



Near real-time monitoring of the IMS event detection capability

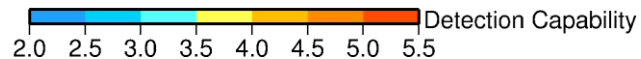
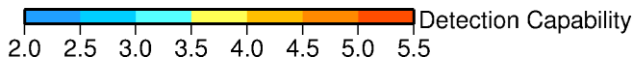
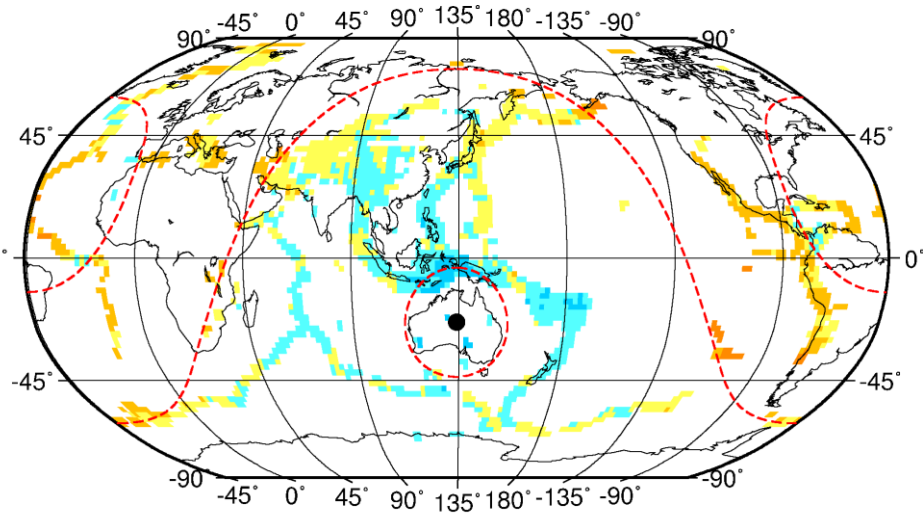
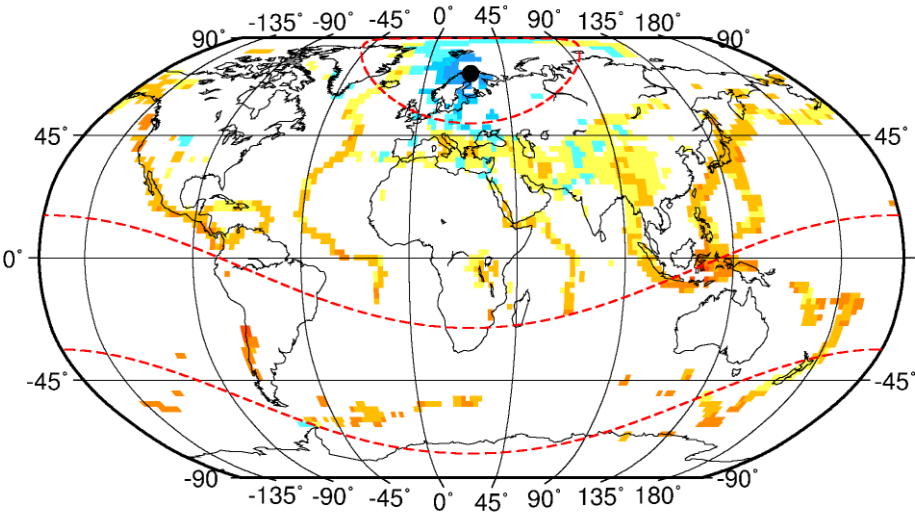
Tormod Kværna

