Analysis and hindcast simulations of an extreme rainfall event in the Mediterranean area: the Genoa 2011 case

Fiori, E.[1], Comellas, A.[1],[4], Molini, L. [1], Rebora, N. [1], Siccardi, F. [1],[4], Gochis, D. J. [4], Tanelli, S. [3], A. Clematis [2], D. D'Agostino[2], A. Quarati [2], E. Danovaro [2], A. Galizia [2], D. Kranzlmueller [6], and Parodi, A. [1]

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(5)National Center for Atmospheric Research, USA
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Flash Flood Nov. 4th, 2011 – Genova: DRIHM critical case

On November 4th, the city of Genoa, Liguria region capital, was gutted by a torrential rainfall event with about 500 millimeters of rain – a third of the average annual rainfall - fell in 5 hours (between 10 and 15 UTC). Six people were killed. Television footage showed cars floating freely and people wading knee-deep through flooded streets.

Flash flood of the Genoa town center. Top rigth corner: the similar event of 1970

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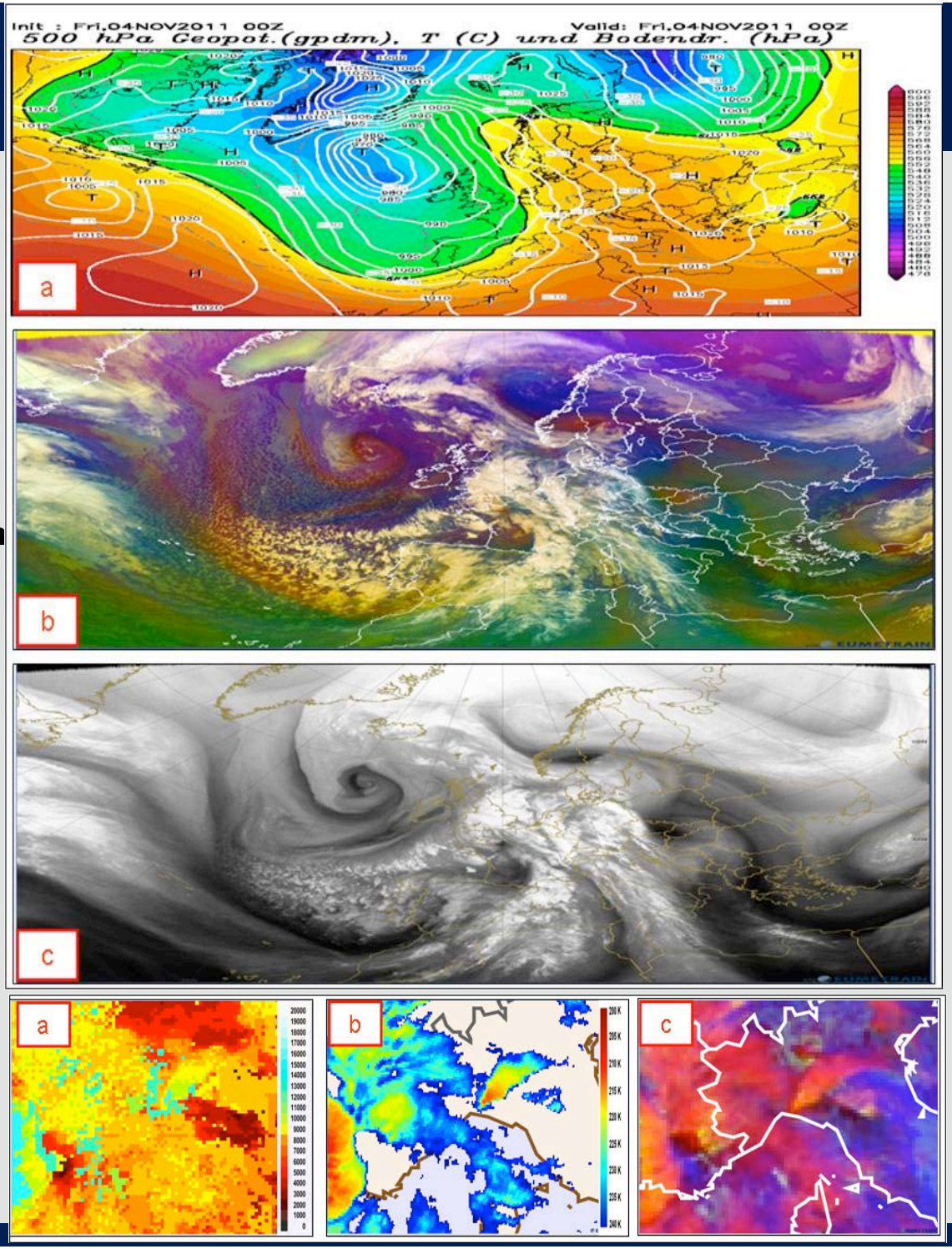
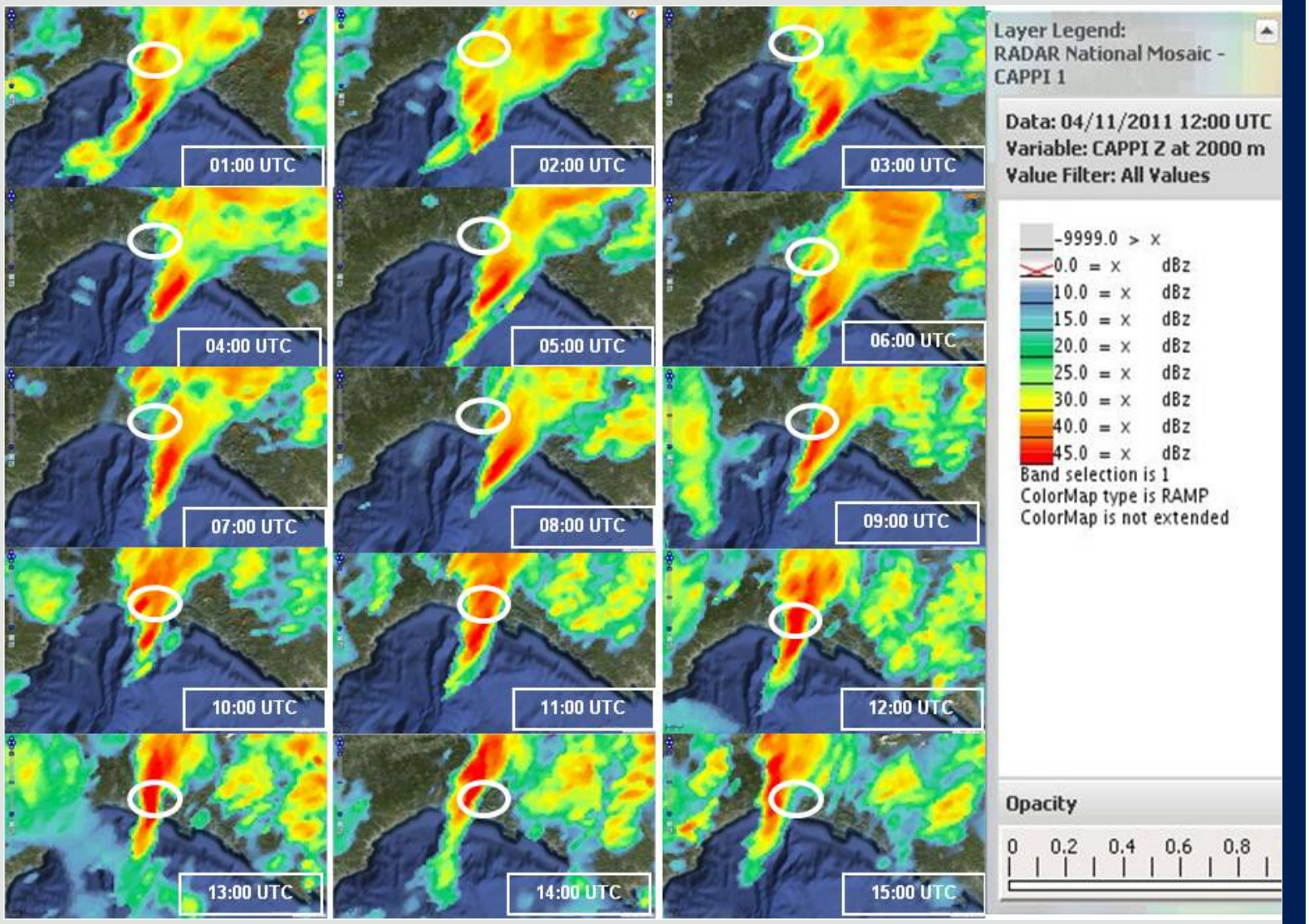
Flash Flood Nov. 4th 2011 – Genova. Synoptic scale



