Wind Field Trends in Hurricane Force Extratropical Cyclones from Satellite Scatterometry

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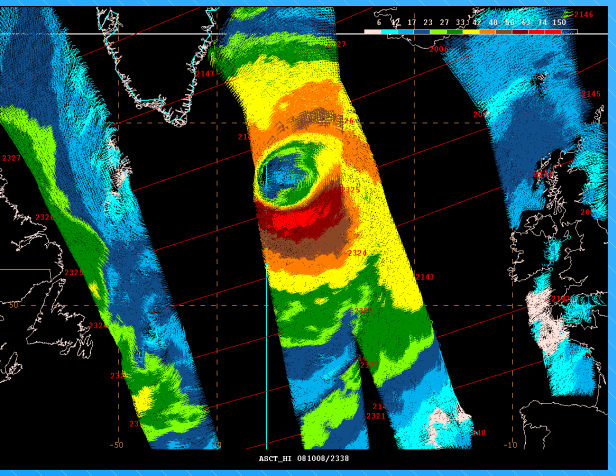
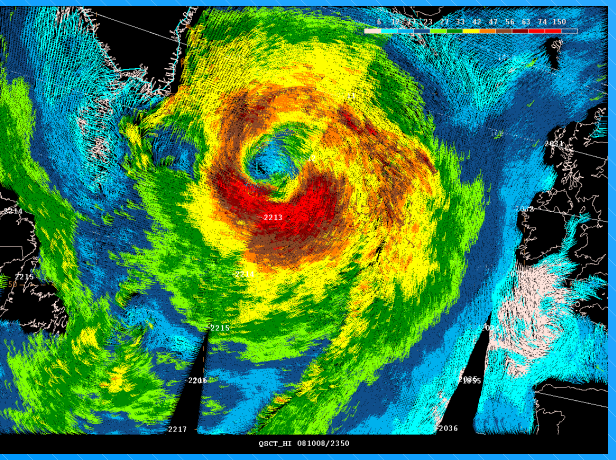
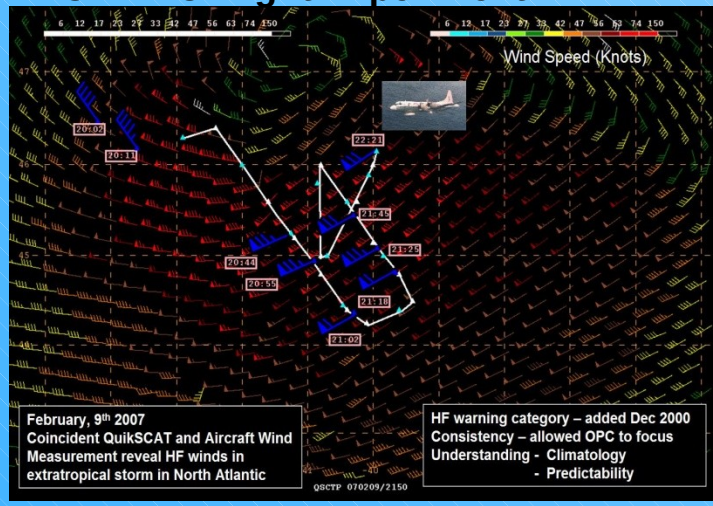
ASCAT



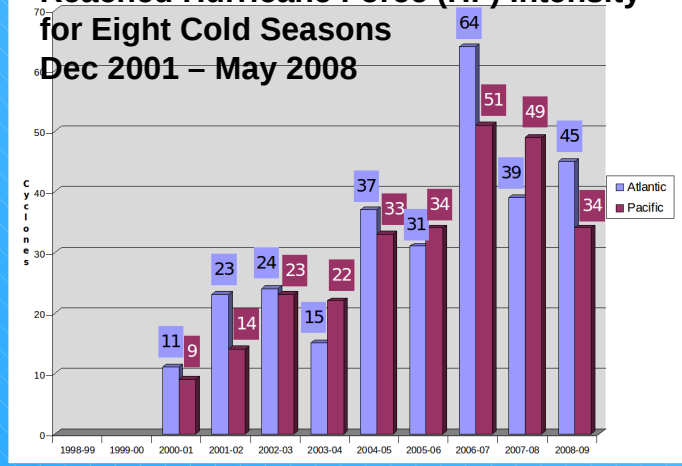
QuikSCAT



NOAA P3 Flight Experiment



Number of Extratropical cyclones that Reached Hurricane Force (HF) Intensity for Eight Cold Seasons Dec 2001 – May 2008



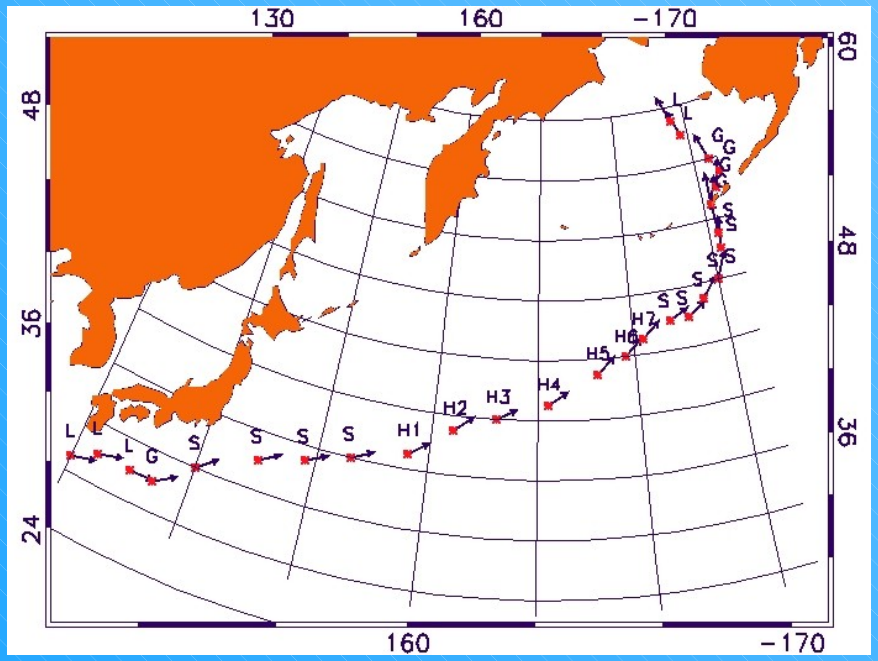
Outline

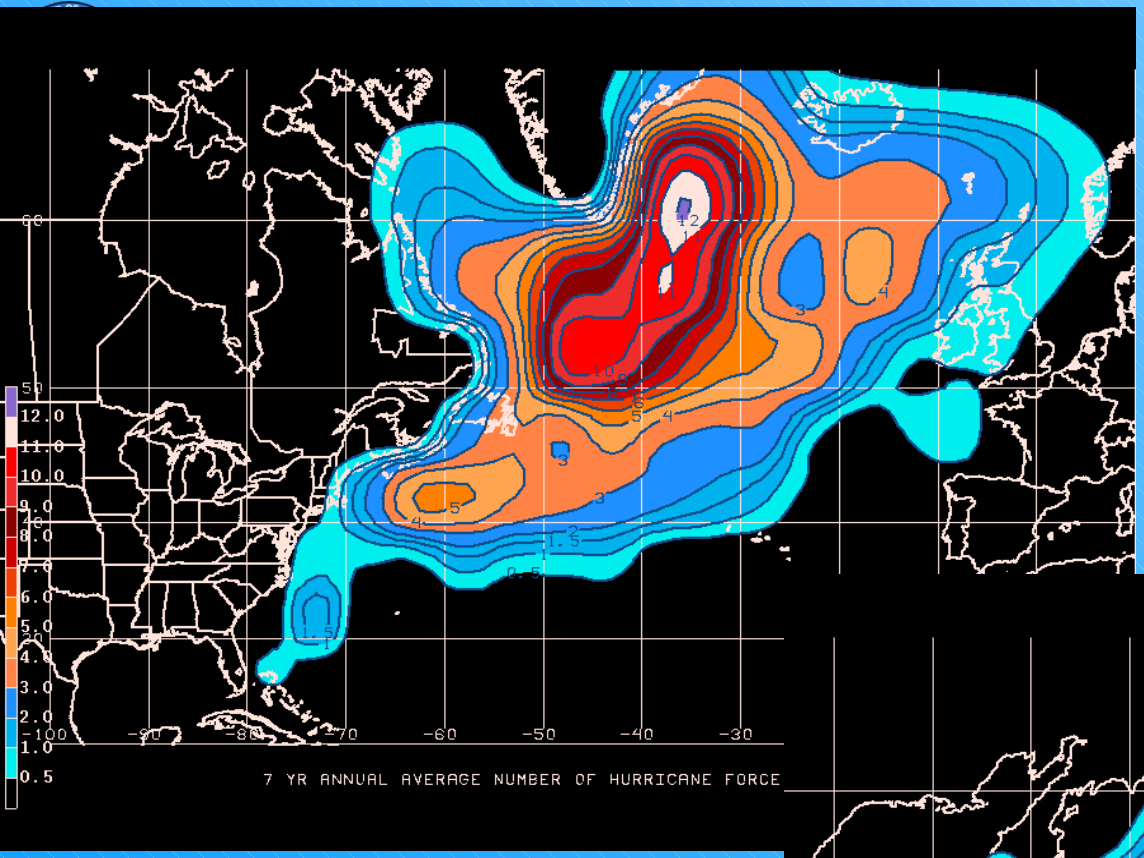
- **Cyclone statistics from OPC extratropical cyclone database**
- **Comparison of QuikSCAT and CCMP and ECMWF wind composite**
- **Comparison North Atlantic cyclones within Labrador sea, Gulf stream, Greenland Tip, Greenland Sea and Open ocean**
- **Conclusions**

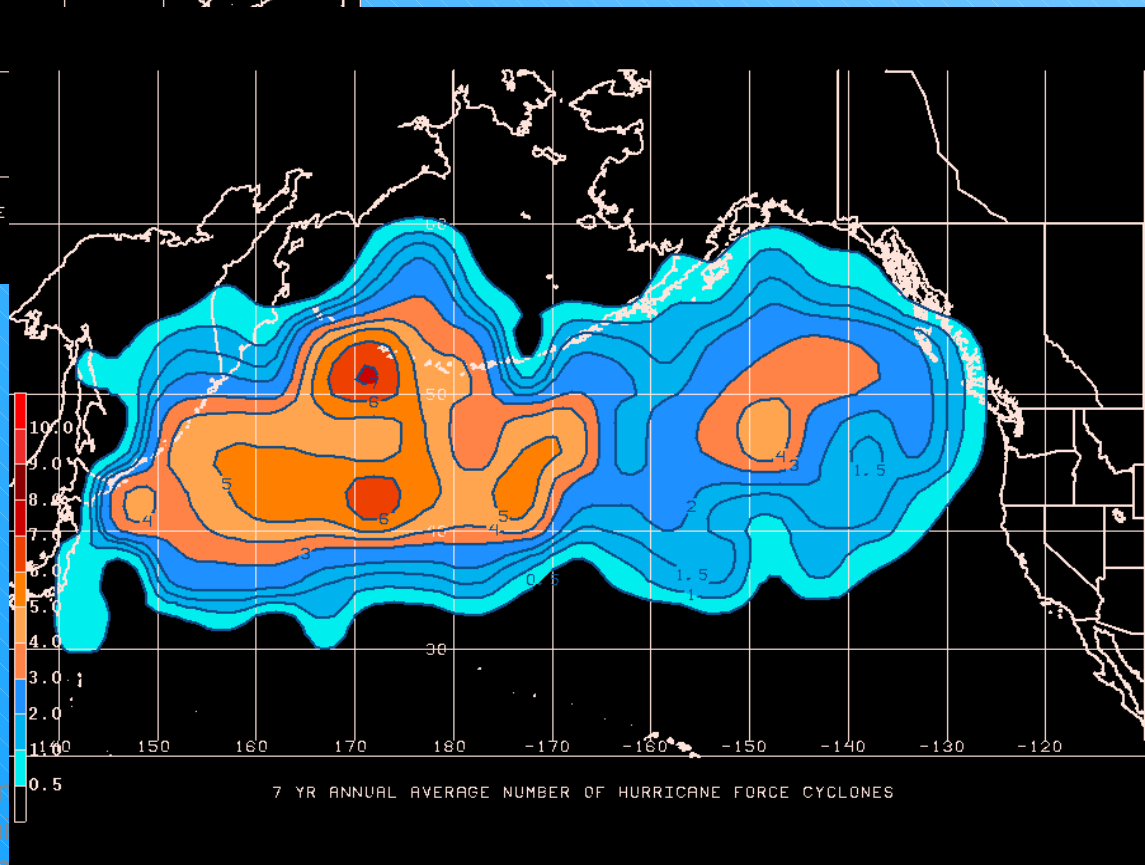
Data Utilized

- 2001-2009
  - 12.5km QuikSCAT science level
  - CCMP
  - ECMWF analysis
  - OPC North Pacific and North Atlantic Cyclone best track Database

