GEOSS and SWE in Ocean Acoustic Monitoring

Eric Delory, dBscale

Christoph Waldmann, Marum, Uni. Bremen

Real-time scalable , fixed and mobile, passive distributed ocean acoustic monitoring

GEOSS-SWE

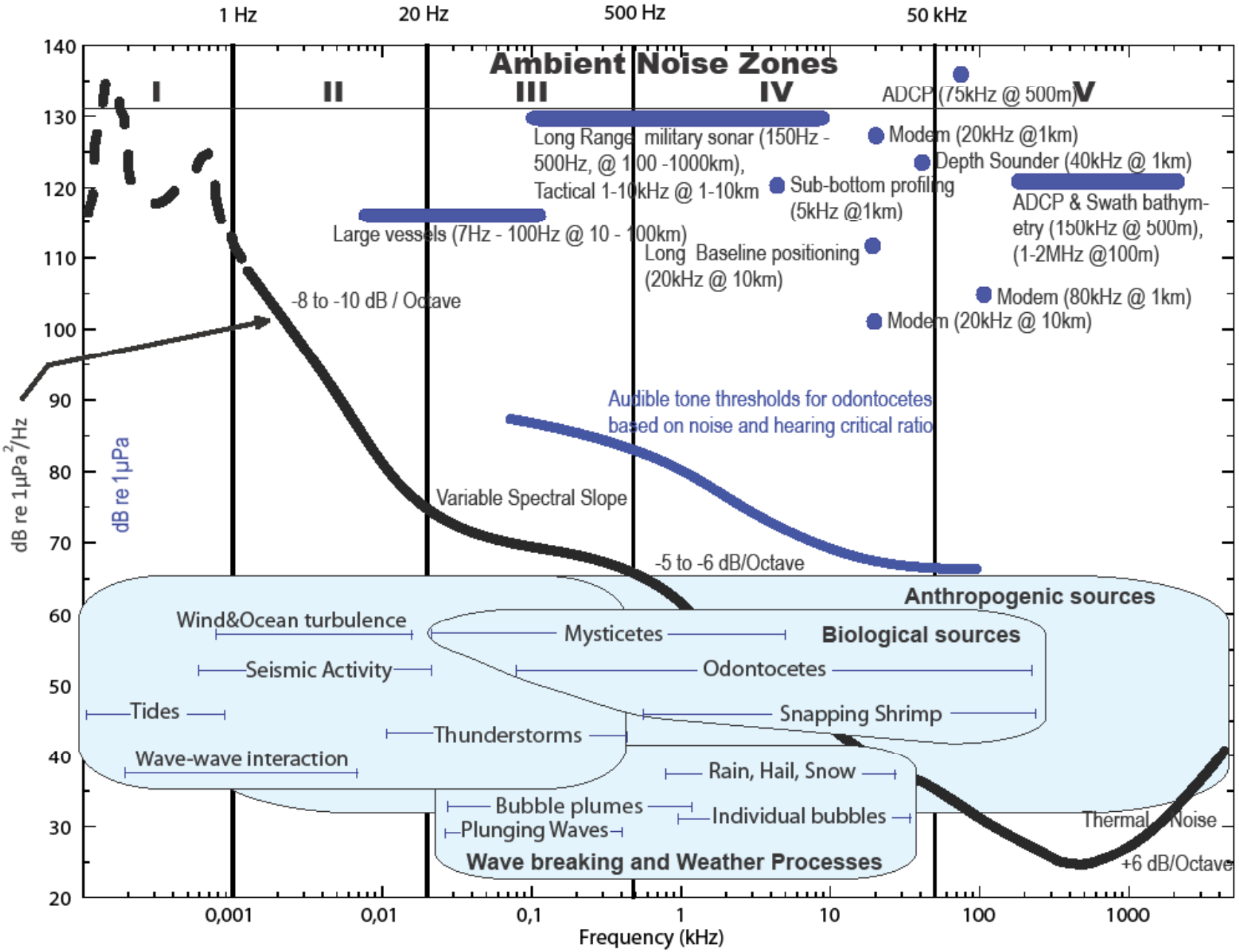
Focus on wildlife

Status

- Acoustics is ubiquitous in ocean monitoring
- Fixed Ocean Acoustic platforms are rare and none offer open access (Military)
- Mobile monitoring lack documenting
- No consensus on methods, hardware and software
- Standardization is a rude word
- OA instruments are costly to develop, deploy and interchange
- Ocean observatories (ESONET, NEPTUNE, DONET) MARS are rapidly changing mentalities: MMI, ESONET WP2