Radar maps from the Italian radar network showing the intense thunderstorm wandering along the Liguria coastline (1-15UTC): White ellipsoid identifies the mostly affected area



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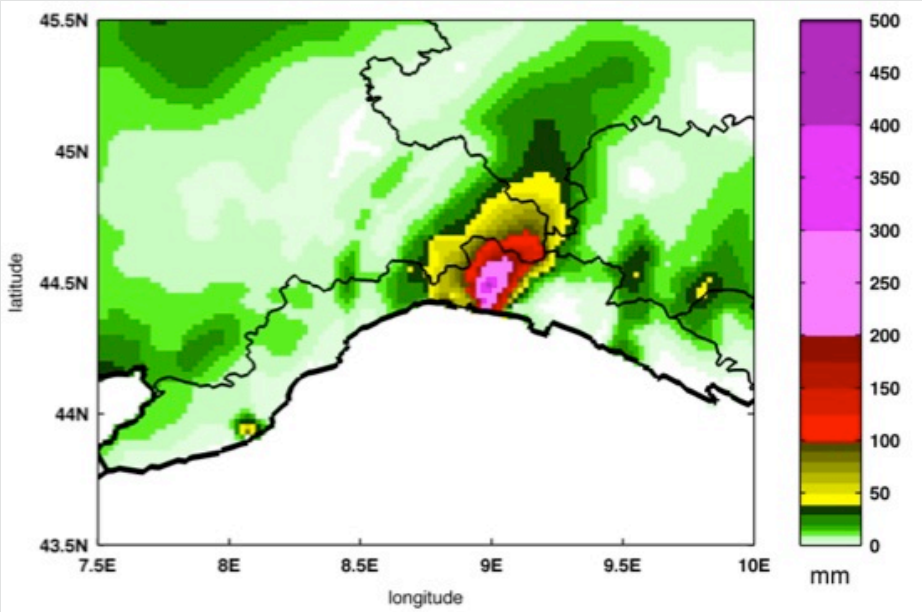
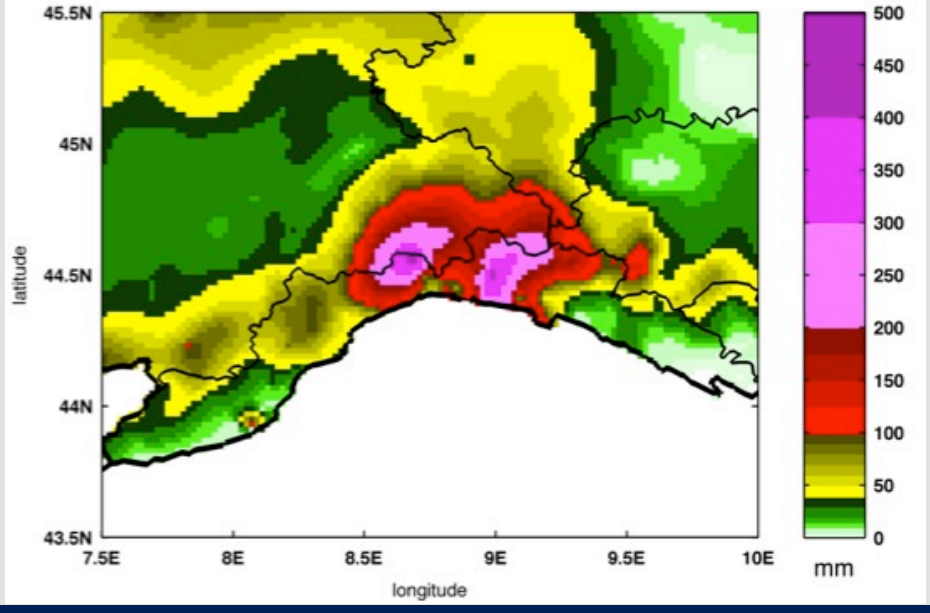
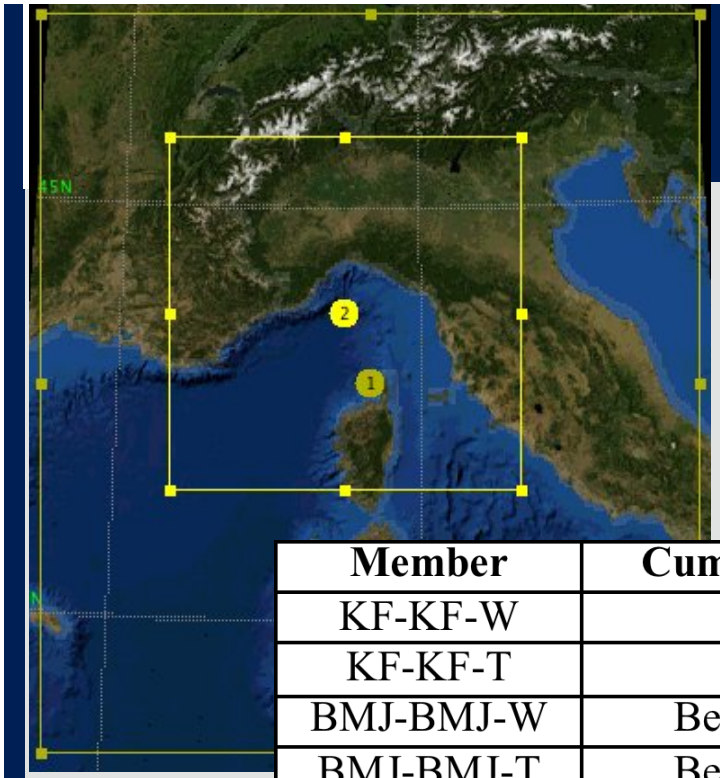
Observed rainfall depth 9-15 UTC



