SOP/EOP Implementation Plan - Overview for the Eastern Mediterranean Target Area

Emmanouil Anagnostou

University of Connecticut & Hellenic Center for Marine Research

Contributions from

Efrat Morin
The Hebrew University of Jerusalem

Marios Anagnostou & John Kalogiros
National Observatory of Athens

Elias Demetriou & Themis Chronis
Hellenic Center for Marine Research

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Hydrometeorological Observations

**Evros River Basin**
Mediterranean mountainous climate (up to 2900 m elevation, >1000 mm of annual rain)

**Western Crete**
Semi-arid maritime climate with complex terrain rain enhancement (up to 900 mm of annual rain and up to 2800 meter elevations)

**Israel**
Combination of semi-arid, Med and mountainous climate (up to 1200 mm of annual rain and 2000 m elevations)
Air-Sea Interaction Observations

- Gliders
- CTD Surveys
- Buoys
- HF Radar

Potentially available surface buoys

Array of submerged moorings with passive listeners
Shallow glider or Argo float
Deep glider and Argo floats in the Levantine
Western Crete – Hydrometeorological observations

Support WG 3 objectives on flash floods from mountainous enhanced rainfall (over small scale basins)

- **Basin areas** in the range of 10–100 km²
- **EOP data** from US Navy C-band/Doppler radar, 10 daily gauges, 6 high-frequency gauging stations, HNMS LMA network (lightning)
- **SOP data** on high-resolution rainfall from X-POL, discharges from acoustic Doppler, and post event surveys in cases of flash floods
- **Auxiliary data** on soils and ground water tables from TUC
Correcting for rain-path attenuation effects

attenuation correction based on $\Phi_{dp}$ (in rain below melting layer)
Western Crete – Hydrometeorological observations

High-resolution X-band dual polarization measurements of precipitation microphysics and rainfall rate

Correcting for bright band effects

melting layer (bright band) boundaries detection based on $\rho_{hv}$

total attenuation due to strong bright band
Western Crete – Hydrometeorological observations

*High-resolution X-band dual polarization measurements of precipitation microphysics and rainfall rate*

Rain estimation after bright band and attenuation correction
Modeling hydrological characteristics of Mediterranean temporary ponds

Topography map of Omalos and Kourna basins

Schematic representation of the MIKE She model

Omalos MTP’s simulated water volume as opposed to the observed volume for the simulation period 1/9/05-31/8/06
Western Crete – Air-Sea interactions observations

Support WG 4 objectives on investigation of impacts from intense air-sea interactions in maritime Mediterranean storms

- **EOP data** on meteorological variables and salinity/temperature from buoys

- **EOP data** on precipitation, wind and air-sea exchanges (bubbles formation, breaking waves, aerosols?) from sub-merged moorings with passive listening sensors

- **SOP data** on salinity/temperature/wind/rain etc from shallow glider with acoustic probe
Western Crete – Air-Sea interactions observations

Support WG 4 objectives on investigation of impacts from intense air-sea interactions in maritime Mediterranean storms

Rain:
- Max = 12 mm/h
- Max = 70 mm/h

Winds:
Israel hydrometeorological Observation

Support WG 3 objectives on flash floods from heavy rainfall (over small scale basins)

Data from the Israeli Meteorological Service, the Hebrew University and Shacham Mekorot

- Basin areas in the range of 10–100 km²
- EOP data Doppler radar, high-frequency gauging stations, streamflow data
- Auxiliary data on soils and ground water tables from TUC

Site 1
Mediterranean climate (650 mm)

Site 2
Semi-arid climate (150-200 mm)

Site 3
Mediterranean mountainous climate (800 m ASL, 550 mm)
Israel hydrometeorological site

Radar-based flash-flood modeling with an uncalibrated model in Israel Site 1

The hydrological model

The Tanim catchment (51 km²)

Rozalis, Morin, Price and Yair, 2010
Hydrological sensitivity to convective rain cell characteristics

Flash flood event 23/12/1993

Peak discharge magnitude can be 2-3 folds larger by small changes in cell location, direction and velocity

Yakir and Morin, 2010
Analysis of extreme flash floods over the Dead Sea region, east to Site 3 (Jerusalem). Climate is varied from Mediterranean to semi-arid and arid.

The Qumeran flash flood
12/5/2007

Discharge data from S.E.R.S

Basin area: 45 km$^2$
Runoff peak: 145 m$^3$/s
S.P.D: 3 m$^3$/s/km$^2$

Basin area: 2.7 km$^2$
Runoff peak: 35 m$^3$/s
S.P.D: 13 m$^3$/s/km$^2$

Rain depth (mm)
- < 10
- 10 - 30
- 30 - 50
- 50 - 70
- > 70

Kilometers

0 2 4 6 8 10

Dead Sea

Site 3
Evros River Basin

Support WG 2 (continental hydrological cycle) and WG 1 (river discharges in Med water budget) objectives of HyMeX including the investigation of impacts from climate change and urbanization effects in the Eastern Med

- Basin area 53000 km², main focus on Ardas (5200 km²) and Evros (Maritsa) (10000 km²) through collaboration with Bulgaria
- EOP data from HNMS C-band/Dual-POL radar, 50+ daily gauges, LMA network (lightning), 5 automatic meteo stations and 3 hydrometric and water quality stations (several more are available from Bulgaria)
- Exploiting auxiliary data during SOPs on soil moisture, water tables and snow cover