Storm ID	Date	Lat	Lon	Press.	Type
PAC011007	2007100712	43.93	-169.72	1013	L
PAC011007	2007100718	43.23	-164.06	1010	G
PAC011008	2007100800	42.37	-158.38	1010	G
PAC011008	2007100806	41.33	-152.07	1007	G
PAC011008	2007100812	39.87	-143.82	998	S
PAC011008	2007100818	40.76	-137.83	974	S
PAC011009	2007100900	43.15	-134.94	970	H
PAC011009	2007100906	44.46	-134.08	964	H
PAC011009	2007100912	46.45	-132.94	966	H
PAC011009	2007100918	47.51	-132.81	968	H
PAC011010	2007101000	48.00	-132.36	967	S
PAC011010	2007101006	50.65	-132.3	964	S
PAC011010	2007101012	52.17	-132.36	975	G
PAC011010	2007101018	53.67	-131.68	977	G



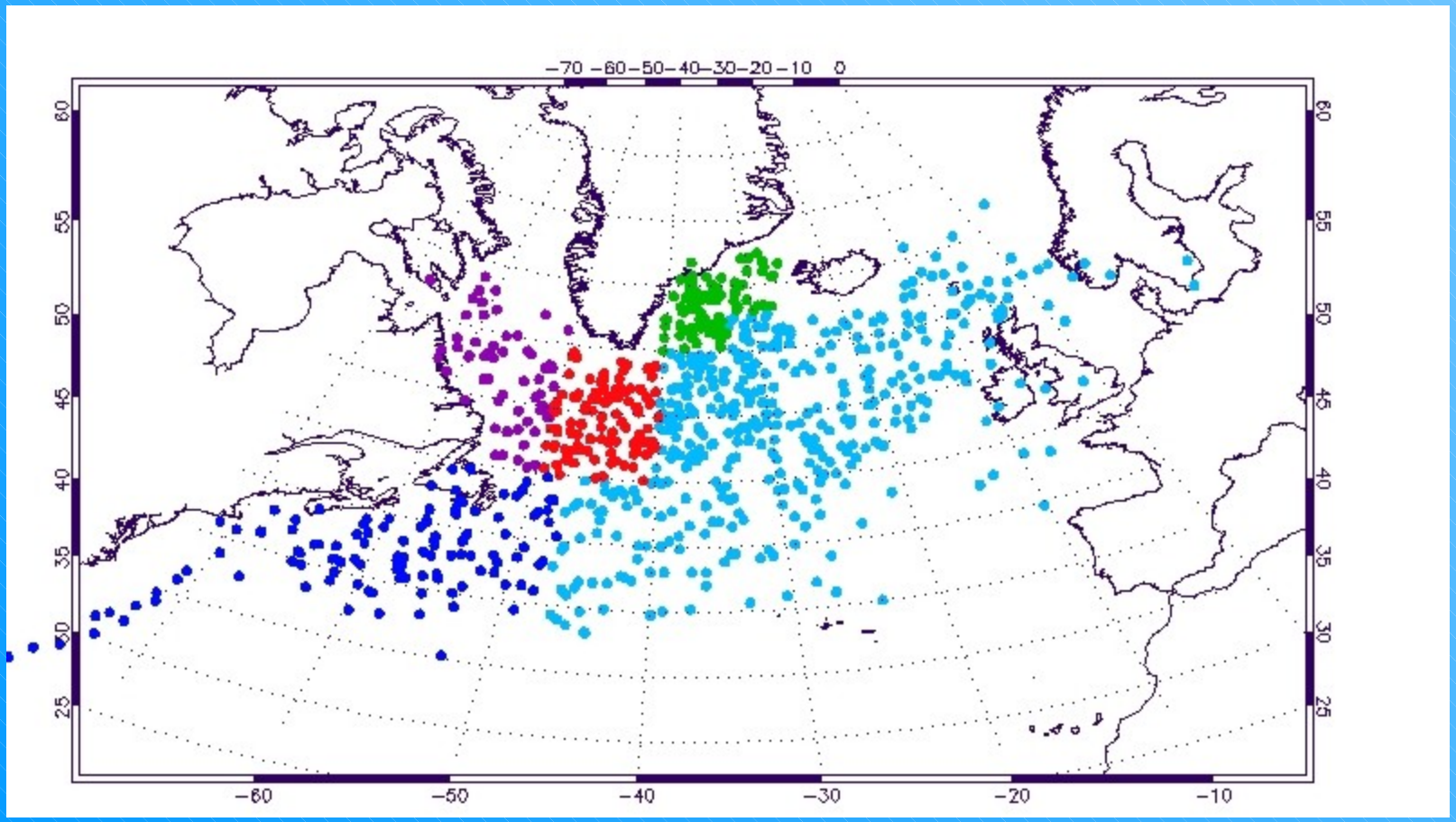




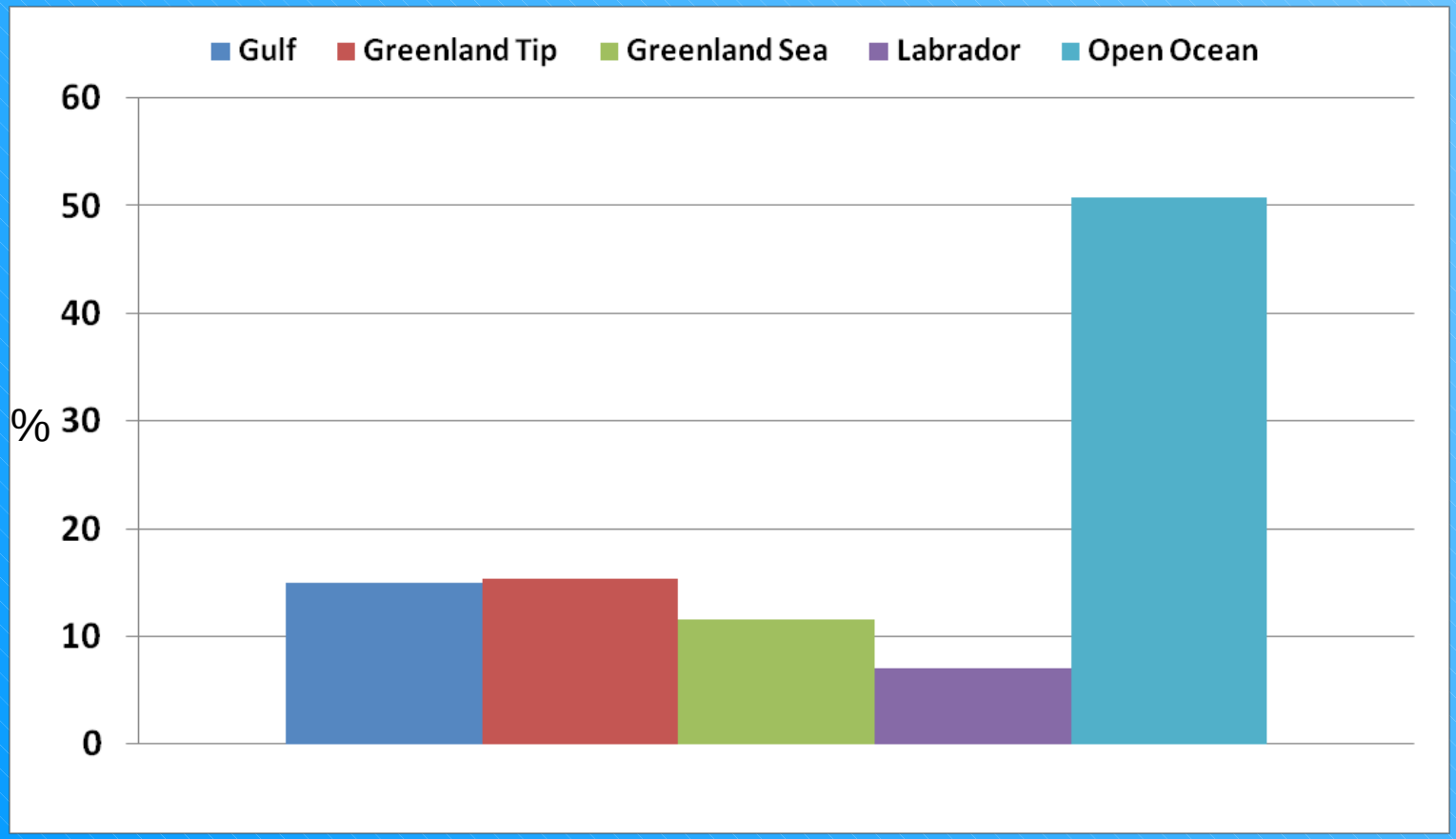
7 yr average number of extratropical cyclones observed (contoured) with hurricane force winds for the years 2001 - 2008

North Atlantic Cyclones Region

- Open ocean
- Gulf stream
- Tip of Greenland
- Greenland Sea
- Labrador Sea



Percentage of HF cycles within North Atlantic Cyclone Regions

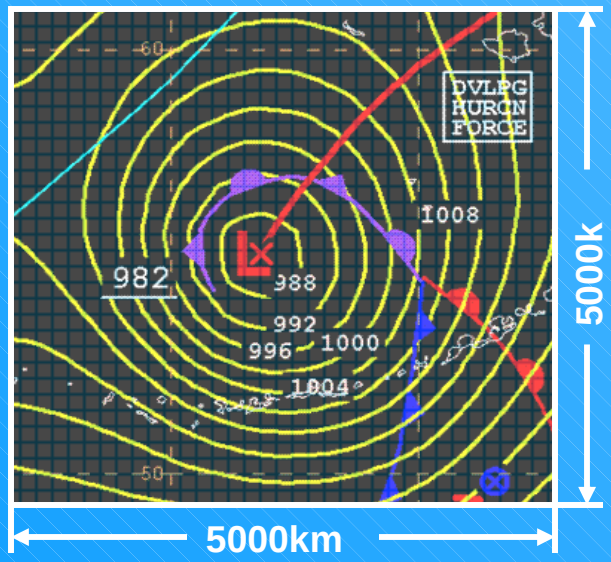


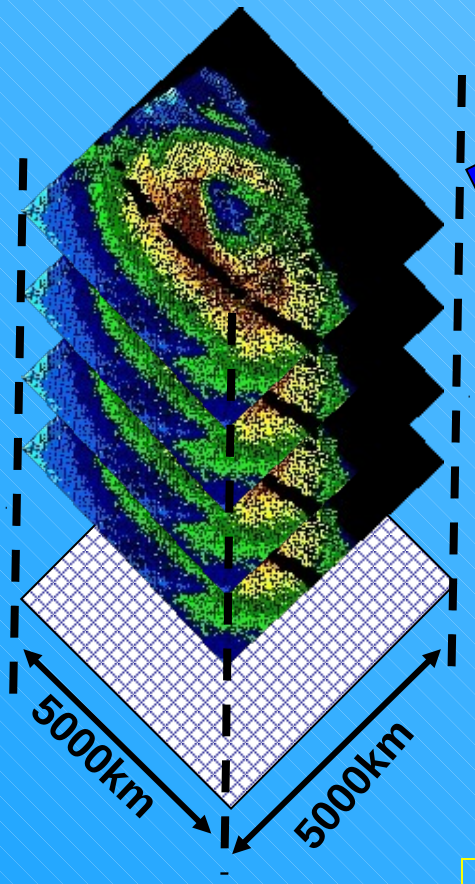
Storm track file

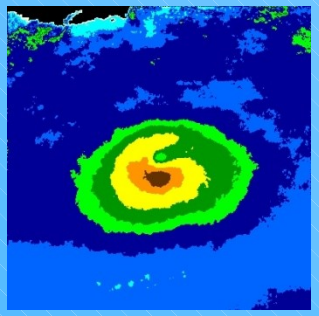
Read HF Cyclone Info.