Ocean Acoustic Sectors

- Military (and a military standards) = 50Hz-100kHz
- Industry (seismics, industrial geophysics) 0.01Hz-20Hz
- Science: Geophysics and Bioacoustics
- Bathymetry 40kHz-2MHz
- Full spectrum = anthropogenic and wildlife

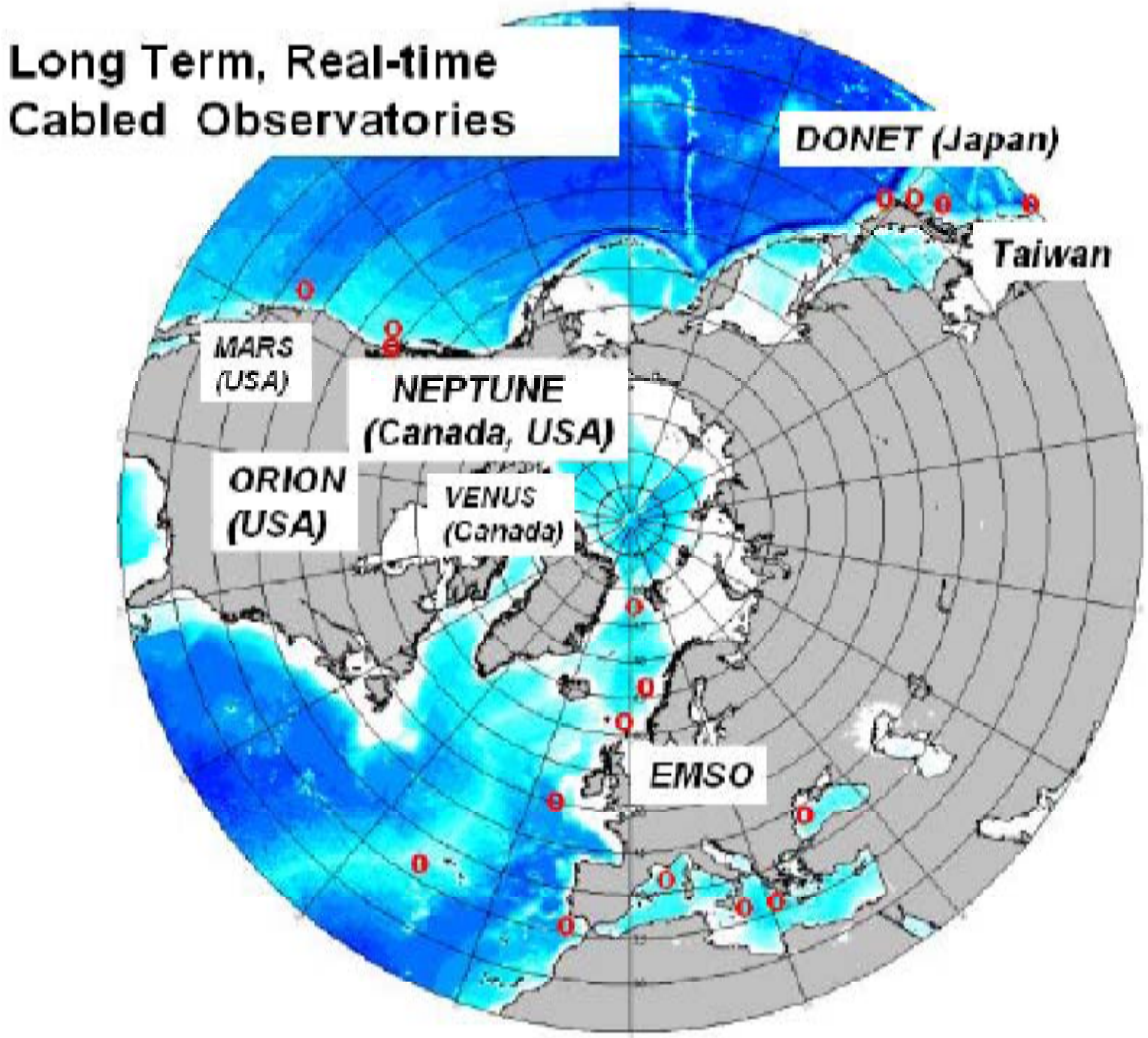


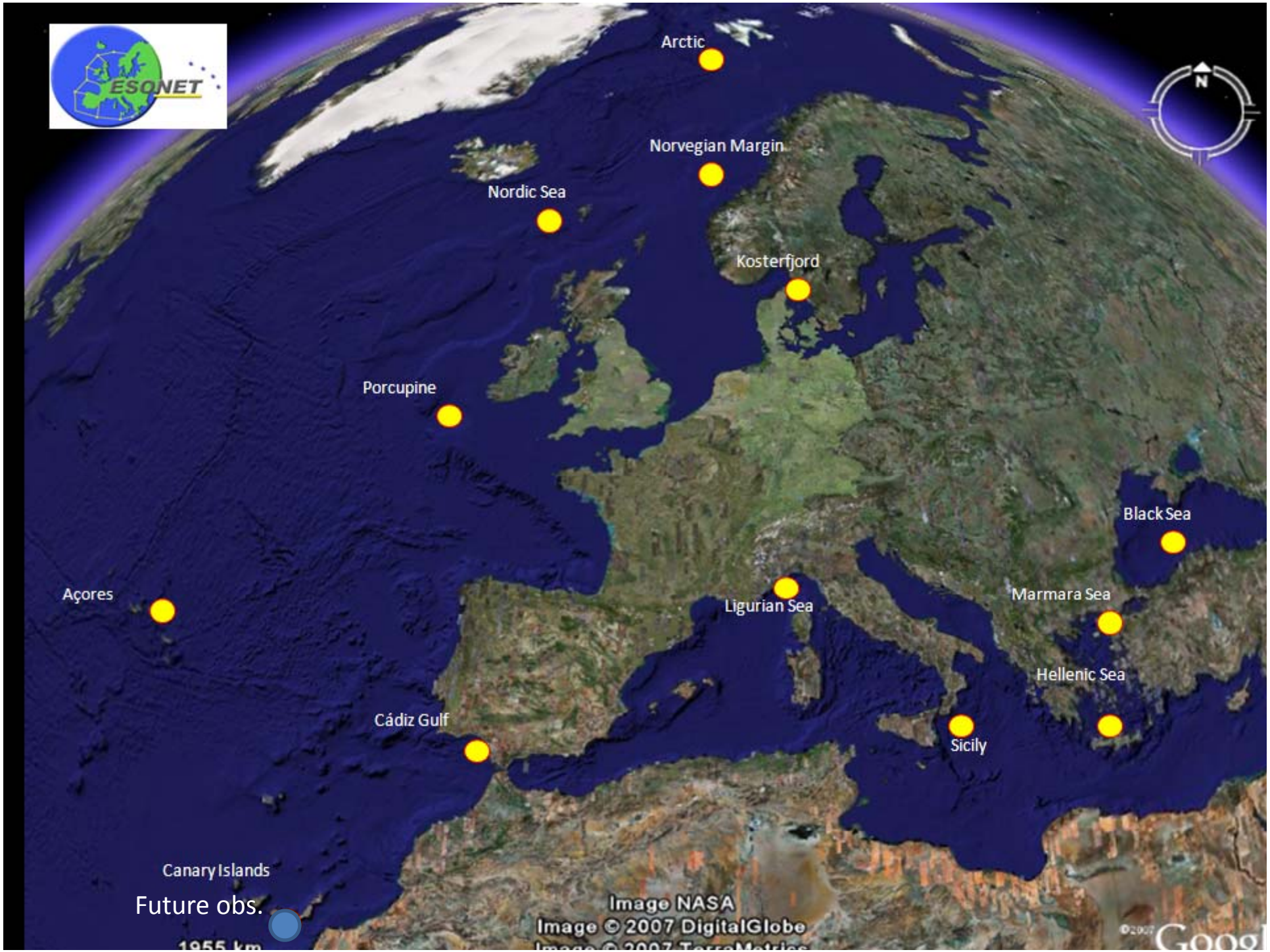
Potter & Delory, 1998 – rev 2008

What's needed

- Consensus on a few aspects:
  - Software: metadata (data content & sensor sensitivity, cal curve, sensor conditionning & filtering (prewhitening) & transforms- e.g. beamforming), SensorML (?), ISO 19110
  - Ontology
  - Encoding of geographical/environmental context (e.g. lat, long, + depth, water temperature, salinity -> sound velocity)
  - Event detection (marine mammal species tracking) to avoid loads ofunnecessary data
  - Hardware interface (IEEE 1451, PUCK)
  - Unique Sensor ID, calibration follow-up