Average detection capability of IMS stations

From analysis of events in the Reviewed Event Bulletin

ARCES

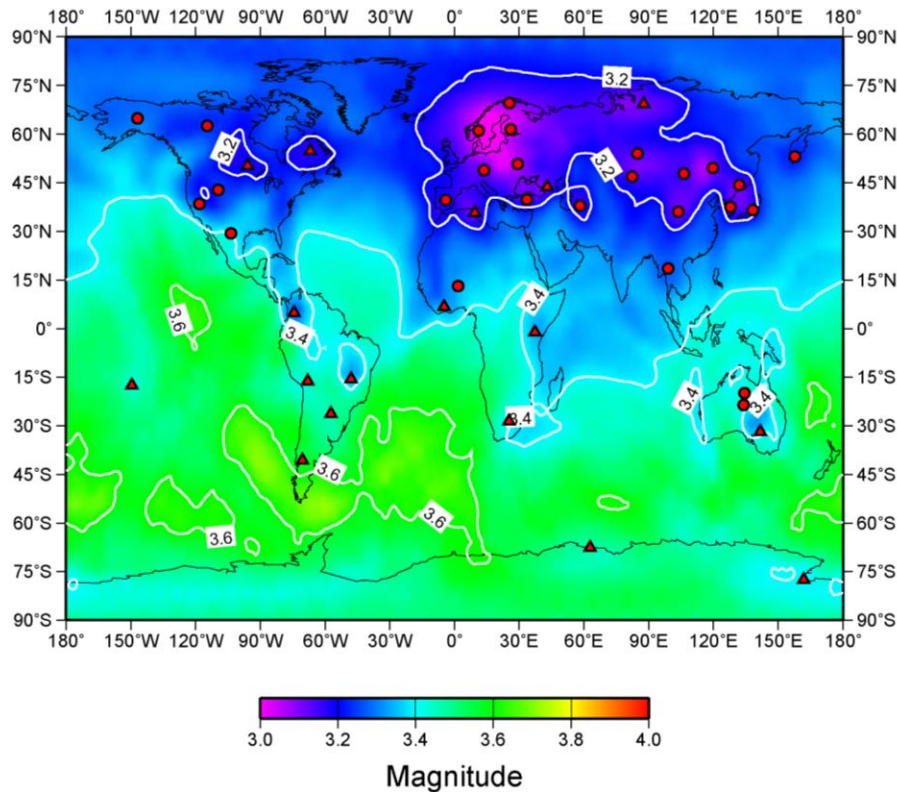
ASAR



Detection capability of the IMS Primary Seismic Network

90% probability of detection at 3 or more stations

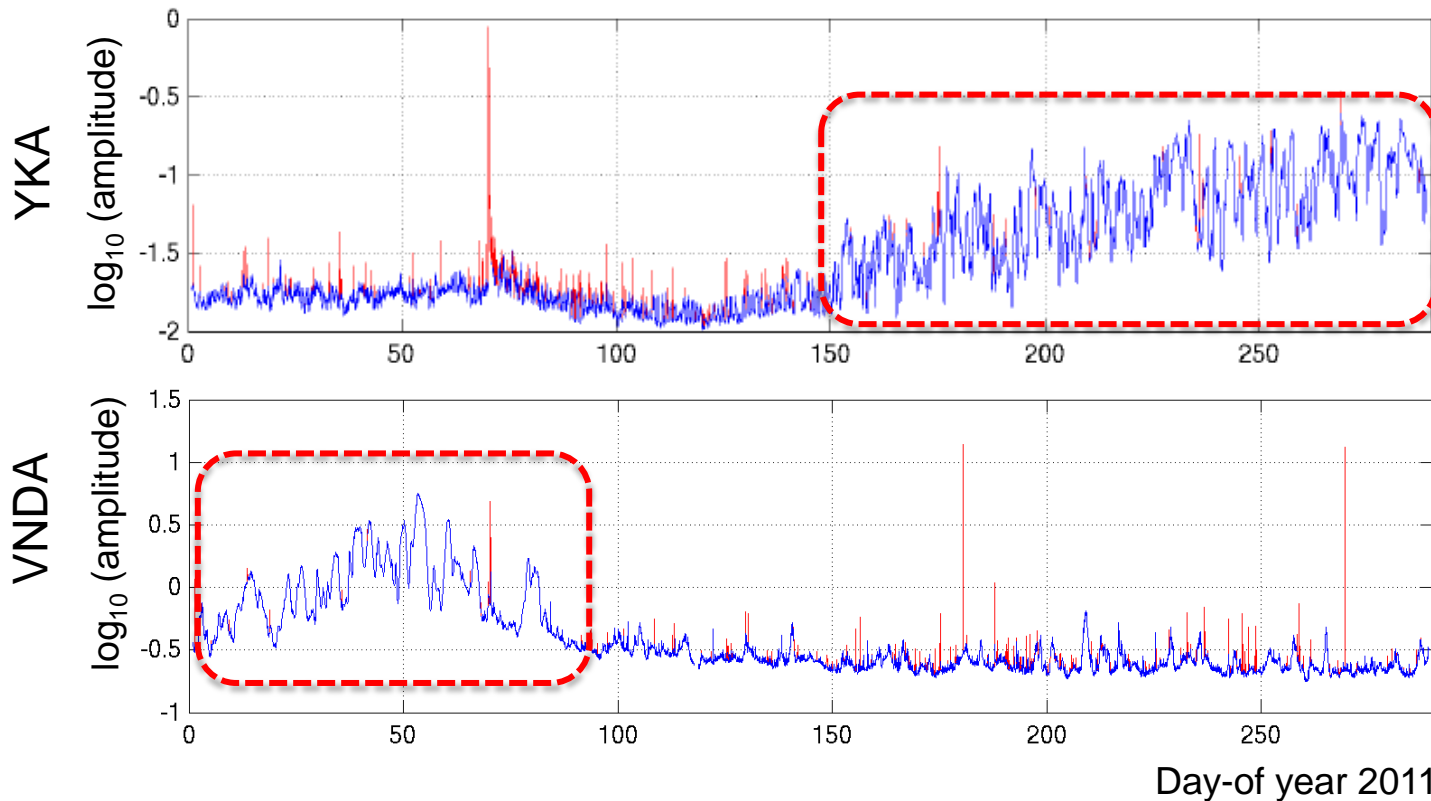
Average properties!