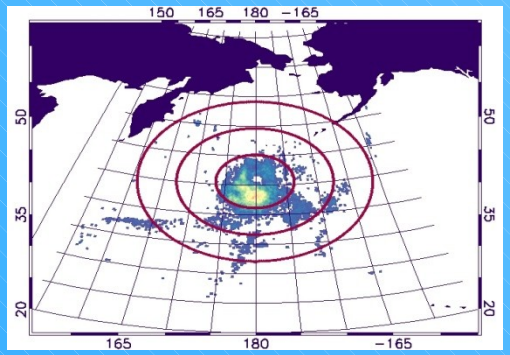
Extract Science SCAT Data
&
Perform QC
(land, ice, coast, rain) flags

Generate Mean Wind Fields

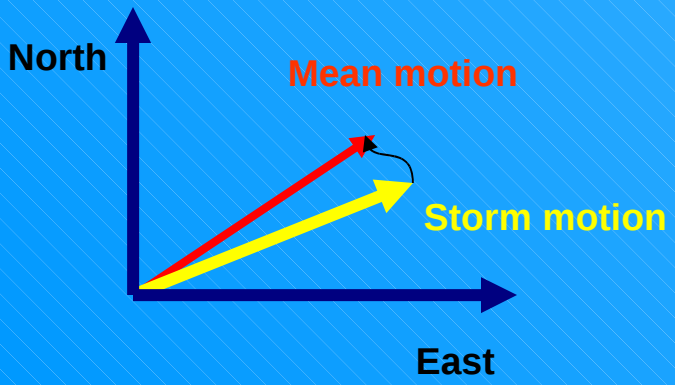






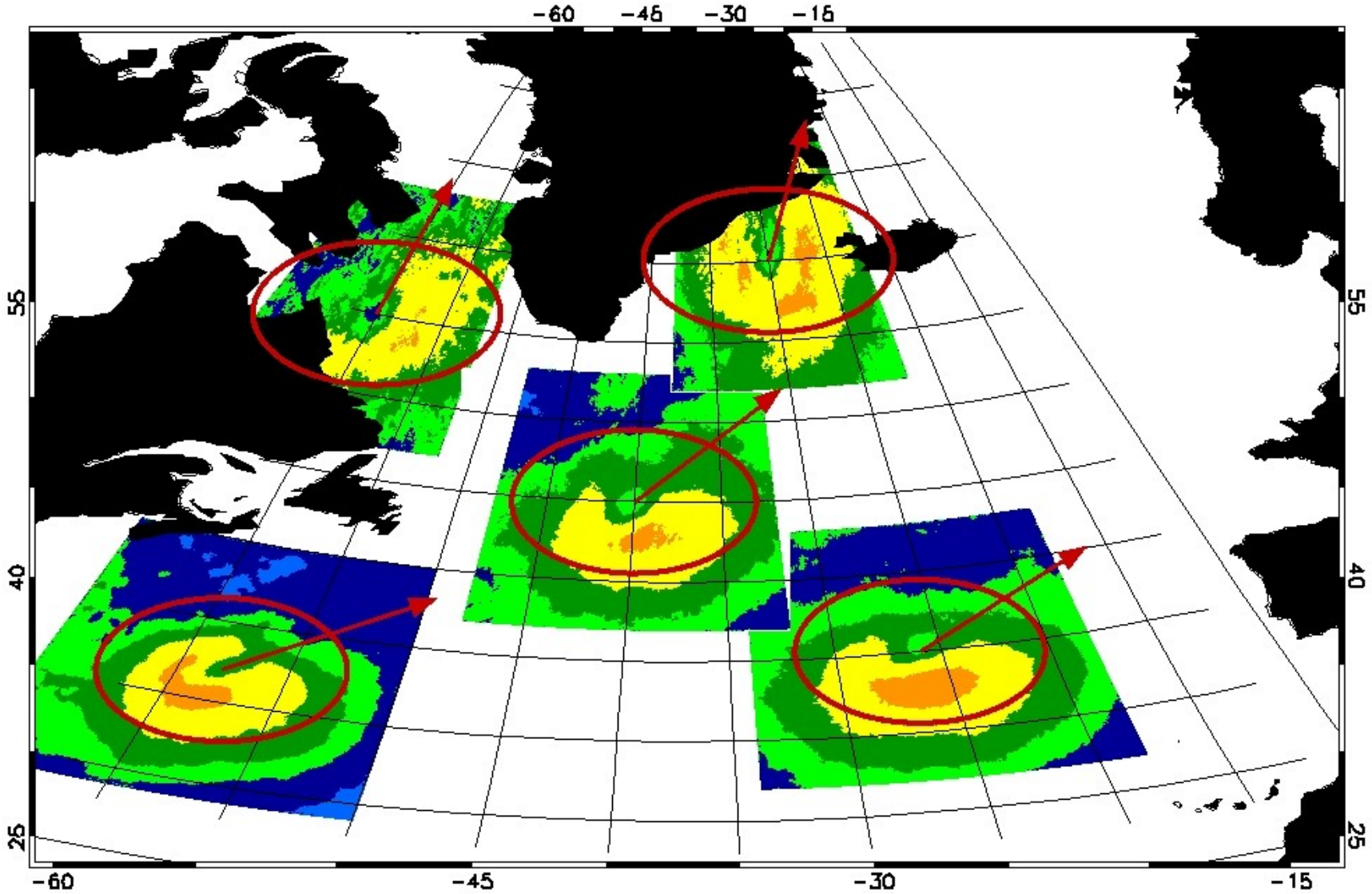


Estimate speed & Angle
(Heading Vector)

