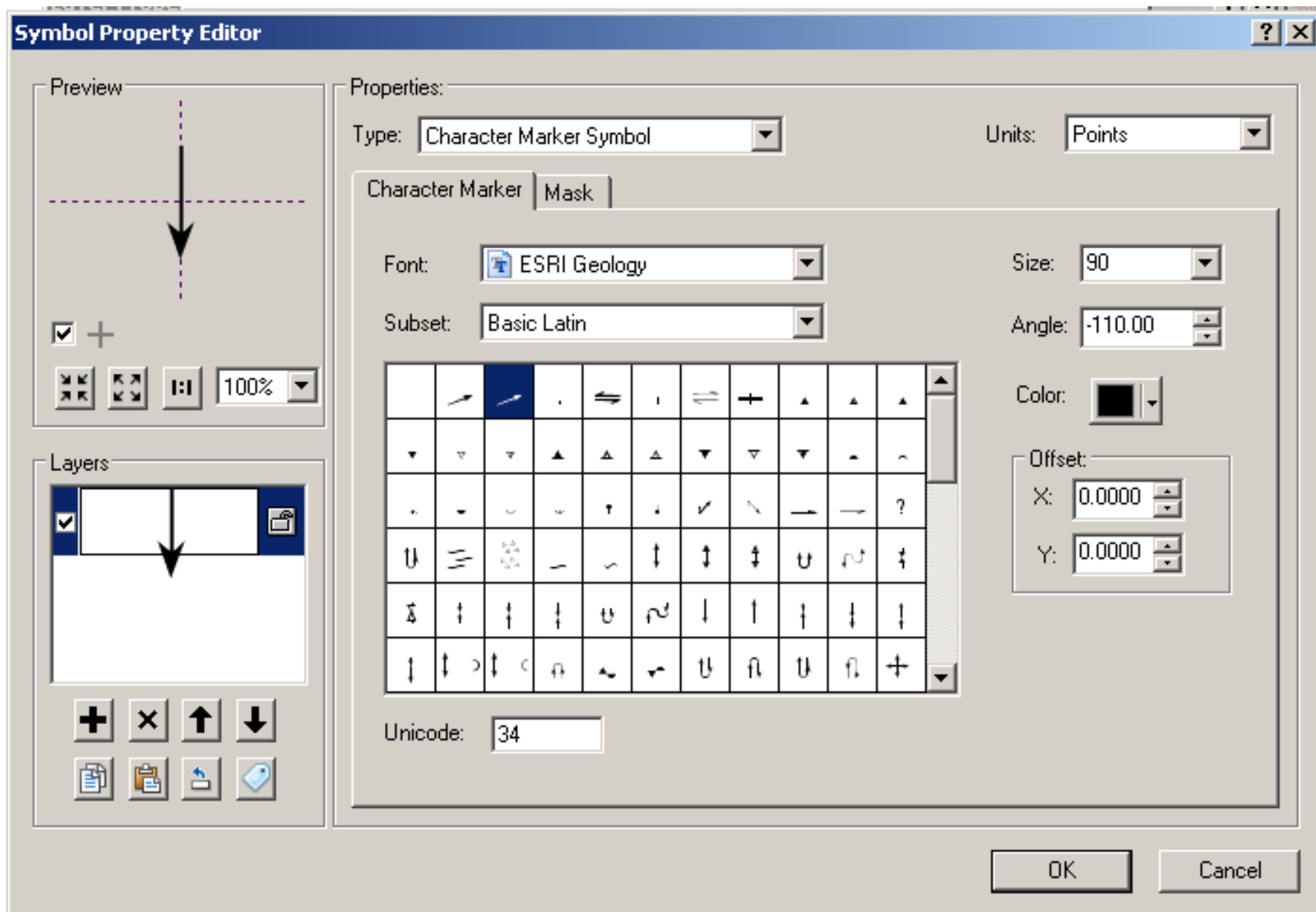
Plot out each point to ensure you have all the data