Factors influencing IMS network detection capability

- Seasonal variability of the background noise

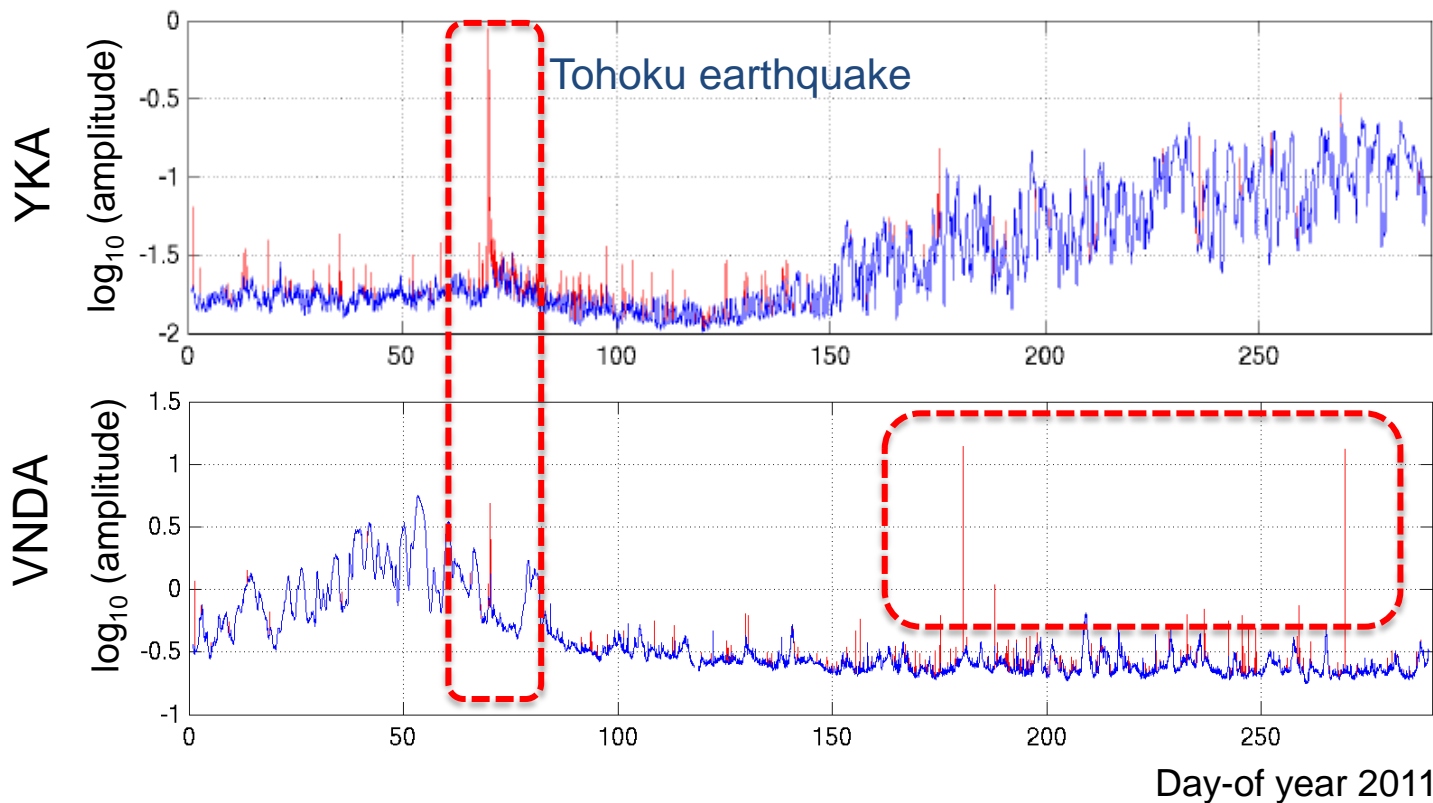
1 min. averages



Factors influencing IMS network detection capability

- Coda from large earthquakes, local signals

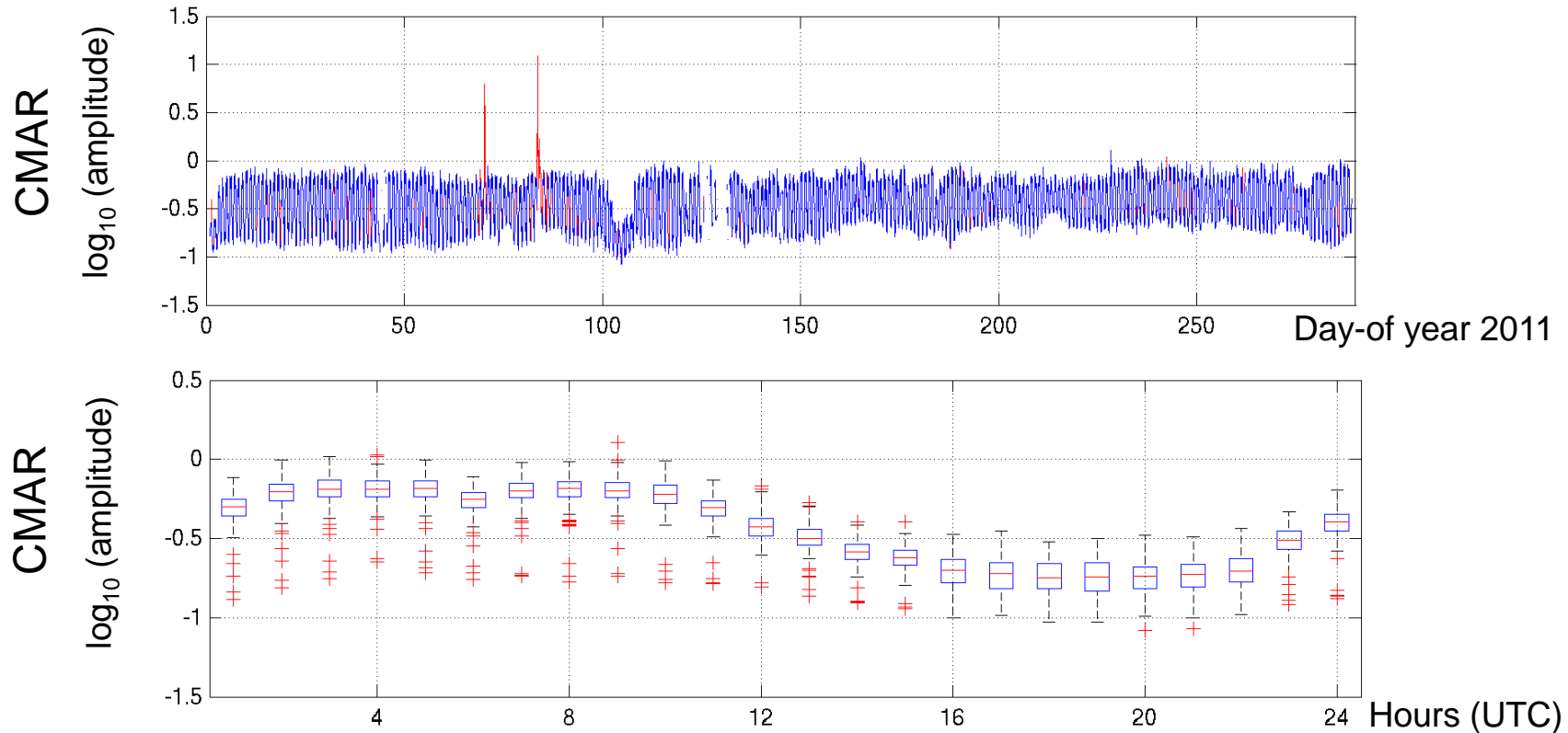
1 min. averages



Factors influencing IMS network detection capability

- Diurnal variations

1 min. averages



Factors influencing the IMS network detection capability

- Temporal variability of the background noise
- Local signals
- Coda from large earthquakes
- Station outages
- Communication gaps
- Data processing failures

Seismic Threshold Monitoring

- Currently provides at the IDC hourly averages and worst-case estimates of the global detection capability of the primary seismic network
- Takes into account all factors by processing real data within the regular IDC processing pipeline

Seismic Threshold Monitoring

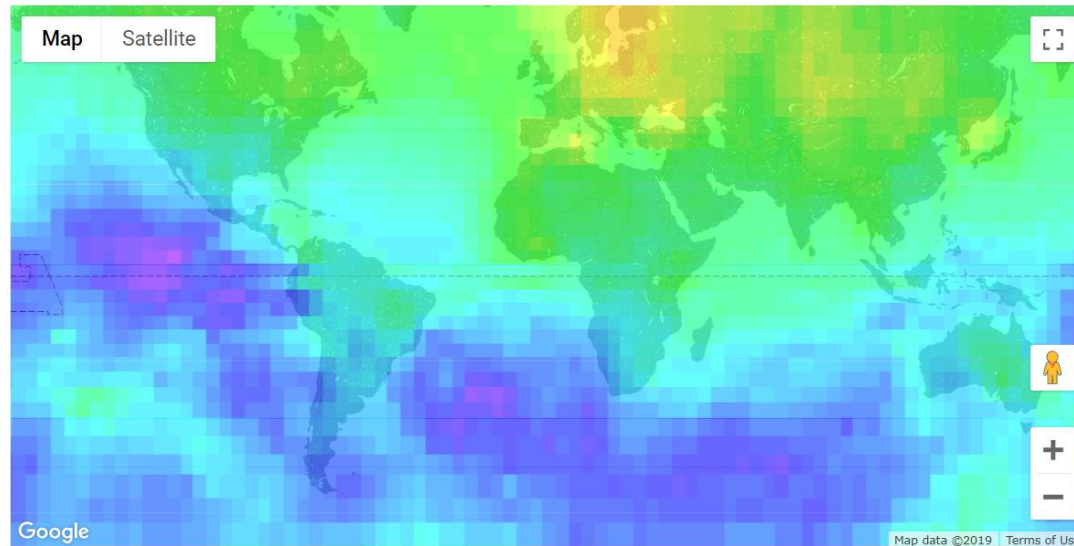
Threshold Monitoring

Report generated for 2019/01/01 22:00.

Date:



Average Detection Capability



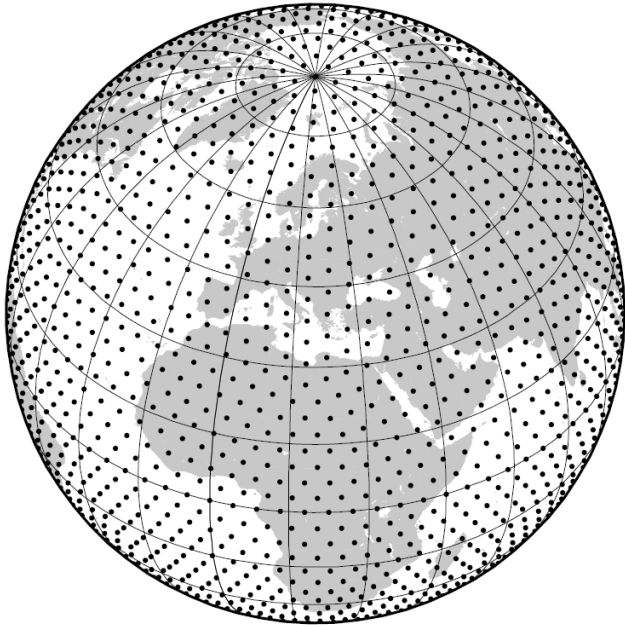
Seismic Threshold Monitoring

- Currently provides at the IDC hourly averages and worst-case estimates of the global detection capability of the primary seismic network
- Take into account all factors by processing real data within the regular IDC processing pipeline
- Provides confidence in the performance of the IMS network
- The potential of the method is not fully exploited, and can be further developed