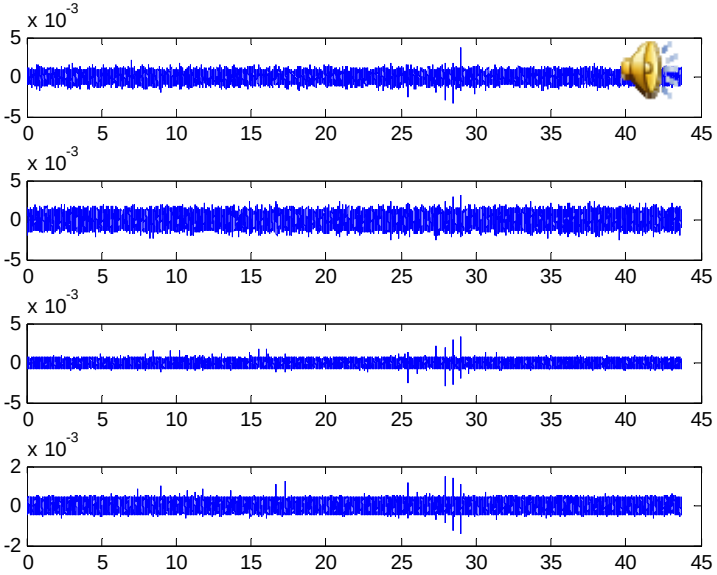
- Consensus on Scientific and Technology outcomes :
  - Global wildlife monitoring
  - Global environmental passive acoustic monitoring/inversion
  - Need for plug and work hydrophones and arrays
  - Open Data access and software tools


Long Term, Real-time
Cabled Observatories
DONET (Japan)
Taiwan
MARS
(USA)
NEPTUNE
(Canada, USA)
ORION
(USA)
VENUS
(Canada)
EMSO


ESONET
Arctic
Norvegian Margin
Nordic Sea
Kosterfjord
Porcupine
Black Sea
Açores
Ligurian Sea
Marmara Sea
Hellenic Sea
Cádiz Gulf
Sicily
Canary Islands
Future obs.
Image NASA
Image © 2007 DigitalGlobe

Sperm Whale Sounds from SN1

- Communication through optical SPDIF
- Wav File Header: FormatTag: 1; Channels: 2; SamplesPerSec: 96000: AvgBytesPerSec: 384000; nBlockAlign: 4;nBitsPerSample: 16;



Example SN1 off Sicily

- 4 channel stream transmitted optically
- Stored as wav files
- Further implementation of SWE would enable the encoding of additional parameters in order to calculate
  - Received Sound pressure level
  - Apparent source level
  - An animal bearing, distance or position
  - Signal conditionning (are these files usable for large mysticetes or not?, is prewhitening applied? What gain, frequency response curve?)
  - Etc.
  - Lat, Long, date, time, data quality not encoded
  - Quality check (50Hz interference, shipping noise, sensor failure, etc.)

Interoperable sound pressure and intensity sensor Arrays

- SWE is being considered
- IEEE 1451 at sensor level for analog sensors
- Detectors, alerts, processors at large
- Storage issues (event detection a prerequesite)
- Metadata (ISO standards – SWE)
- Global research is starting
- Vessels of opportunity & buoys & fixed platforms

Ocean Acoustics – Focus on wildlife tracking