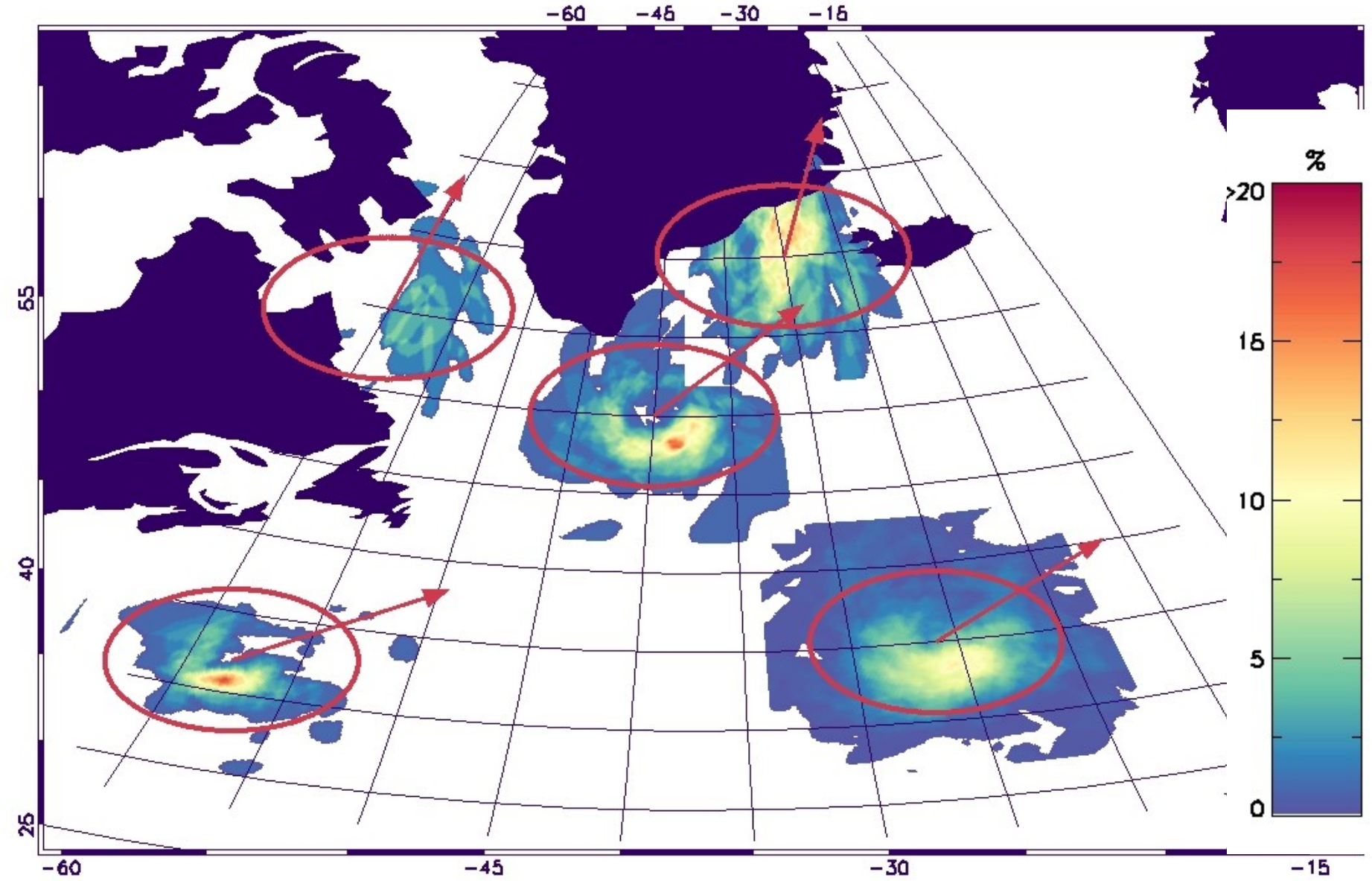


Generate Frequency of HF Occurrence per grid cell

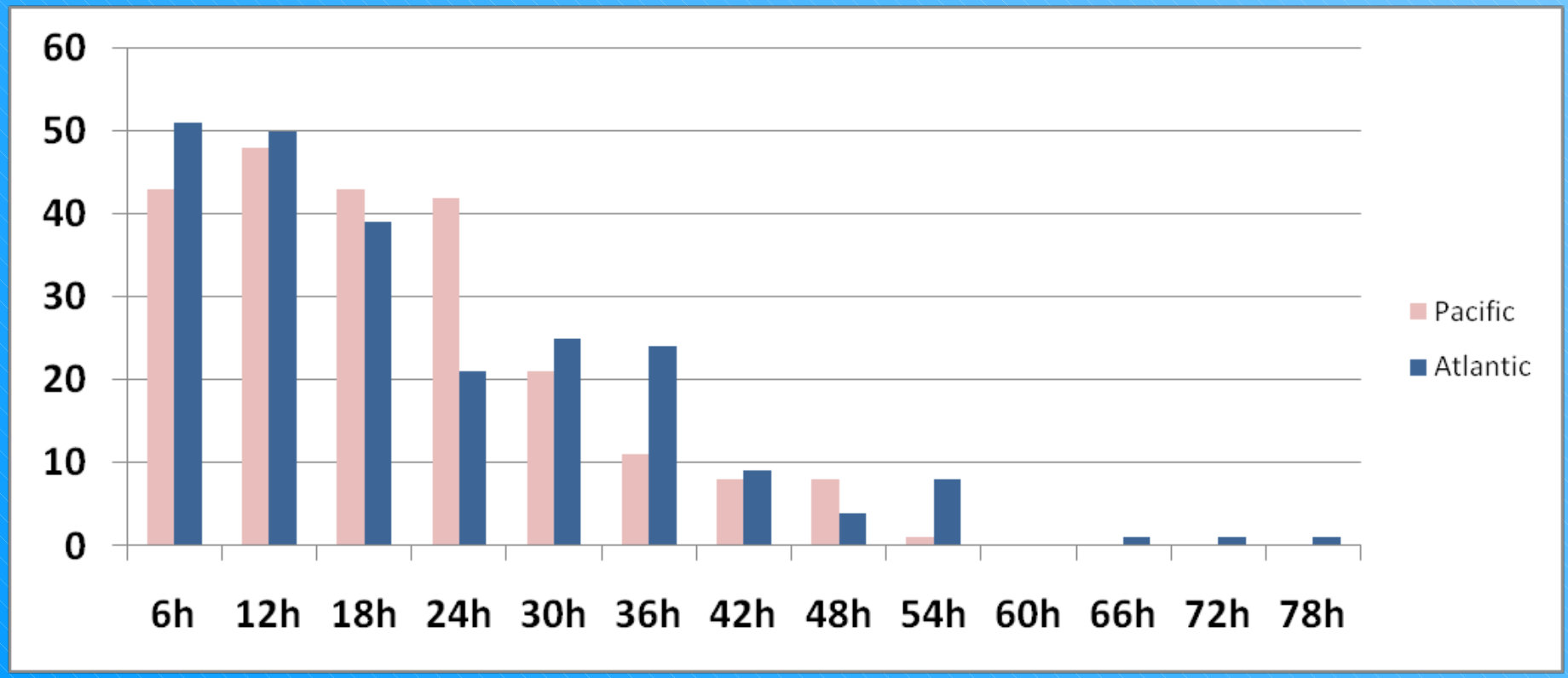
QuikSCAT



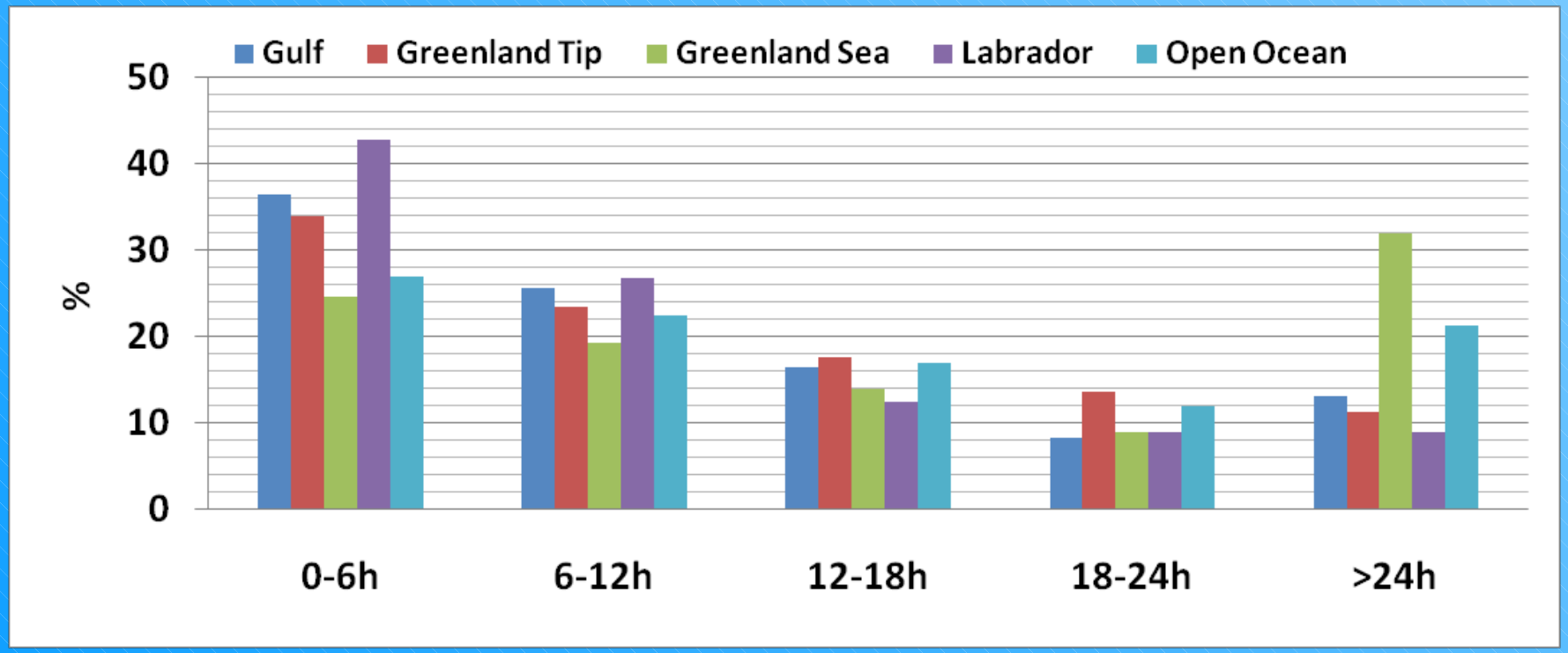
CCMP



Longevity of North Atlantic and North Pacific Cyclones

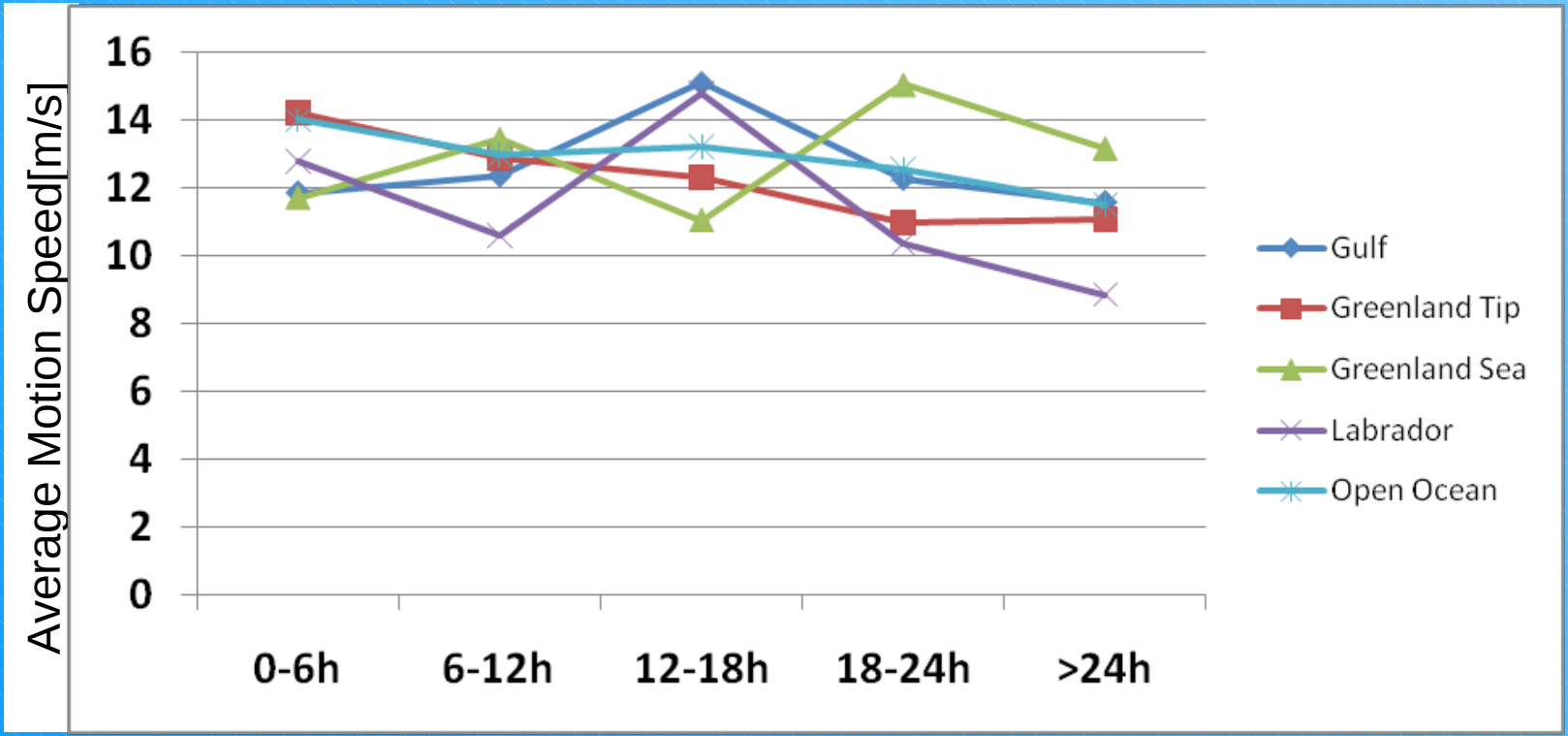


6h HF Cycles per N Atlantic Cyclone Regions



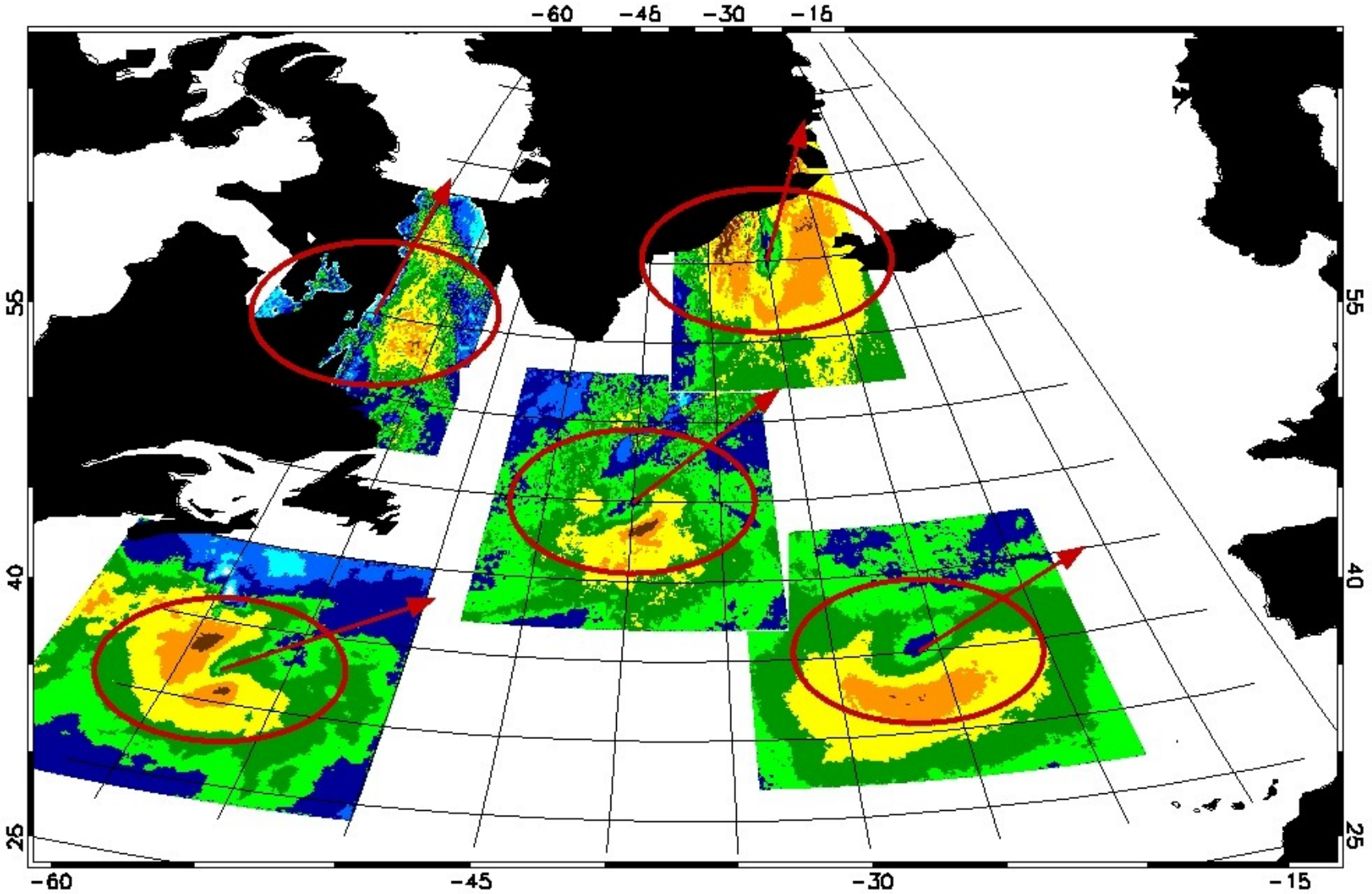
- In general extratropical cyclones are short lived cyclones. 31% of HF stages last only 6h
- 30% of cyclones in Greenland Sea and 25% of cyclones in open ocean live 24h or longer
- Labrador sea cyclones are shortest lived.