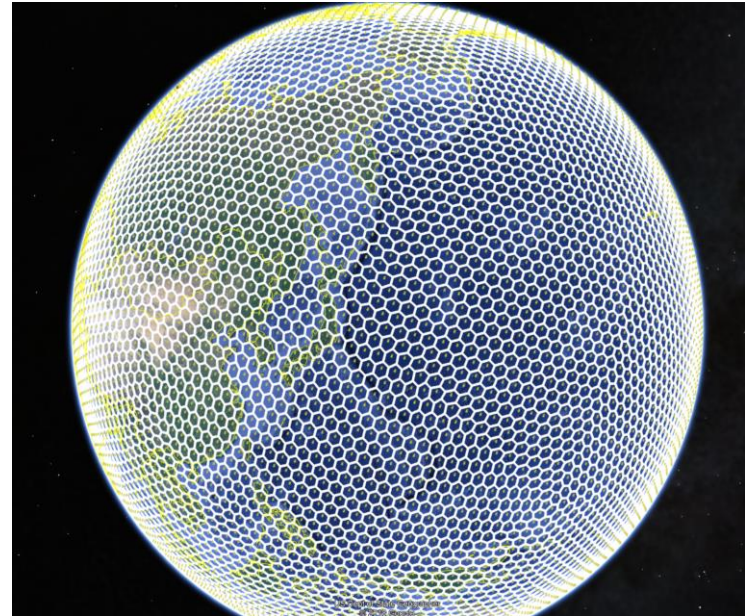


Introduce a denser global grid system

Current: 2562 grid points

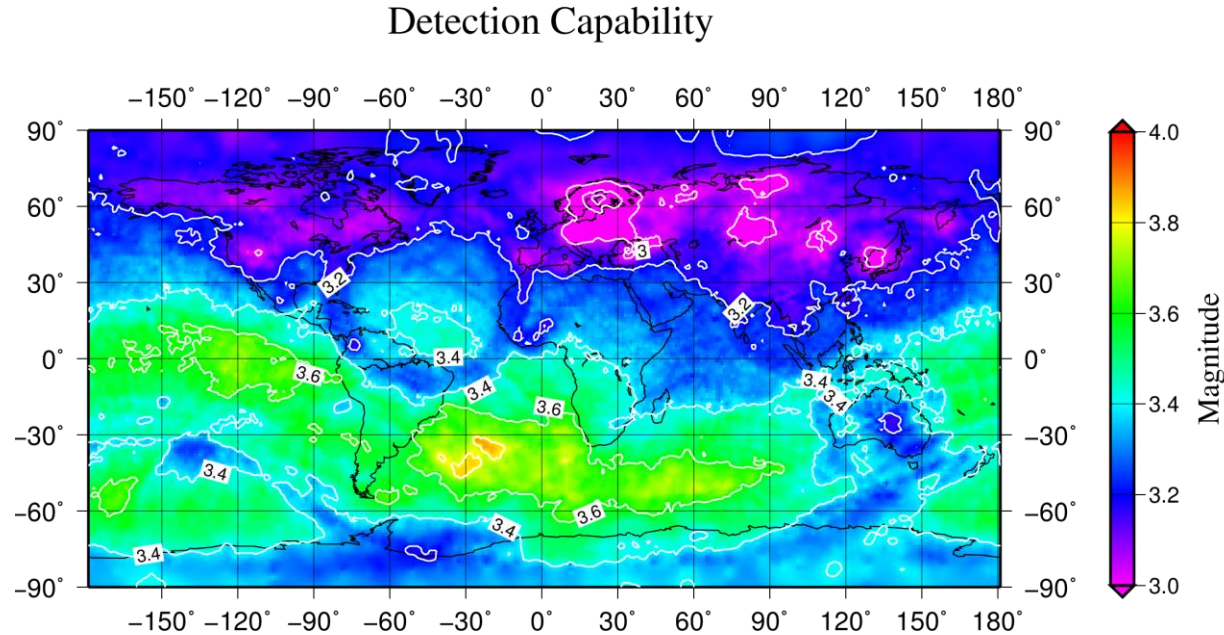


12962 grid points



Displays of instantaneous detection thresholds

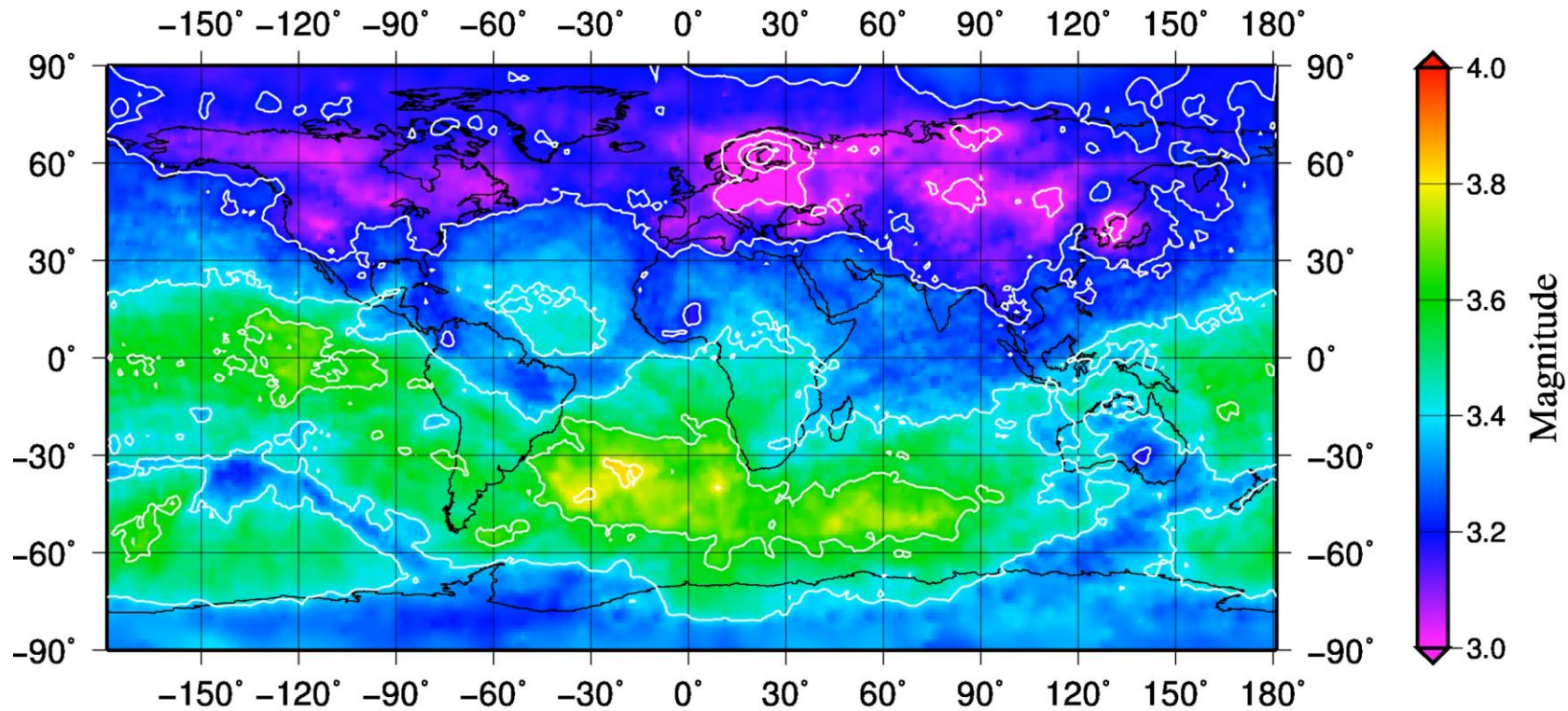
- Make use of the high temporal sampling of the detection capability estimates (5 or 10 s)



2018/02/25 17:07:00

Following example: Thresholds before and during a M_w 7.5 earthquake in Papua-New Guinea