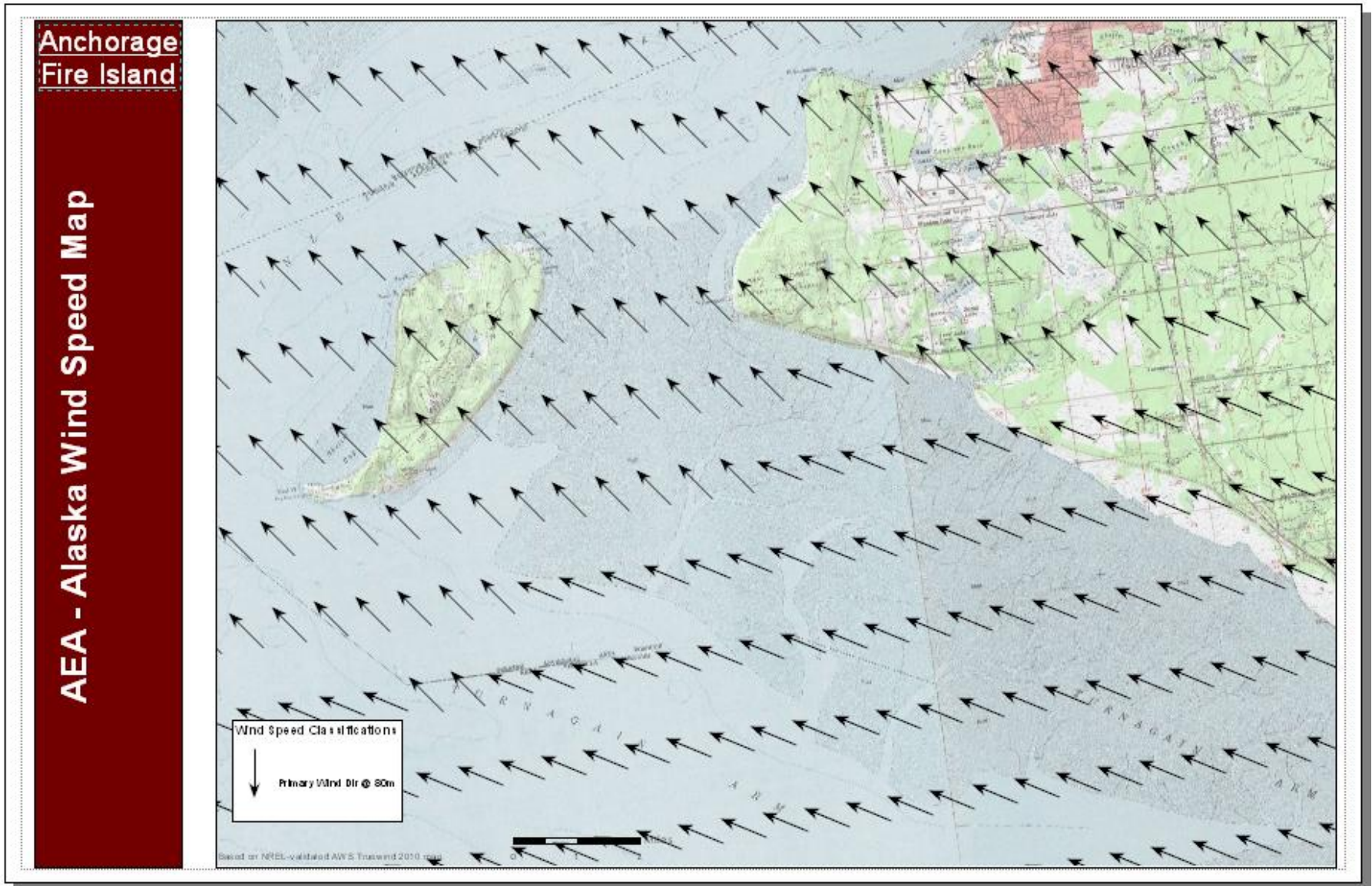
GIS Layer Fields and Symbology



Select arrow style and adjust angle if needed