Average Cyclone Motion Speed During HF Cycles

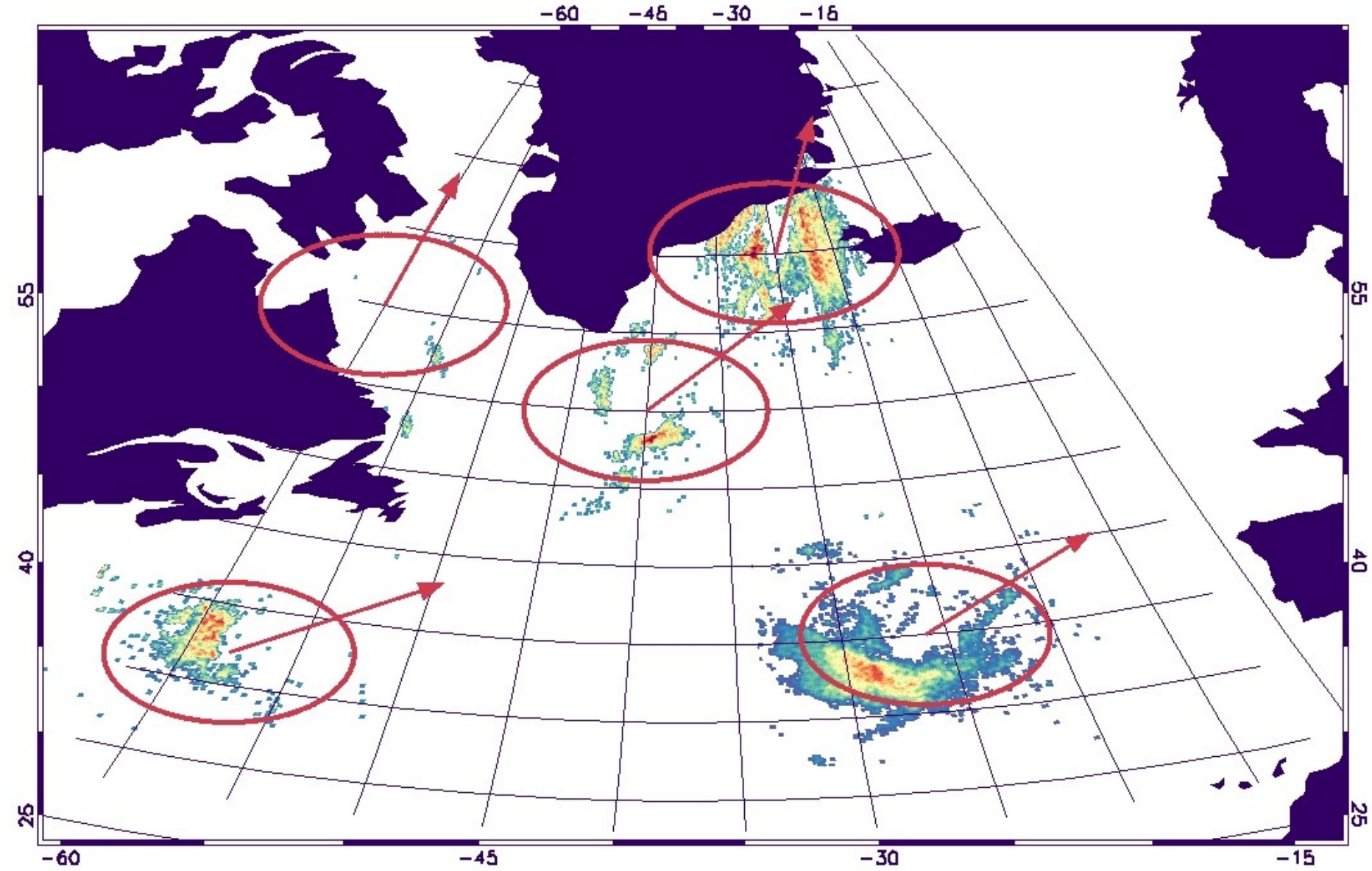


- In general cyclones slow down during HF stages however
  - As time progresses motion of Labrador cyclones reduces 31%
  - Between 12-24h stages Greenland sea cyclones speed up 2-4m/s

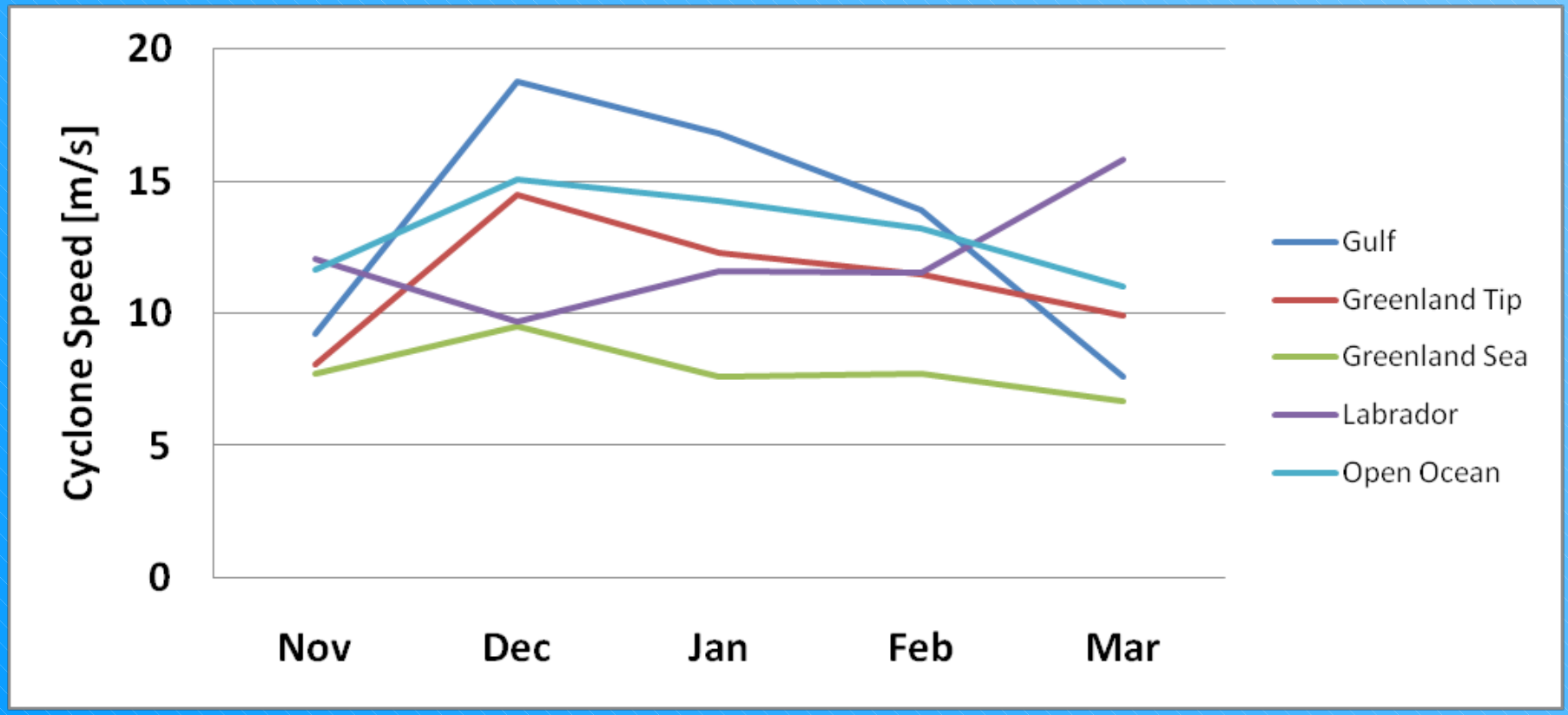
>24h



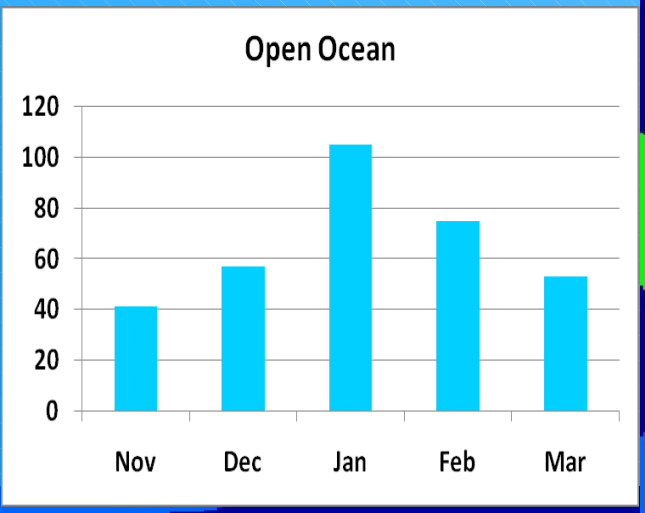
>24h

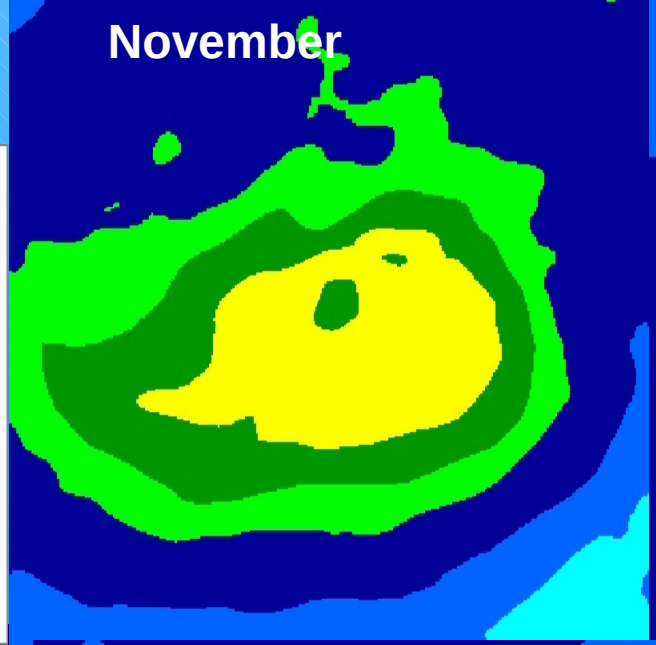


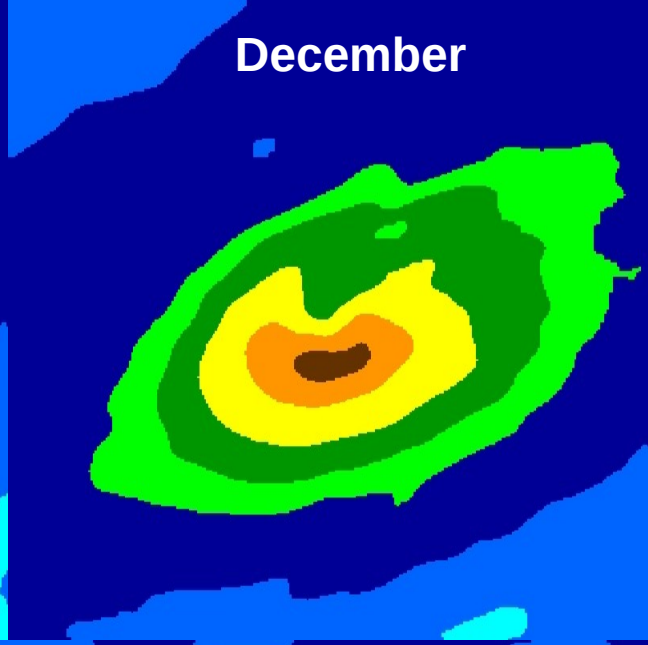
Changes in Cyclone Speed During Winter Season Months