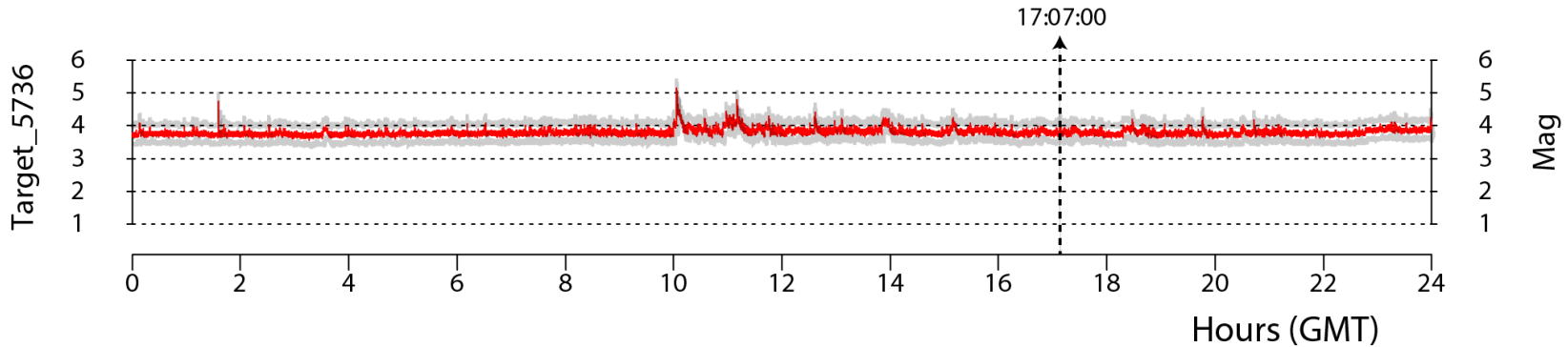
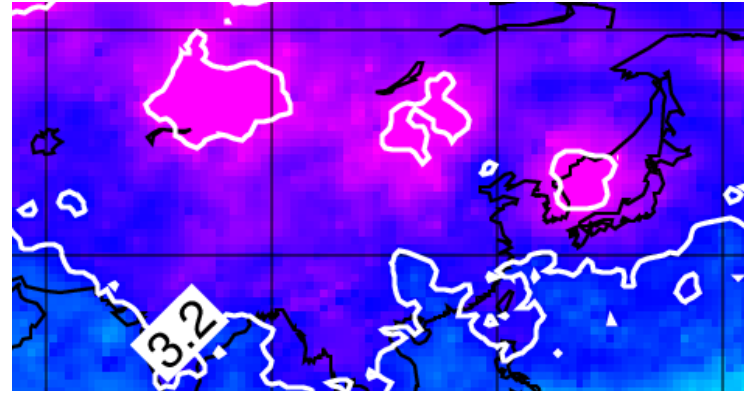
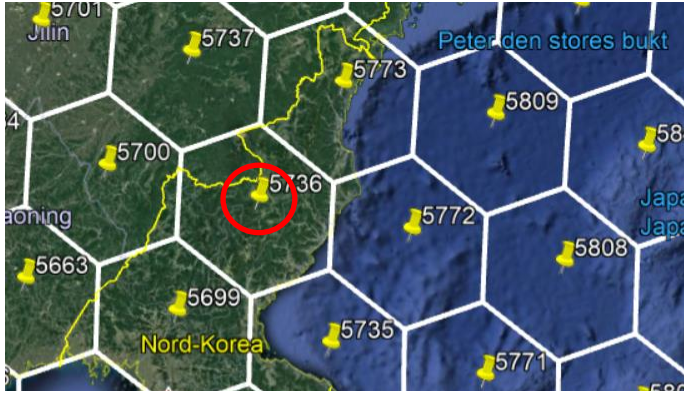
Detection Capability



2018/02/25 17:15:00

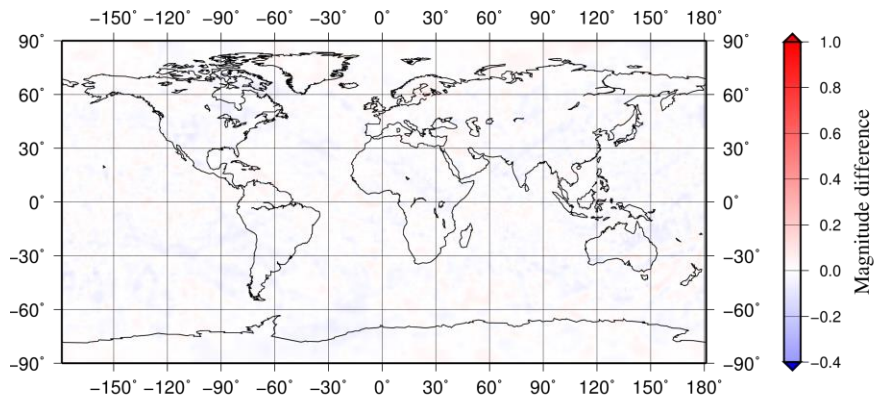
Information on detection thresholds of any area

- Interaction between a map display and the temporal detection thresholds at individual grid cells



