

The mechanism of the high wave “Yorimawari-Nami” on February 24th 2008

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2. Introduction (Yorimawari-Nami)

Yorimawari-Nami: A swell which generated in the northern part of the Japan Sea and propagated toward the Toyama Bay.

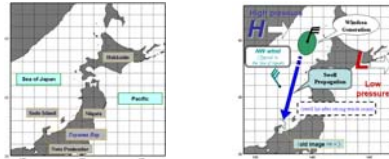


Fig. 1 The map of the northern part of Japan (left) and the schematic image of Yorimawari-Nami (right).

1. Weather and wave condition

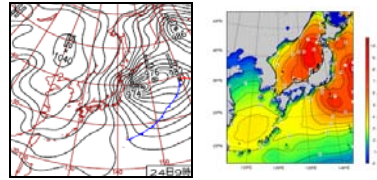


Fig.2 (a) surface analysis chart and (b) wave chart (00UTC 24th Feb.)



Fig. 3 Maximum Significant Waves observed and photos.

High waves were observed in almost whole the coast in the Sea of Japan. Wave heights of more than 6m were observed at many stations. At Toyama quite high wave of 9.92m was observed, although at Fushiki-Toyama, which is just next to Toyama, the maximum value was only 4.22m.

3. Numerical method and results

The computational area : 32.5°N - 46.5°N, 126.0°E - 143.0°E.
The grid resolution : 5 minutes (8km).
Initial condition : 12UTC on February 22nd 2008 (static)
Calculation period : 2-day (48hours)

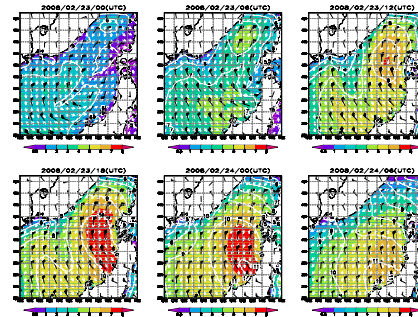


Fig. 4 Simulated wave condition in the Sea of Japan.

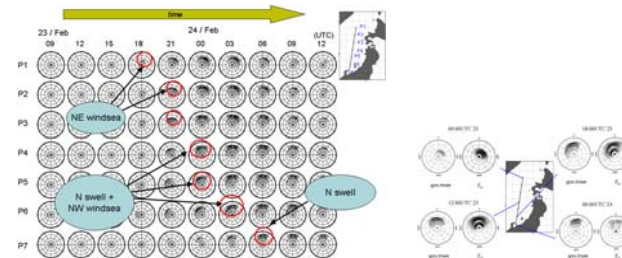


Fig.5 (left) Simulated wave spectrum from 09UTC 23rd to 12UTC 24th, February.

The circles: drawn in every 5 seconds of wave period from the center.
Fig.6 (right) The wave spectra and nonlinear energy values (S_{nl}) along the path of swell propagation.(The shaded areas in S_{nl} : positive transfer)

The swell is intensified by non-linear energy transfer in propagating through the Sea of Japan.

4. Discussion

The non-linear energy transfers when swell and windsea exist simultaneously are calculated.

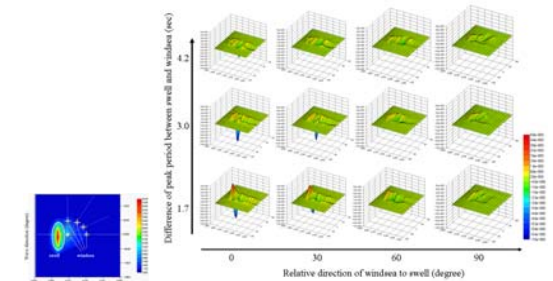


Fig.7(left) test image (The stars: various windsea cases) and (right) Calculated non-linear energy transfer. (The x-axis: the relative angle and the y-axis: the peak-period difference)

The energy flow to low frequency side and 0-direction (swell) by the non-linear energy transfer becomes the largest when swell and windsea almost coincide.

5. Conclusion

1. The main reason of high waves in the central Sea of Japan was the overlap of windseas and swell.
2. Large energy was transferred to swell from windseas which led to extraordinary large swell. The nonlinear effect would be crucial mechanism for this energy flow.
3. That may be the reason why extraordinary large wave of over 9m height and 16sec period was observed at Toyama. (However, this value was influenced by the shallow water effects which we did not consider.)
4. It will be necessary to evaluate the non-linear effects quantitatively for well intensification.