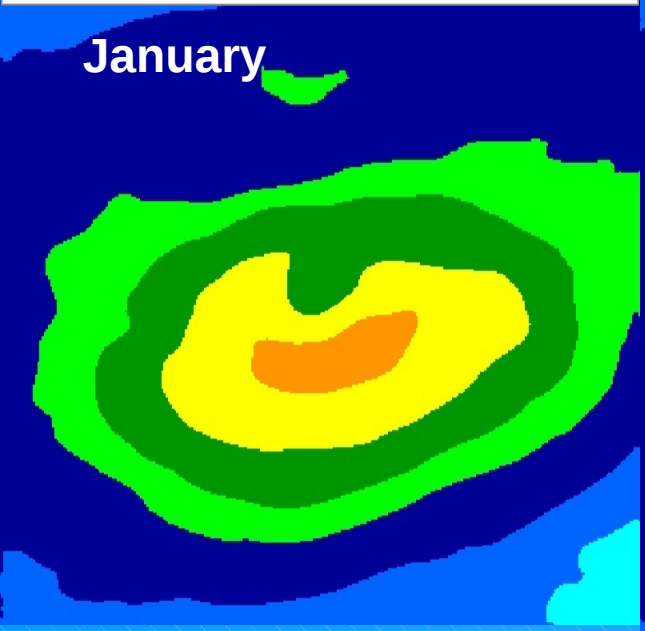


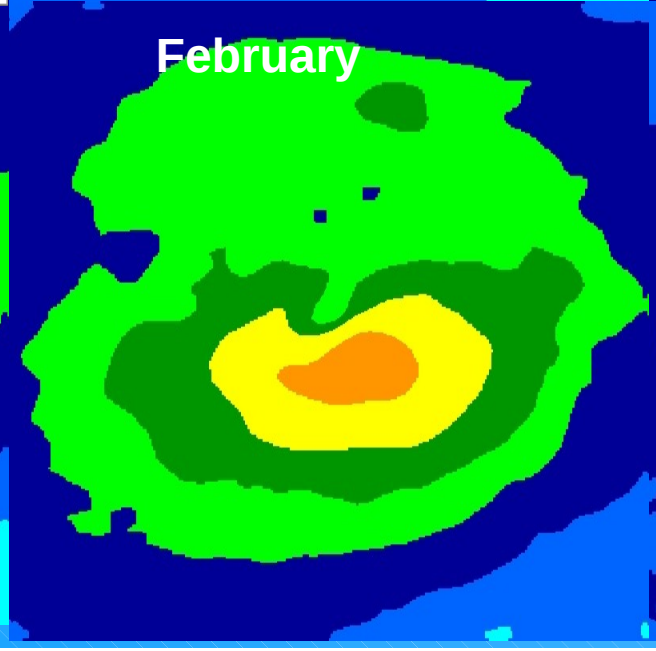
CCMP Open Ocean – N Atlantic

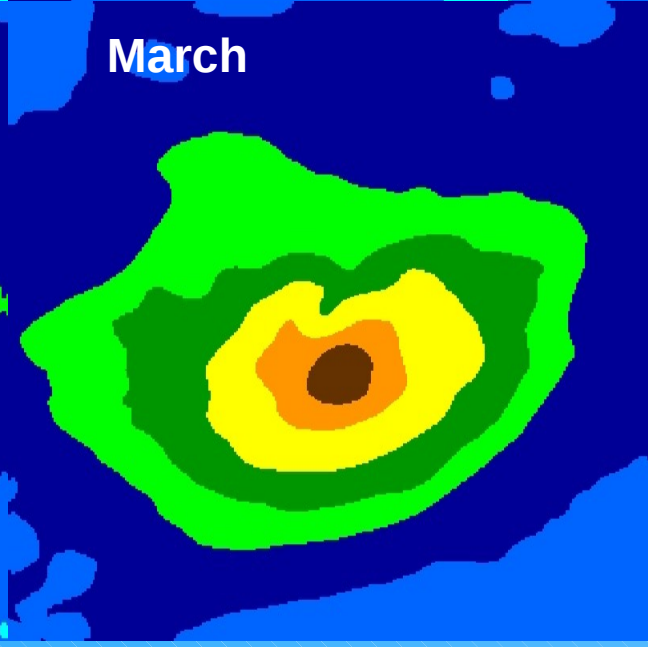




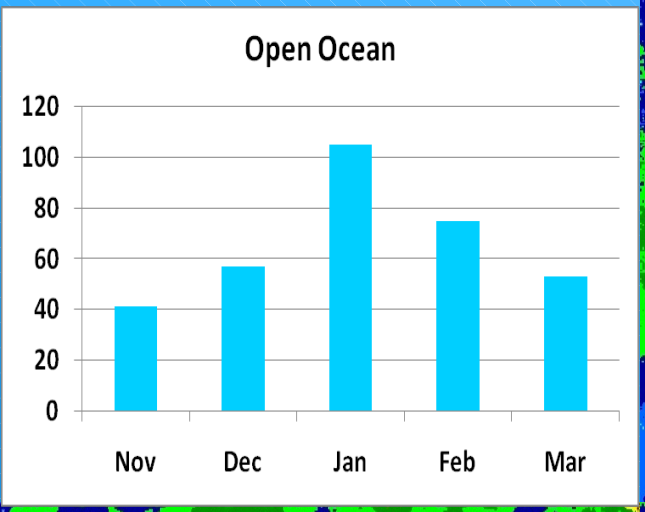


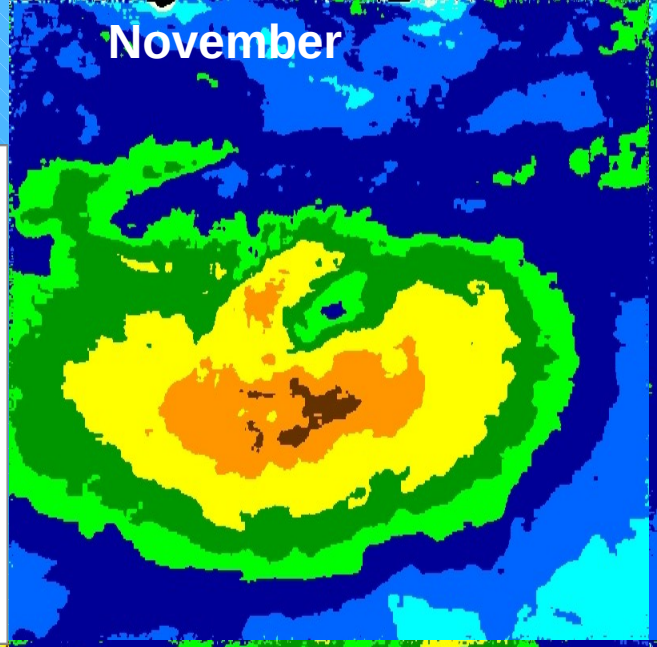


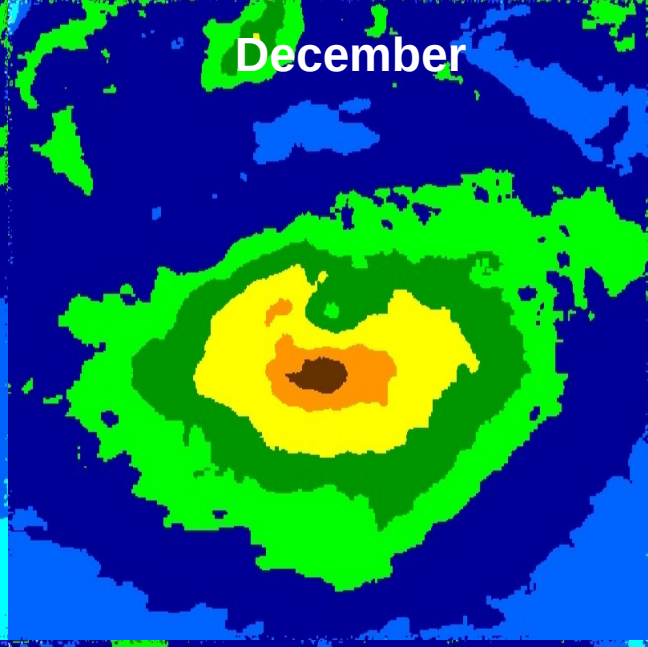


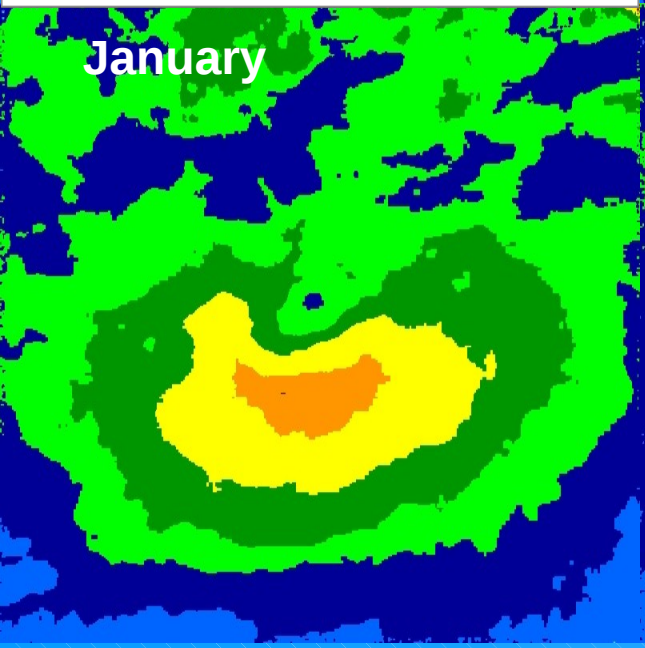


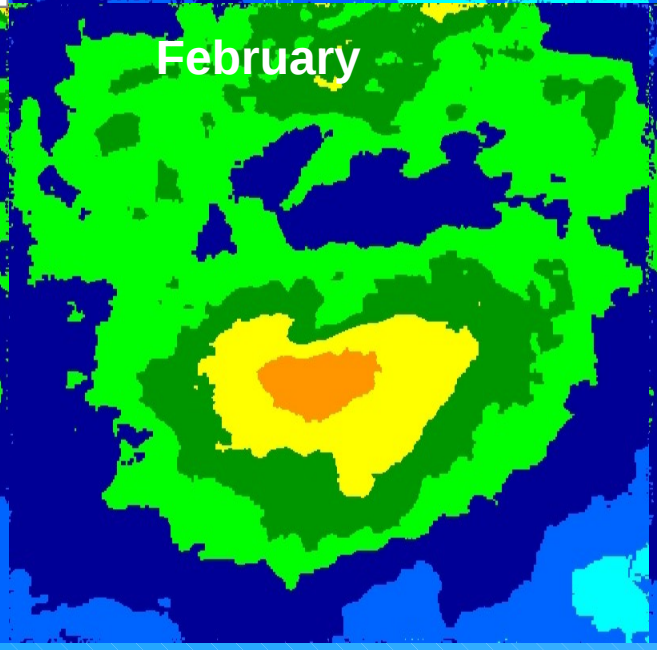
QuikSCAT Open Ocean – N Atlantic

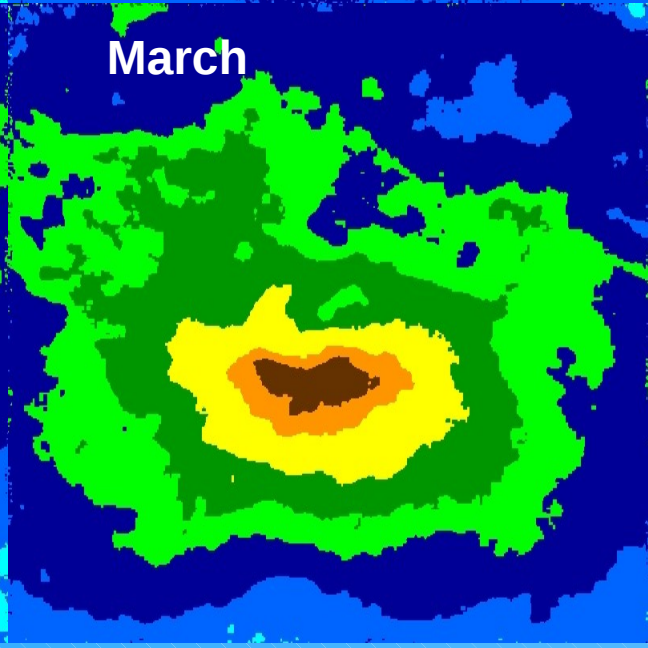




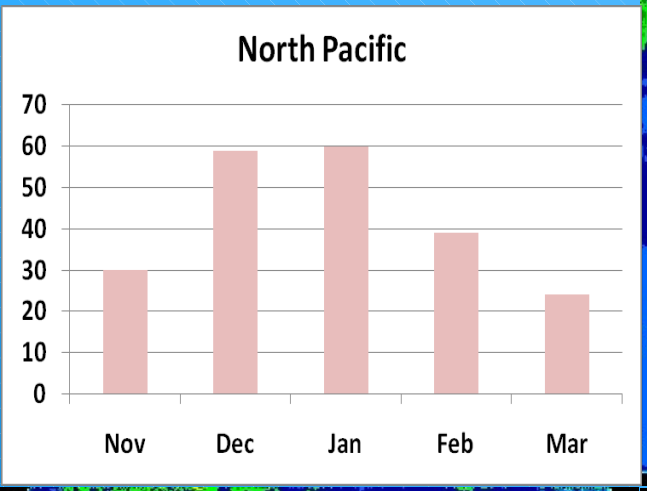


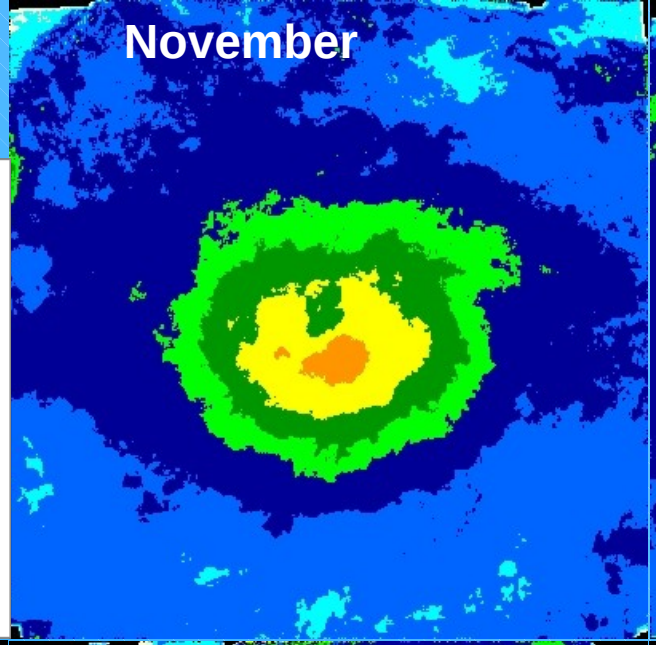


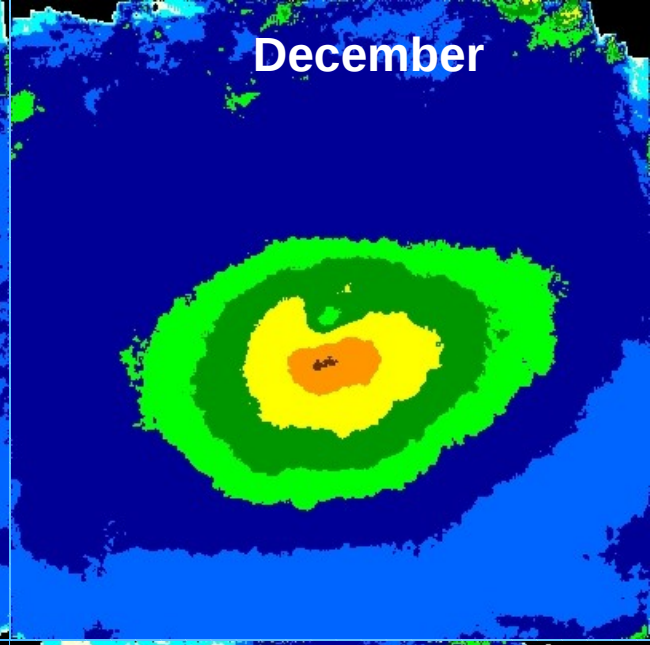


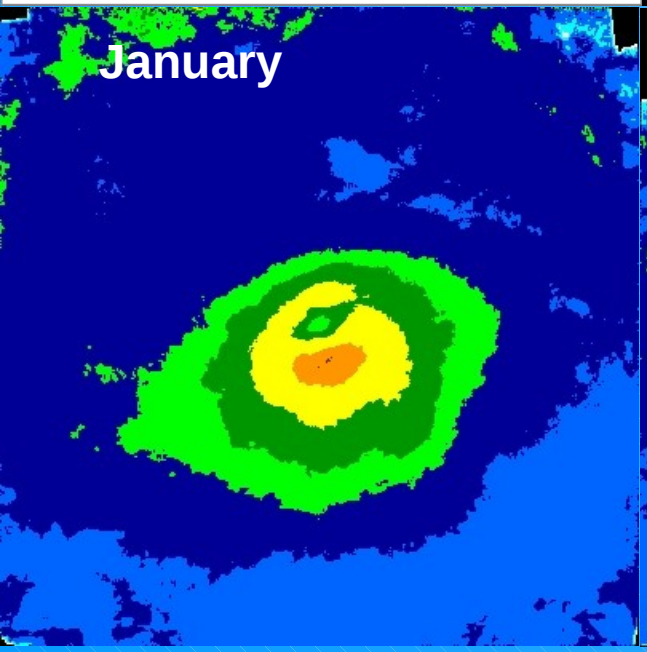


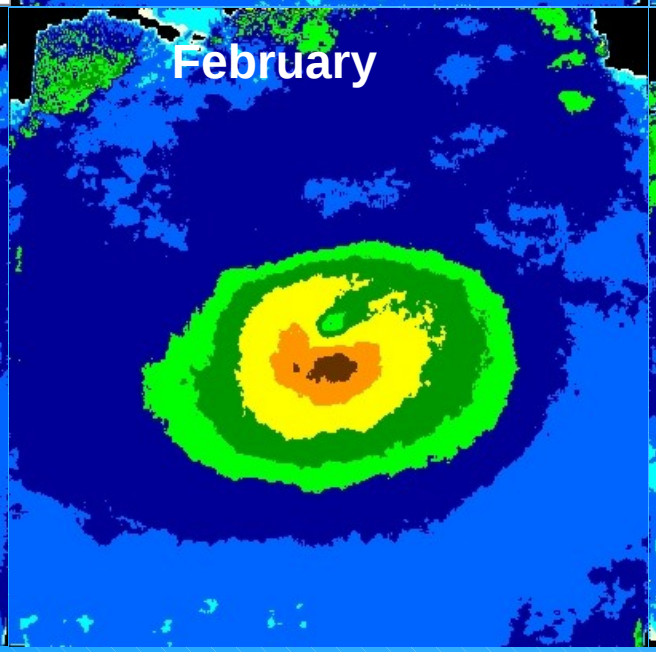