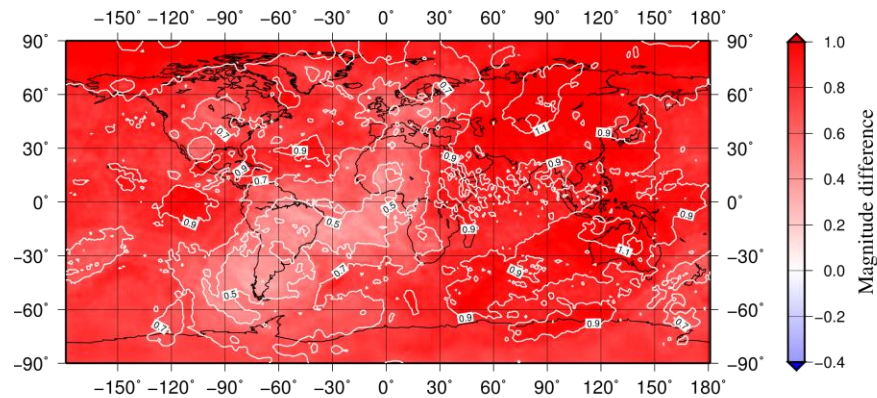
Deviations from the baseline

Relative Detection Capability



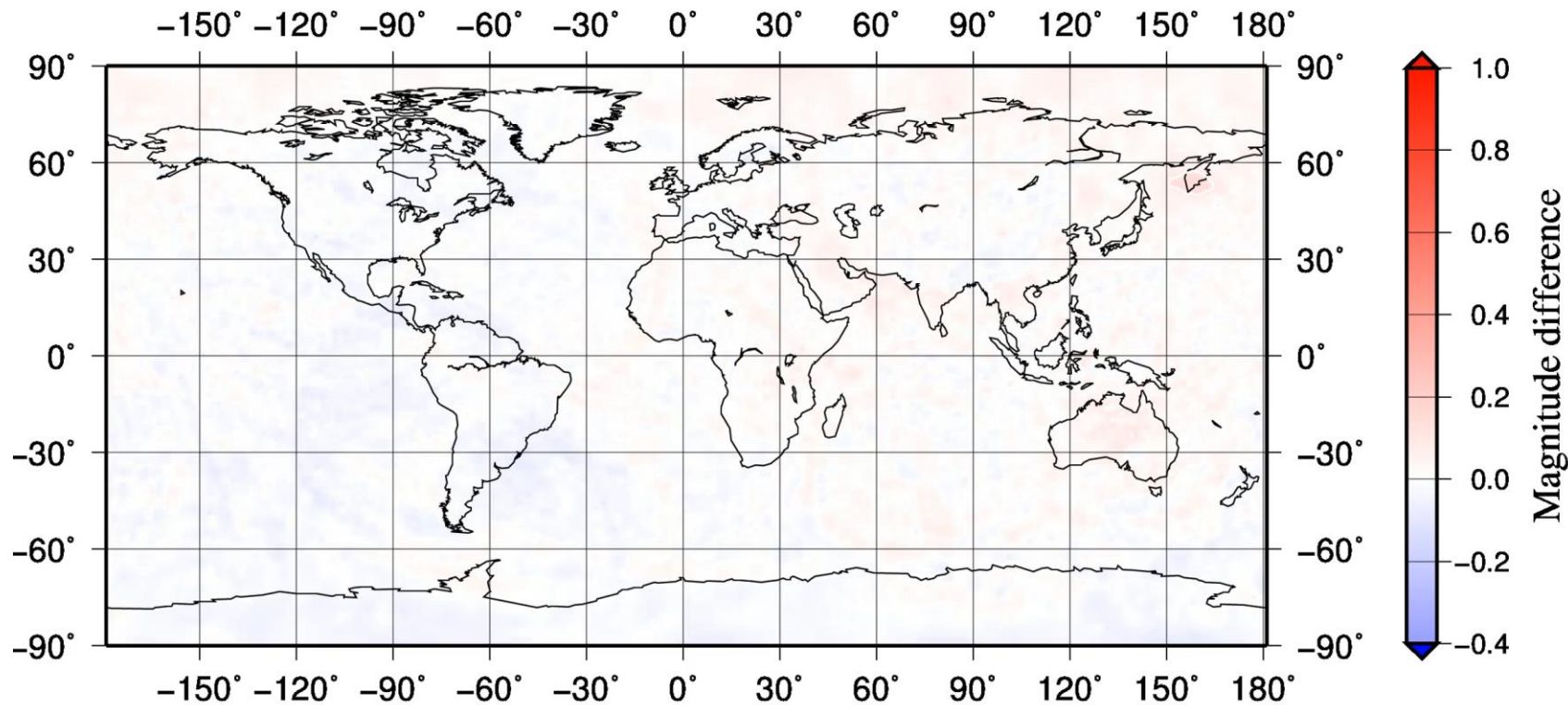
2018/02/25 17:07:00

Relative Detection Capability



2018/02/25 17:58:20

Relative Detection Capability



2018/02/25 17:15:00

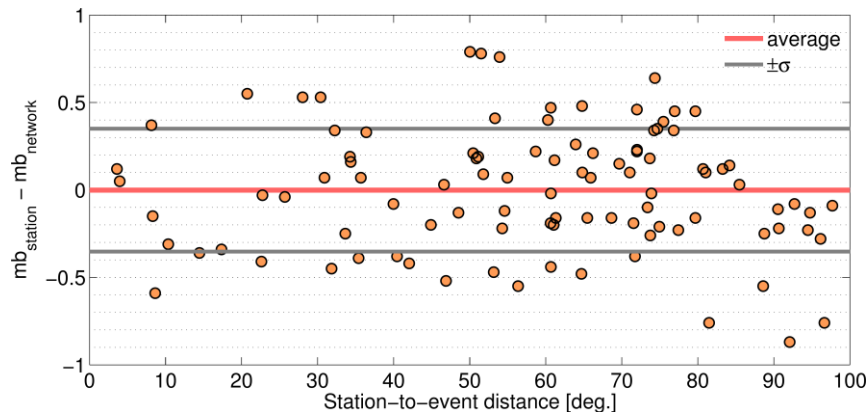
The global P amplitude-distance curve has a high variance

Example: DPRK 2017

network mb = 6.1

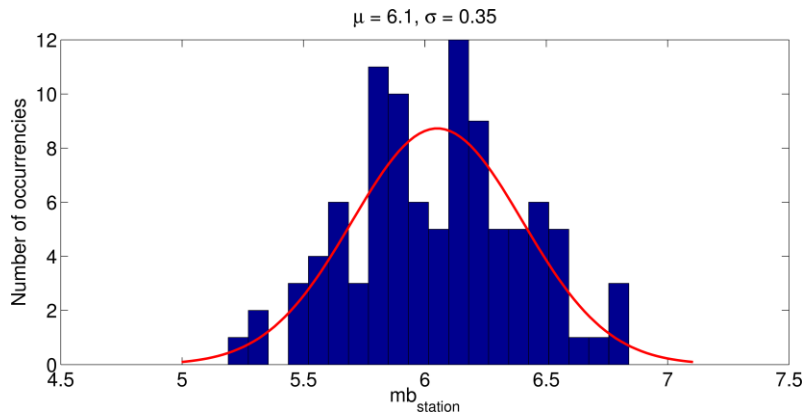
#stations = 74

st.dev = 0.35



In Threshold Monitoring this variance is reflected in the calculation of the 90% detection probability

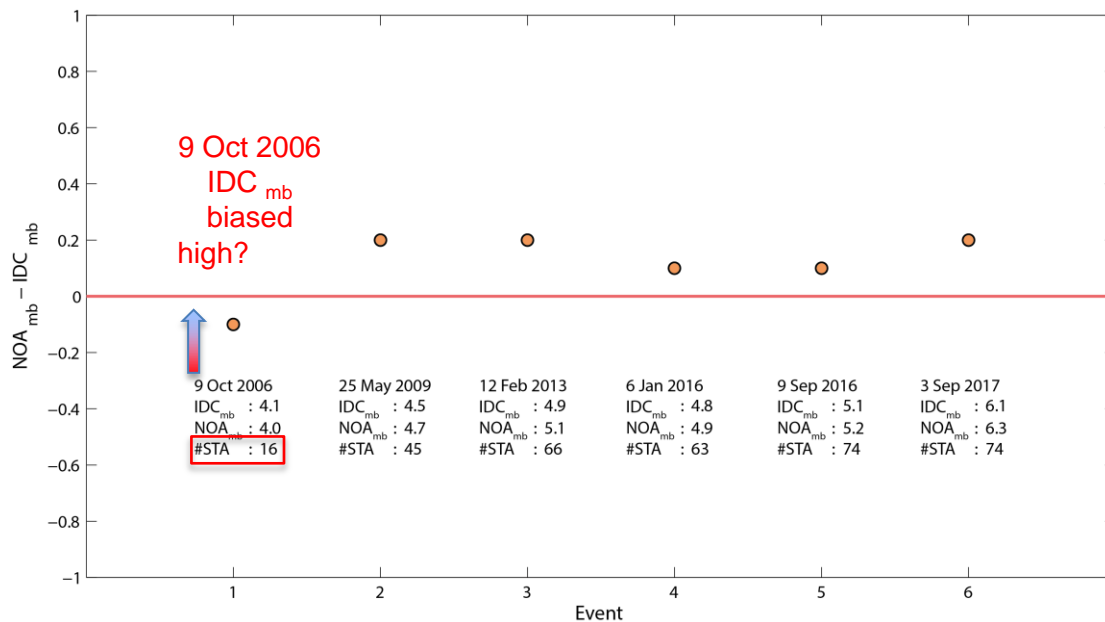
A lower variance would be preferable!



