Scaling properties of sea ice deformation during winter and summer

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Abstract

We investigate sea ice deformation observed with ice drifting buoy arrays deployed in the western Beaufort Sea during November 2004 to February 2005, including a smaller, smaller-scale (20 km) array deployed in the eastern Beaufort Sea. The ISPOL and SEDNA arrays, and larger arrays were deployed by the Canadian Space Agency, and analysis performed by M. Thomas, Wavelet software was provided by C. Torrence and G. Compo, and is available by the Australian Government's Cooperative Research Centre Program (ARC). Many thanks to Christian Haas and Jouko Launiainen who provided access to APLIS07, supporting camp construction. Many thanks used throughout this poster to identify data from particular buoy arrays.

Three ways of looking at spatial scaling

1. Is there a decorrelation length scale?

We calculate the correlation coefficient between divergence at 20 km and 140 km within the ISPOL and SEDNA arrays revealed that deformation did not correlate well over length scales of 20 km or 140 km. This indicates variability in deformation over those length scales is not consistent. Within the ISPOL array, divergence was more coherent on 20 km and 140 km scales, with the correlation reducing as the scale progressed towards the larger.

2. Is there a relationship between spatial scale and deformation magnitude?

We demonstrate that the deformation at all three scales is important in the overall behavior of sea ice. Which has important implications for the design of sea ice deformation monitoring systems.

3. Is there temporal evolution in coherence between large and small arrays?

We consider the correlation of divergence time series between a large buoy array and smaller arrays embedded inside the larger array. As M04 we find an inverse relationship between deformation magnitude and scale, within the ISPOL and SEDNA arrays, and smaller arrays embedded inside the larger array. This has important implications for the design of sea ice deformation monitoring systems.

ISPOL: Austral Summer, Weddell Sea

SEDNA: Boreal Winter, Beaufort Sea

Case Study of lead impact on ice mass balance

Beaufort Sea

We conducted a time series from March 26 to April 12, 2007, when all the DMSO buoys were deployed. The time series is estimated to be consistent over larger distances than a buoy later radar time (year).

Two ways of looking at spatial scaling

Can small scale deformation be predicted given larger scale measurements?

We consider the correlation of divergence time series between a large buoy array and smaller arrays embedded inside the larger array. The 40 km triangle contains 11 smaller 20 km triangles. The 40 km triangle contains 11 smaller 20 km triangles. This shows that deformation at the small scale can be predicted given the larger scale measurements.

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Summary and Initial Conclusions

Can small scale deformation be predicted given larger scale measurements?

In our investigations of correlation between divergence of smaller buoy arrays and larger arrays we found that correlation is not consistent. We found that correlation is not consistent.

Is there a decorrelation length scale for deformation?

The decorrelation length scale for deformation is larger than the ISPOL array.

Is there a relationship between spatial scale and deformation magnitude?

As ISPOL we find an inverse relationship between deformation magnitude and scale. This is consistent with the larger scale observations.

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