QuikSCAT Open Ocean – N Pacific

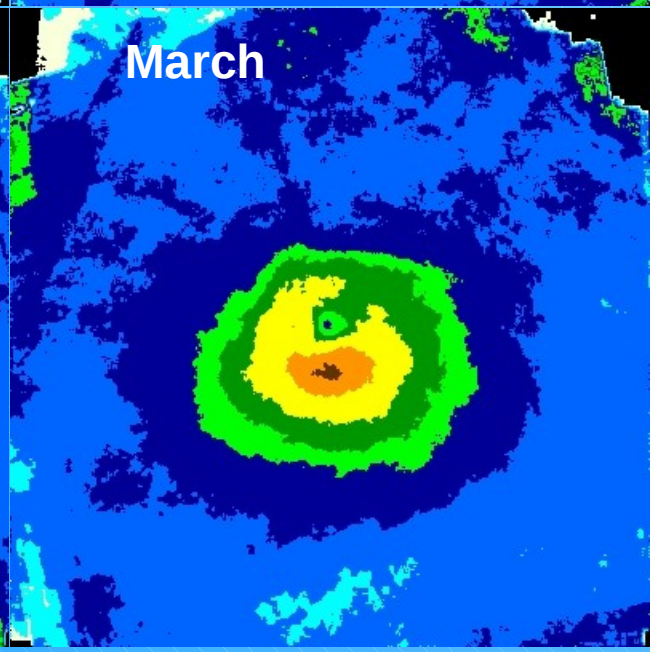


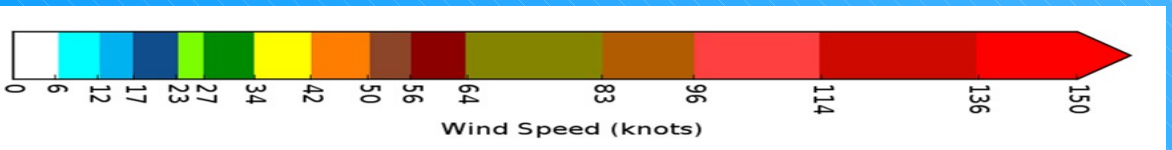




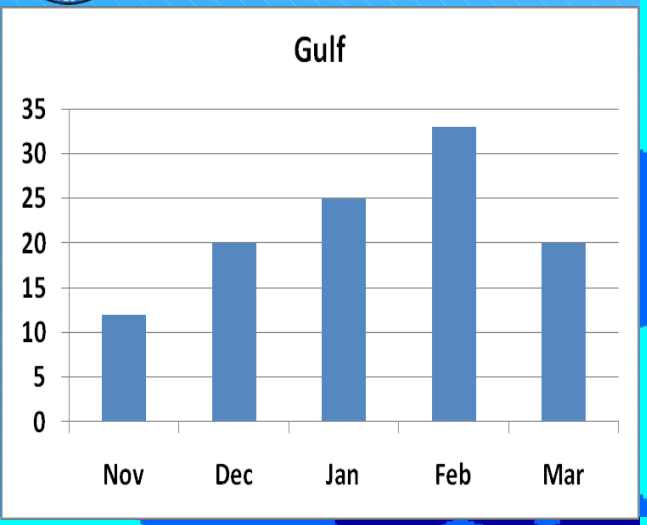


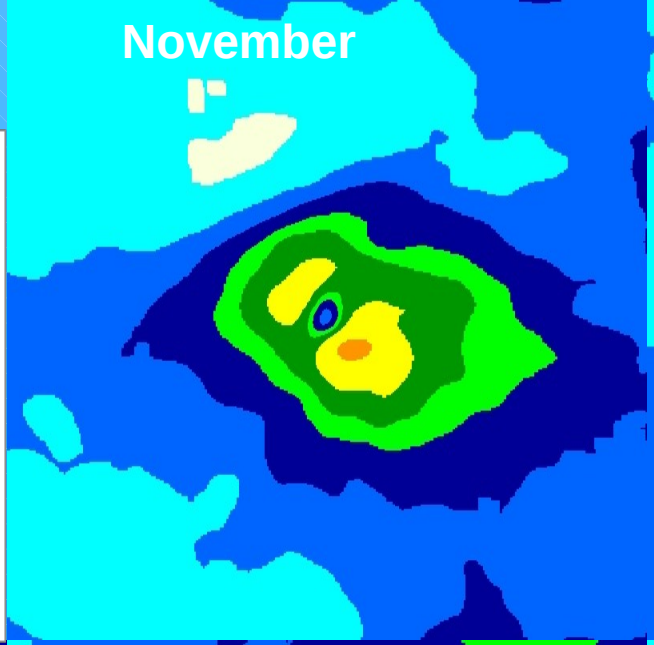


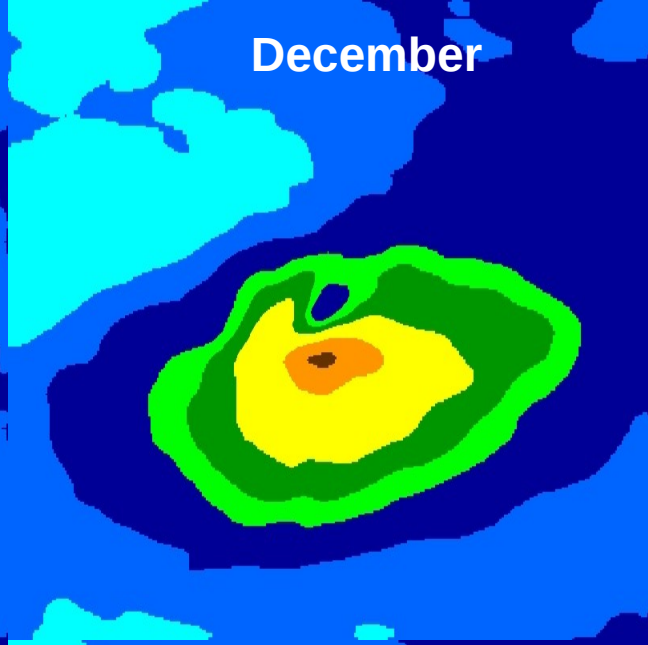


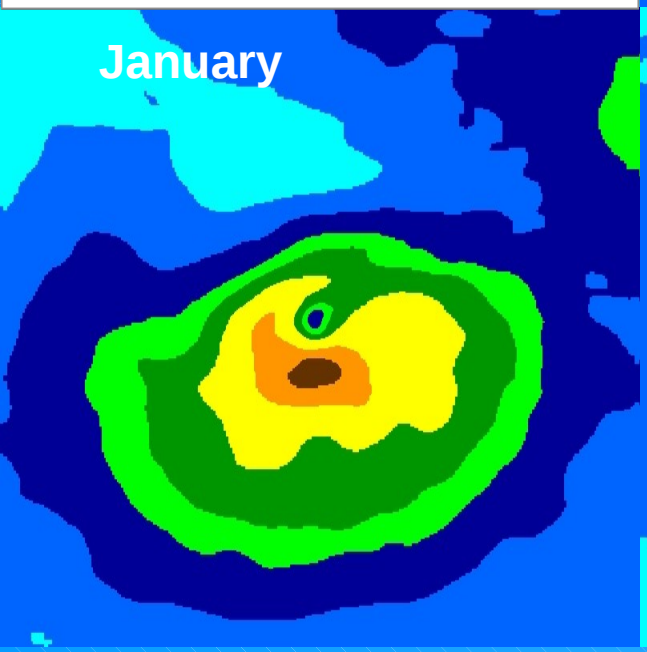


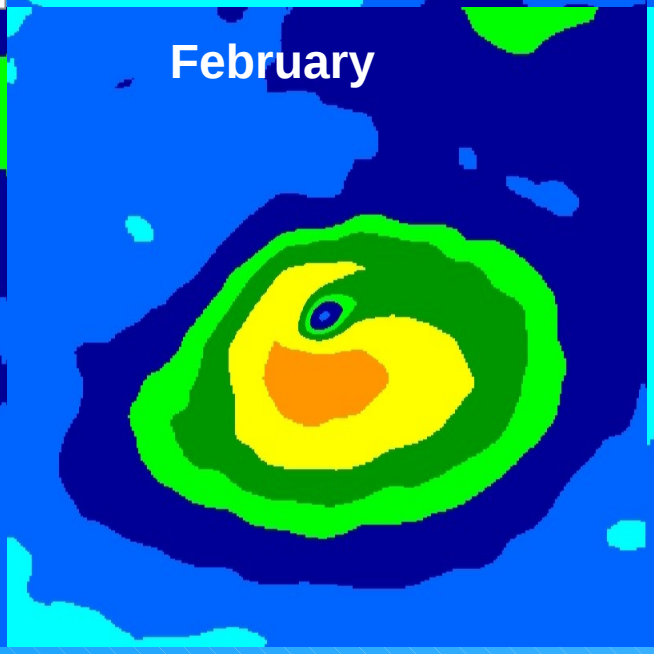
CCMP - Gulf Stream

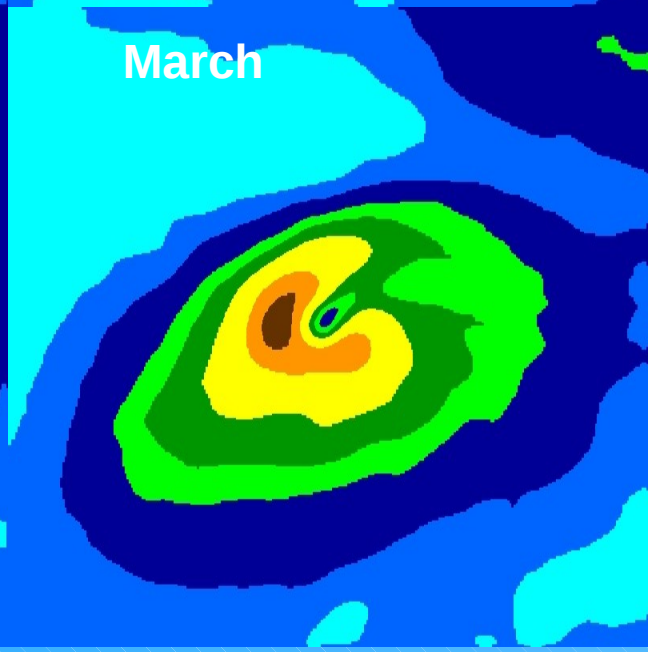




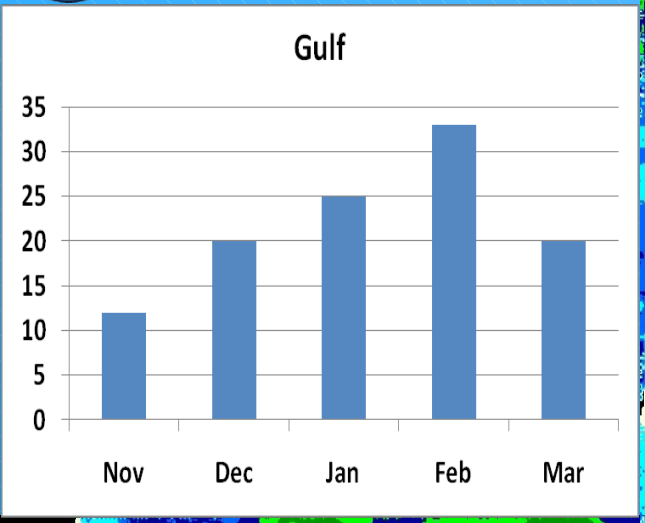


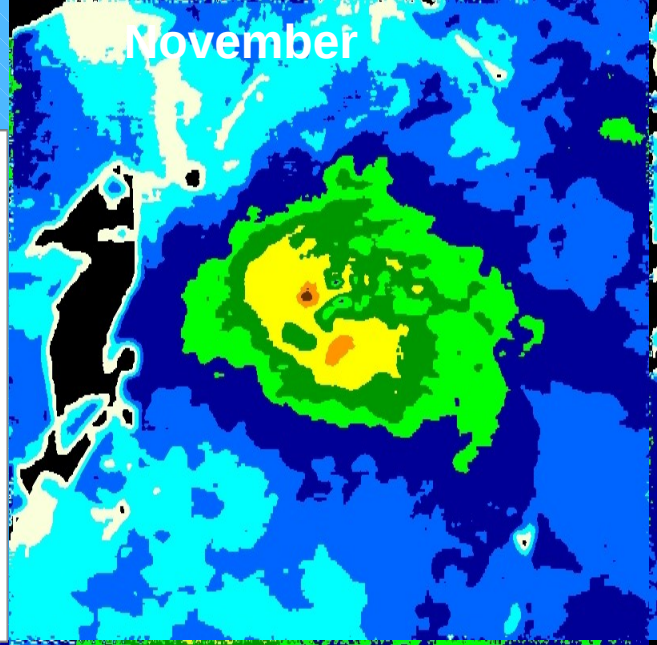


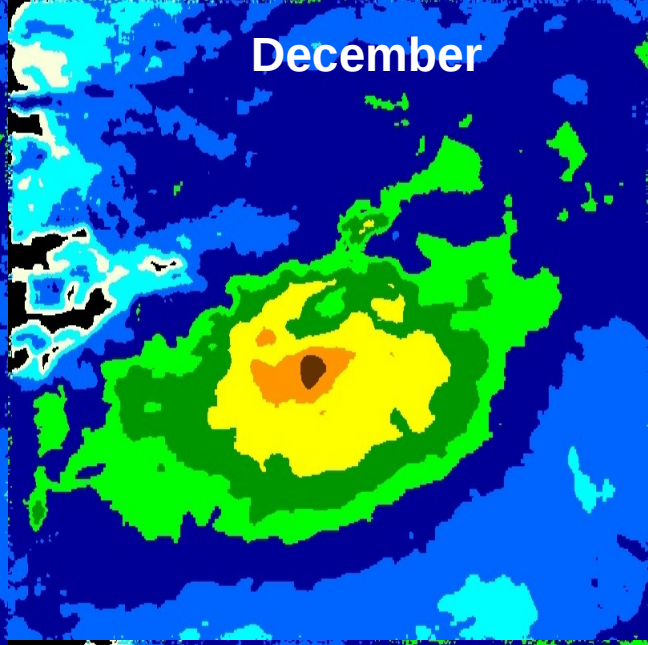


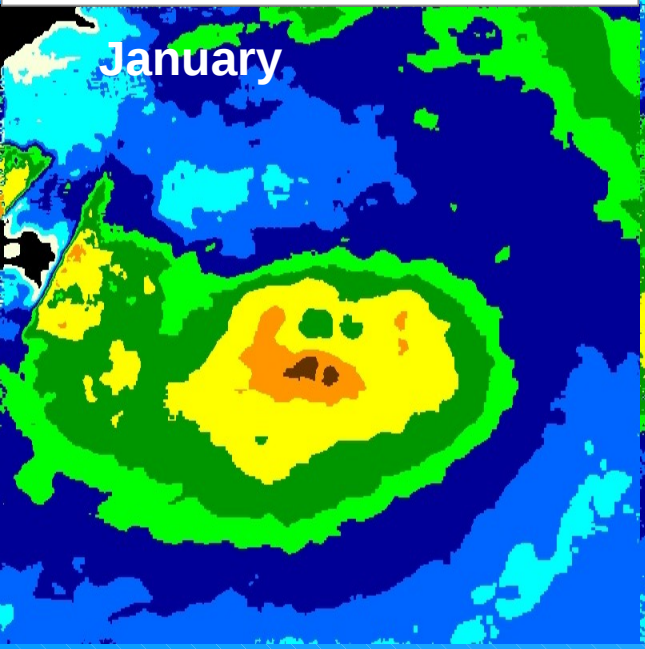


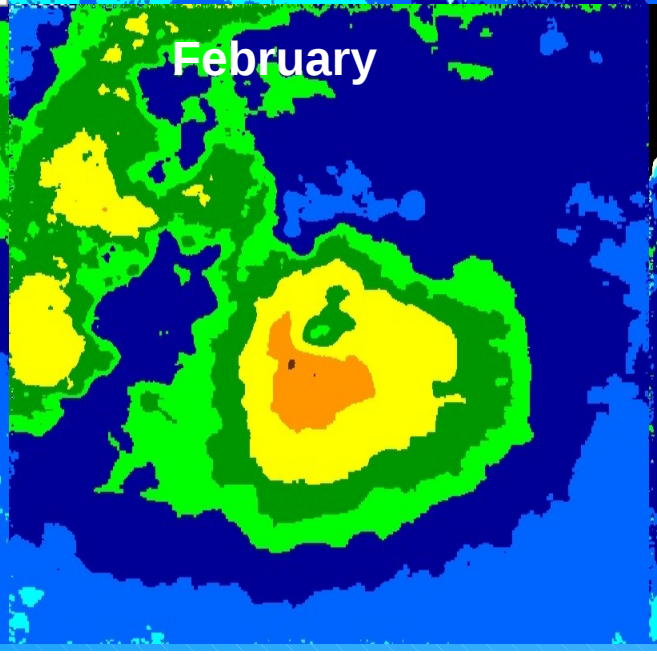
QuikSCAT – Gulf Stream