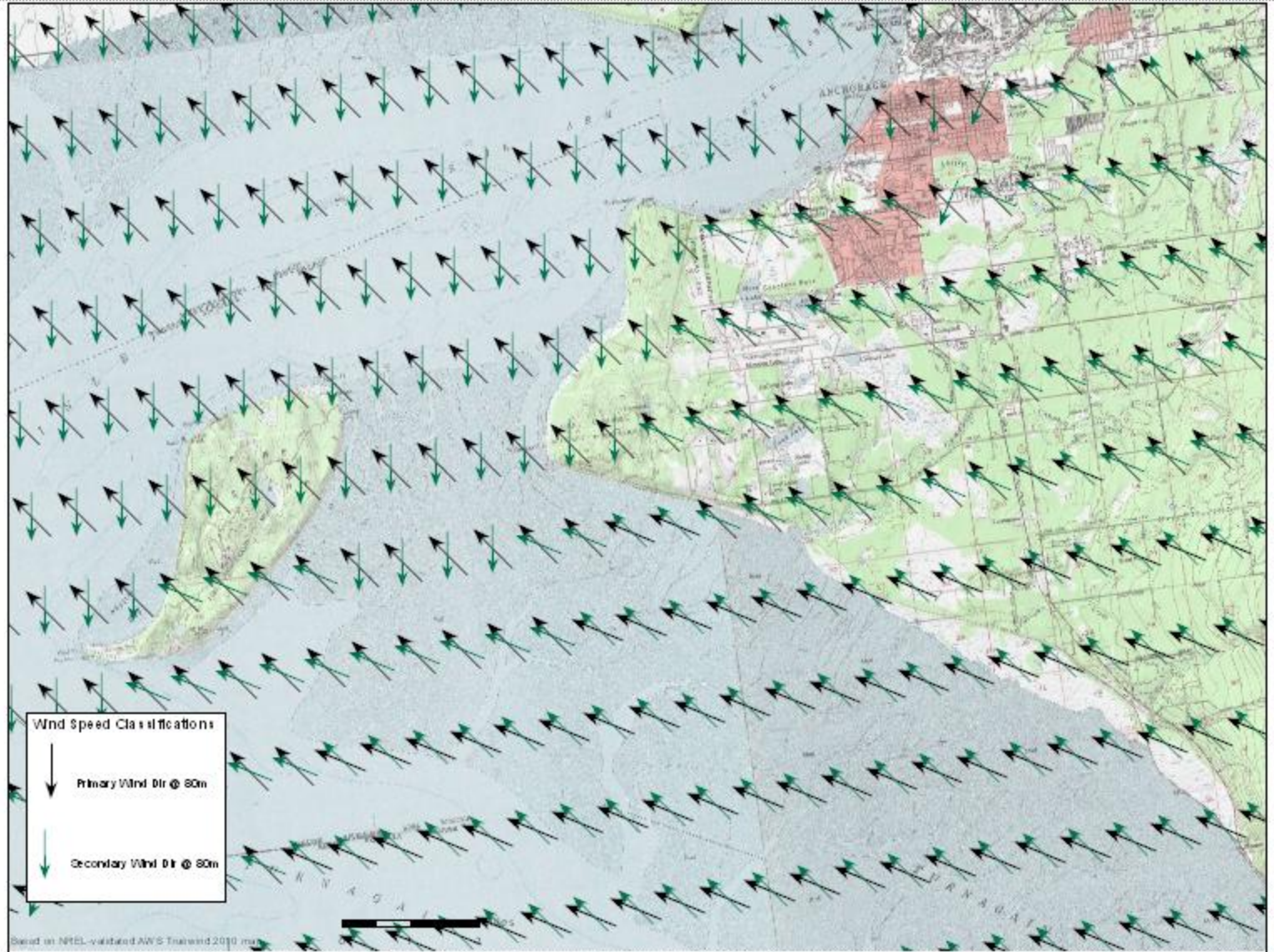
Add topo layer



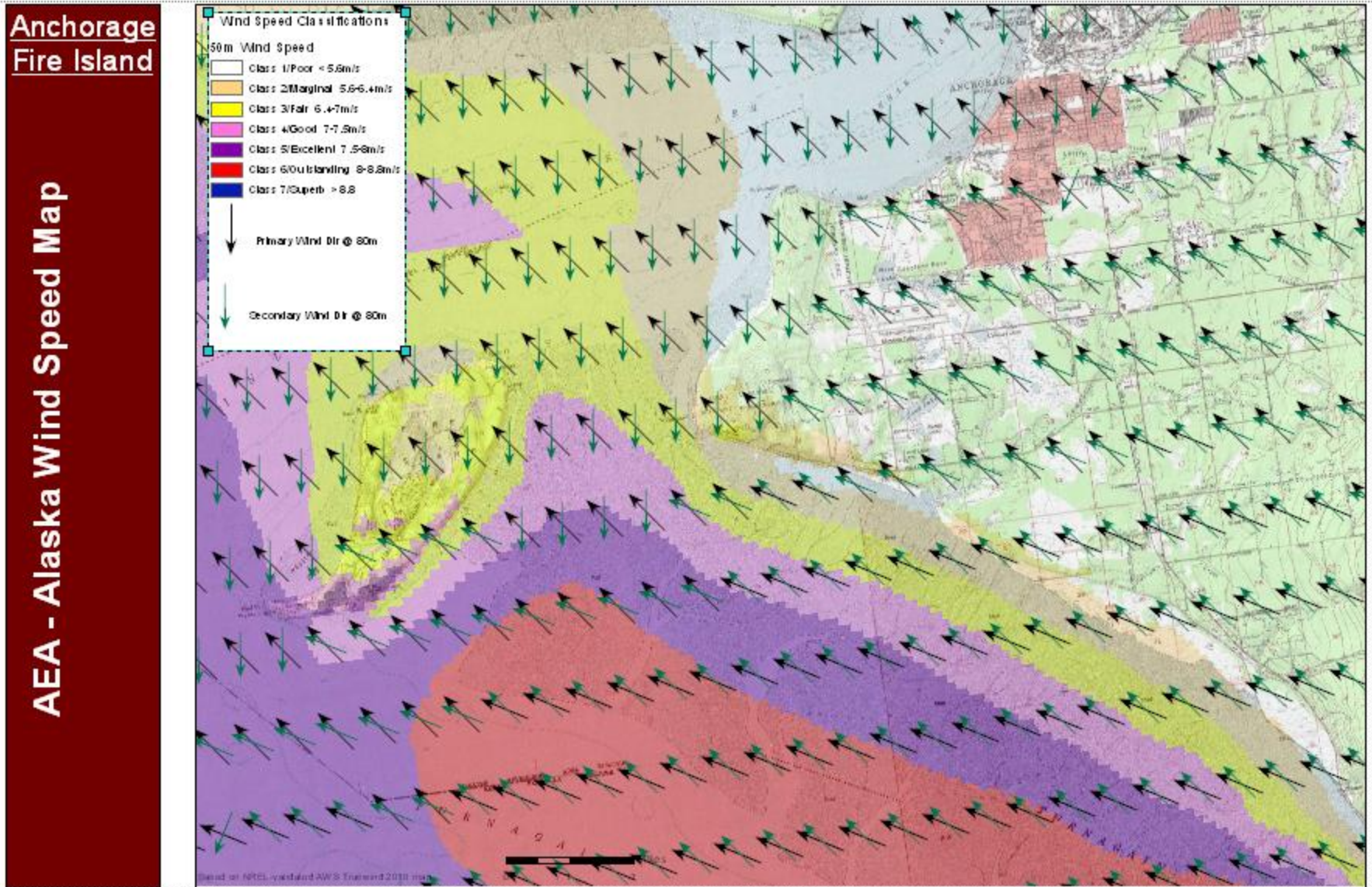
Add second arrow

Anchorage
Fire Island

AEA - Alaska Wind Speed Map



Add wind speed layer, and you're done!



Layer order. Topo has transparency.