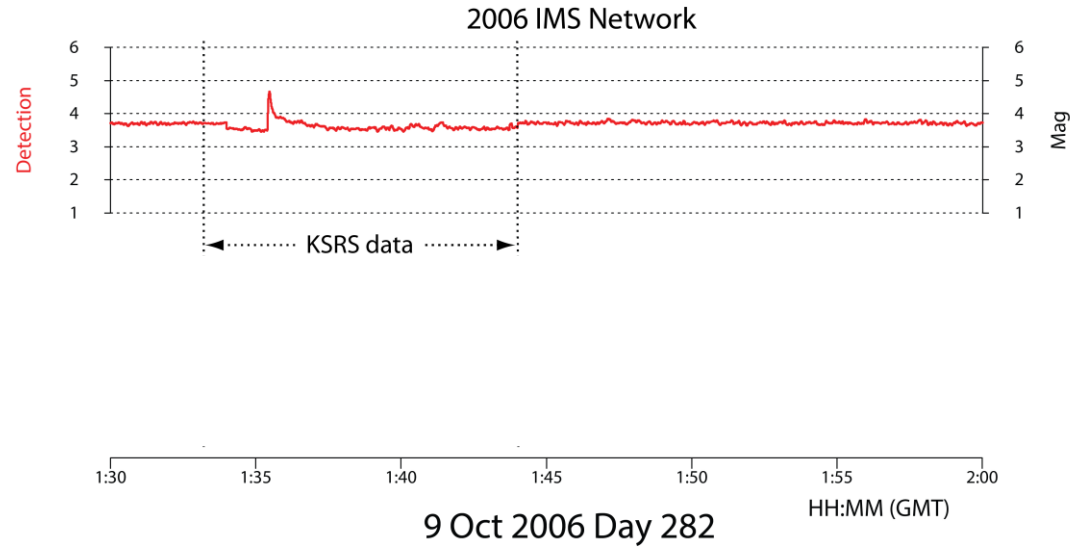
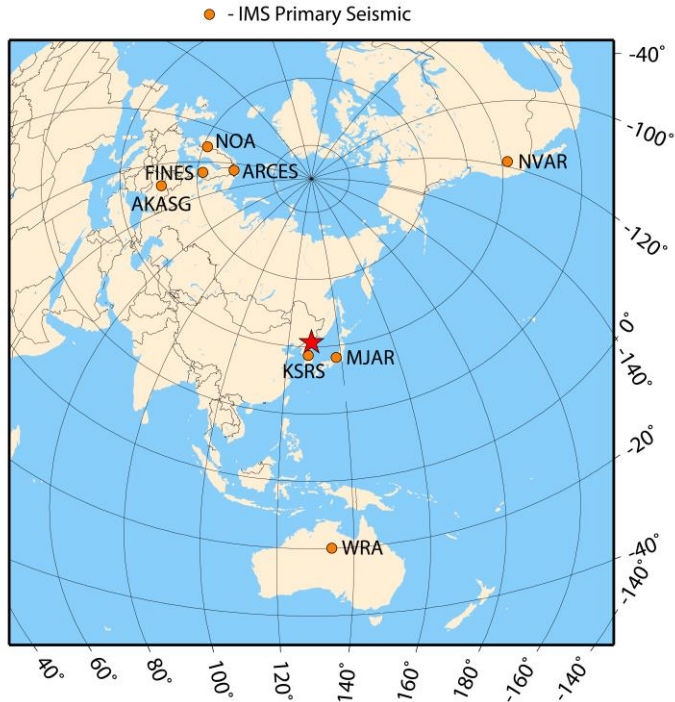
Site-specific Threshold Monitoring

For a given source-receiver path the magnitudes show a much smaller variability and are internally consistent

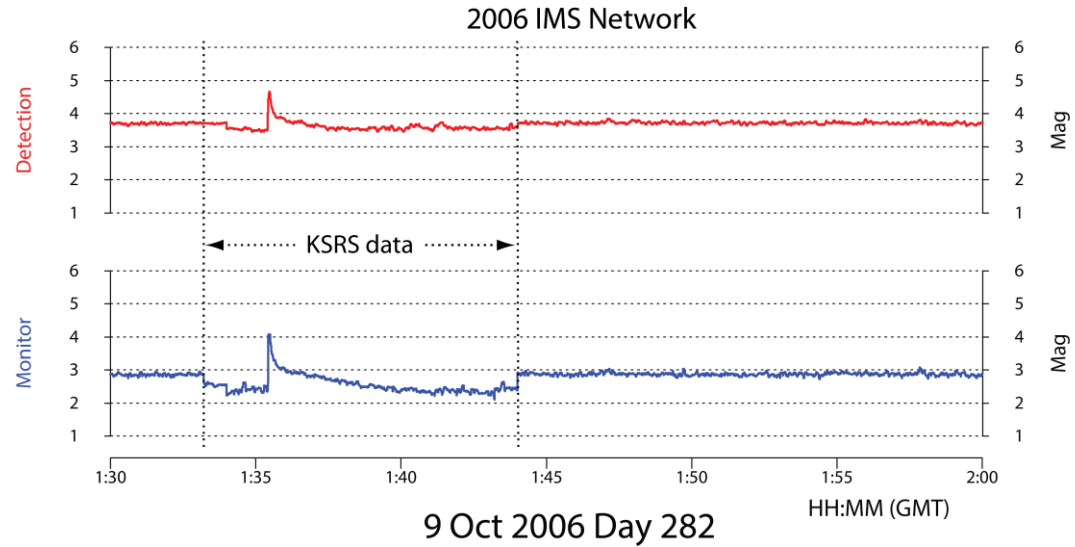
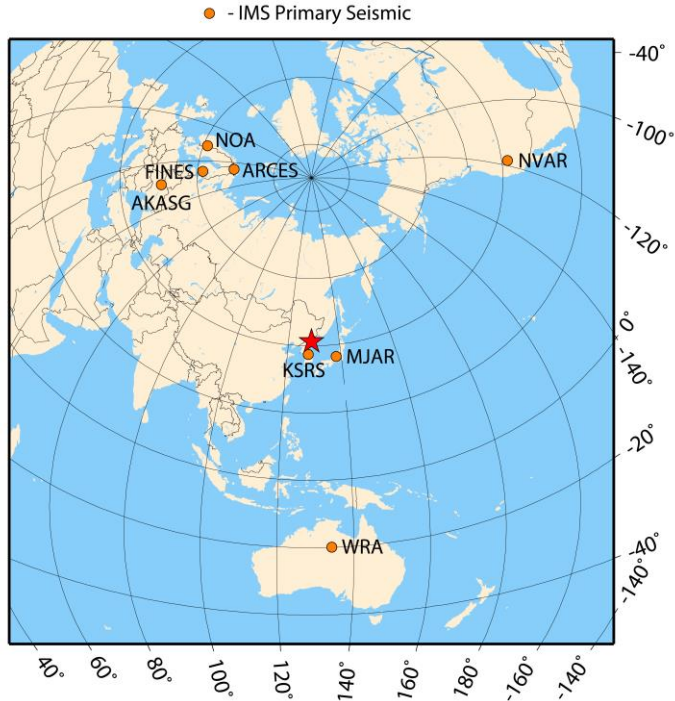
e.g. from the DPRK test site to the NOA array.



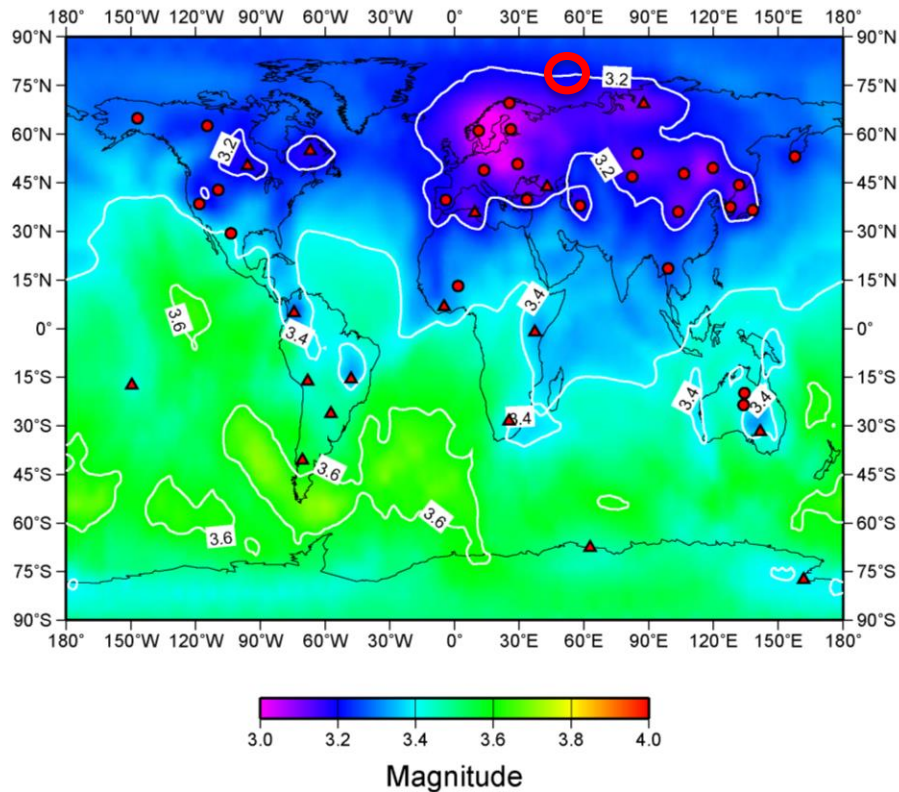
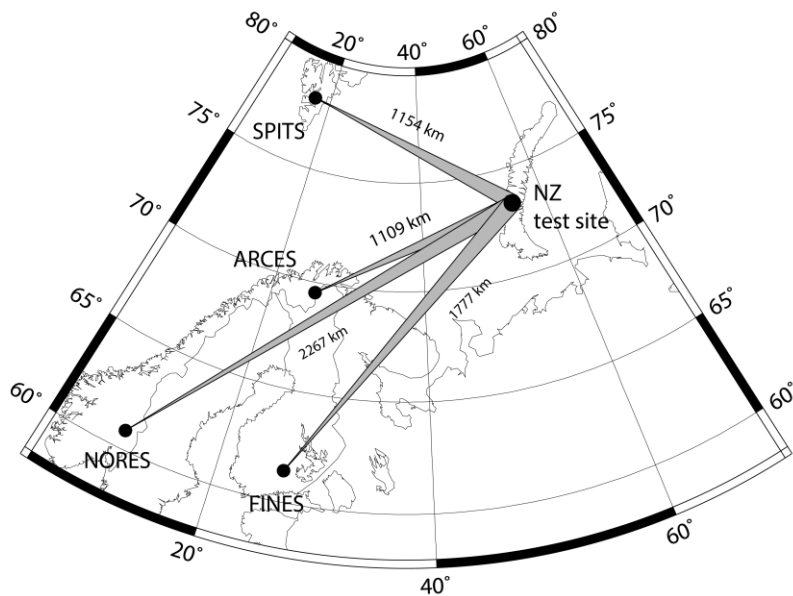
Site-specific Threshold Monitoring of the NK test site (2006)