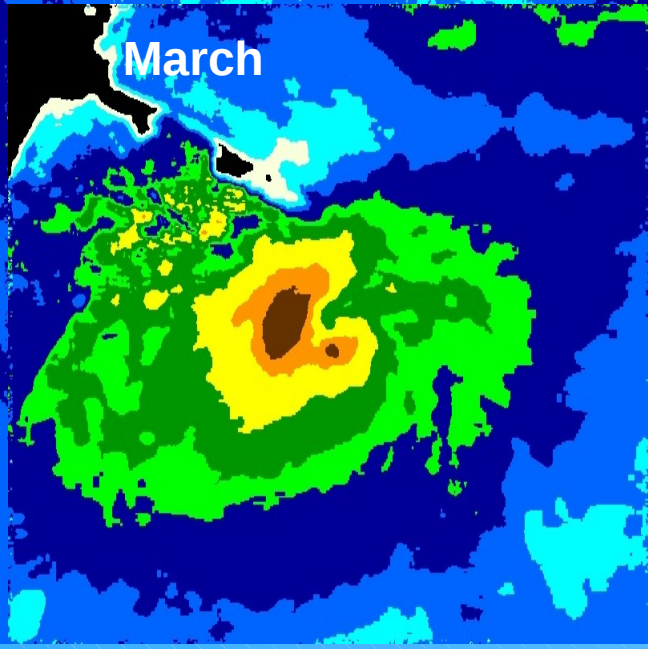












Conclusions

- North Atlantic cyclones:
  - Longest lived in Greenland Sea
  - Largest wind field in cyclones that stay over open ocean
  - Fastest moving cyclones in period between December and February are Gulf stream cyclones
- Problems with CCMP winds in Greenland Sea?
- QuikSCAT winds somewhat higher than CCMP
  - QuikSCAT data processed with JPL 2006 model function that probably overestimates high wind
  - Overall agreement between CCMP and QuikSCAT wind field in open ocean and Gulf stream cyclones
  - Land impact on cyclones very apparent within Greenland see composites

THANK YOU