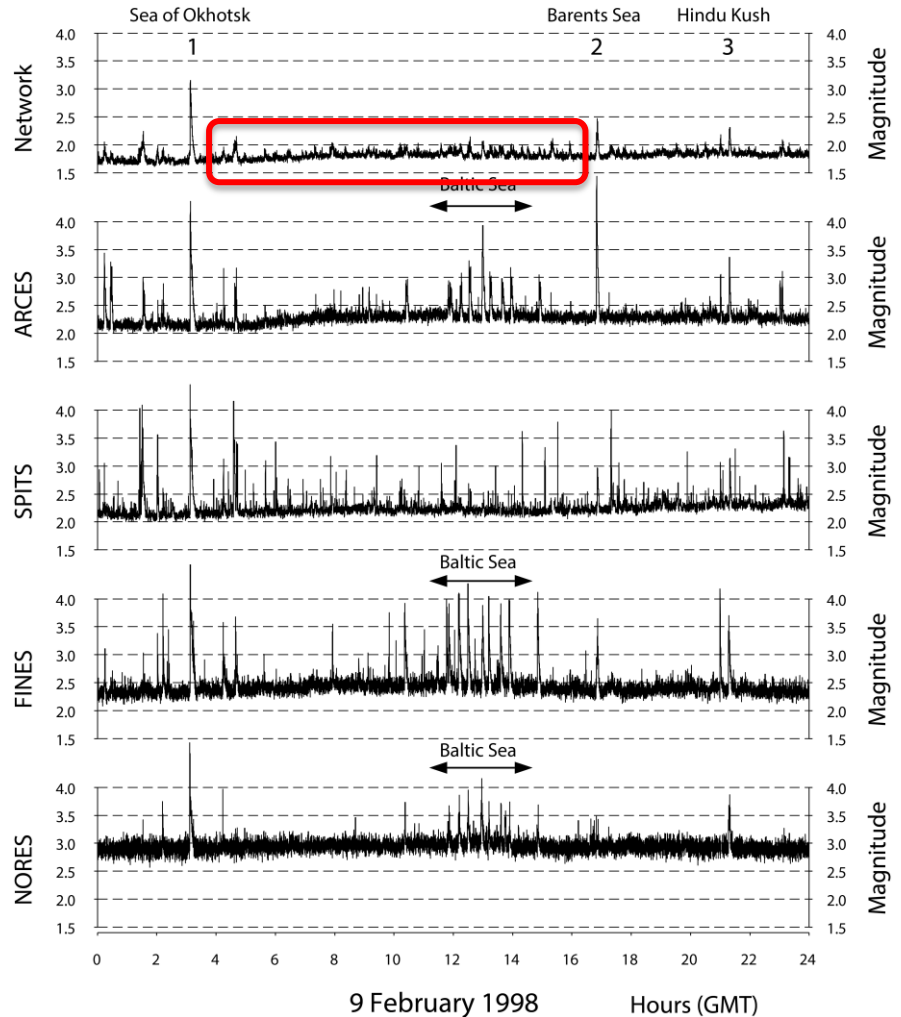
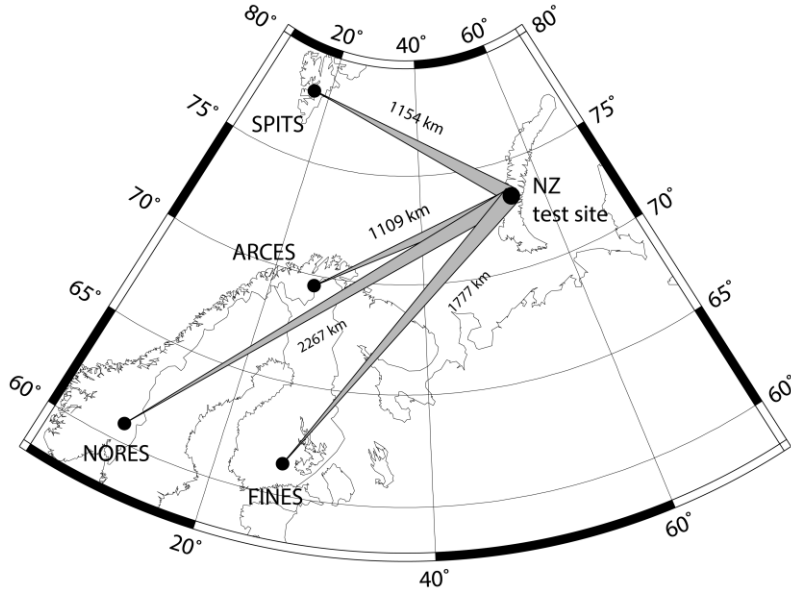
Site-specific Threshold Monitoring of the NK test site (2006)



Site-specific Threshold Monitoring of the Novaya Zemlya test site (1998)



Site-specific Threshold Monitoring of the Novaya Zemlya test site (1998)



Summary (1)

- The potential of the Threshold Monitoring method is not fully exploited, and should be further developed.
- The detection capability estimates of the Threshold Monitoring system is well suited to become a Key Performance Indicator (KPIs) of the seismic component of the International Monitoring System.
- The Threshold Monitoring method can also be used to monitor the upper magnitude limit of possible events which might have occurred in any specified geographical target area.
- This will call attention to any time instance when a given threshold is exceeded, which will enable analysts to focus their attention to analysis of events occurring during these time intervals.
- Thus, the Threshold Monitoring method is a supplement to, and not a replacement of, traditional or new event analysis methods.



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Summary (2)

- NORSAR is prepared to cooperate with the PTS on further development and implementation of an extended Threshold Monitoring system into the reengineered IDC software.
- An extended Threshold Monitoring system should include graphical interfaces such that the NDCs themselves can derive near real-time results and statistics (e.g., capability maps, temporal threshold traces, and associated distributions).
- The Omniglobe on display in the Antekammer includes an animation of the relative detection thresholds before and during a Mw 7.5 earthquake in Papua-New Guinea.



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