Observed rainfall depth 0-24 UTC



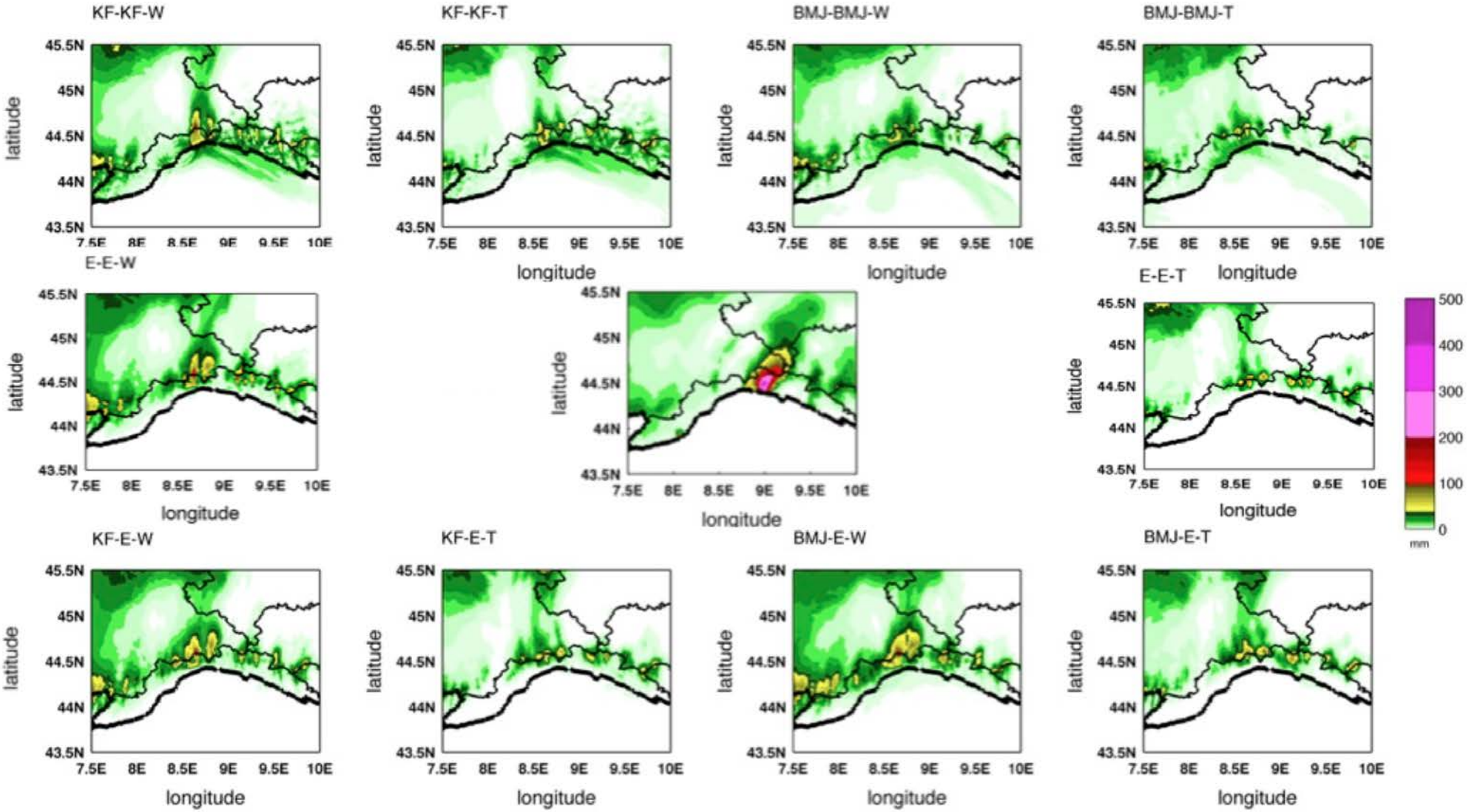


WRF (v 3.3.1) model settings:

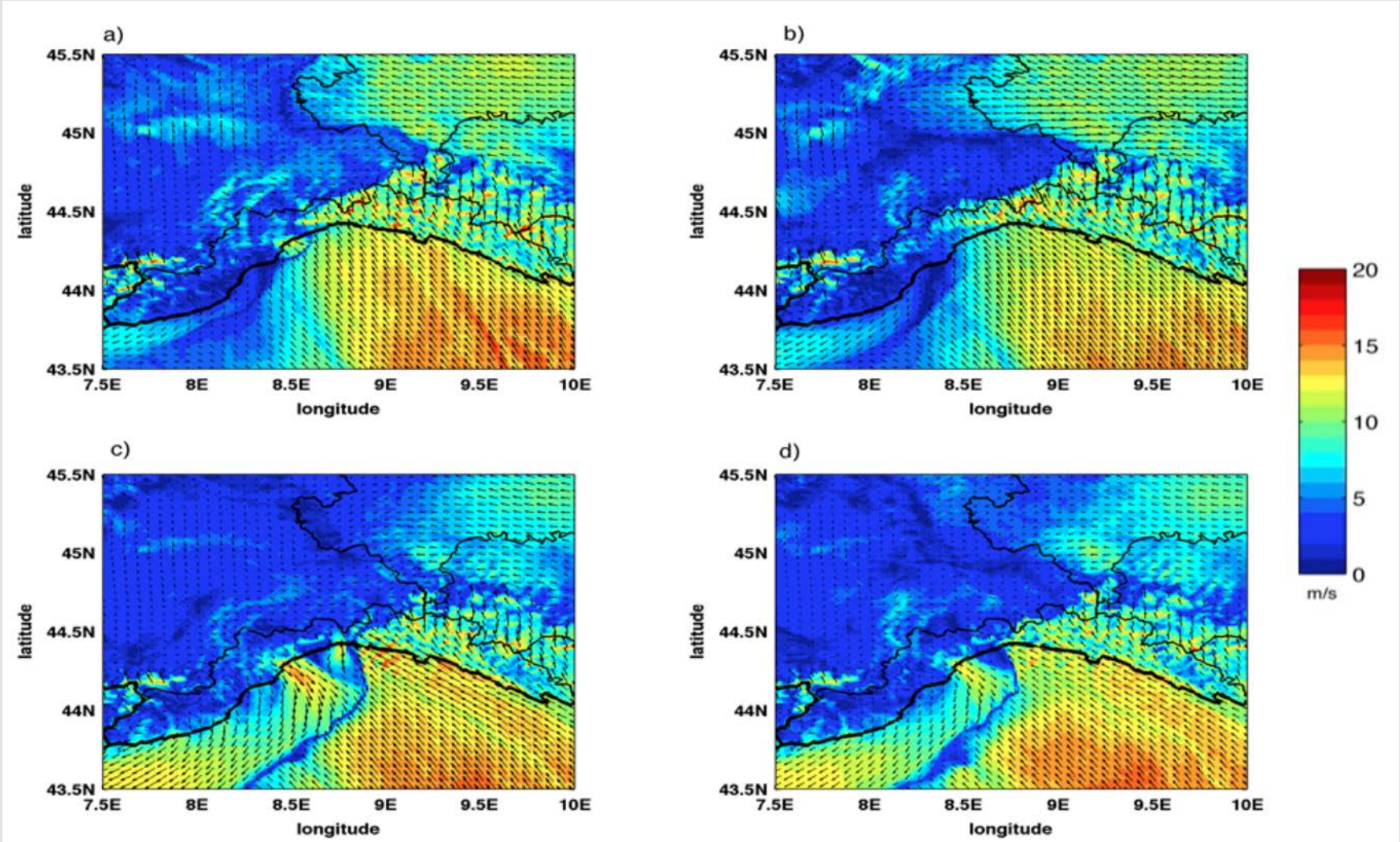
domains d01 (dx=dy= 5 km) and d02 (dx=dy= 1km) adopted for WRF simulations

Member	Cumulus scheme d01	Cumulus scheme d02	Microphysics
KF-KF-W	Kain-Fritsch	Kain-Fritsch	WSM6
KF-KF-T	Kain-Fritsch	Kain-Fritsch	Thompson
BMJ-BMJ-W	Betts-Miller-Janijc	Betts-Miller-Janijc	WSM6
BMJ-BMJ-T	Betts-Miller-Janijc	Betts-Miller-Janijc	Thompson
KW-E-W	Kain-Fritsch	Explicit	WSM6
KW-E-T	Kain-Fritsch	Explicit	Thompson
BMJ-E-W	Betts-Miller-Janijc	Explicit	WSM6
BMJ-E-T	Betts-Miller-Janijc	Explicit	Thompson
E-E-W	Explicit	Explicit	WSM6
E-E-T	Explicit	Explicit	Thompson

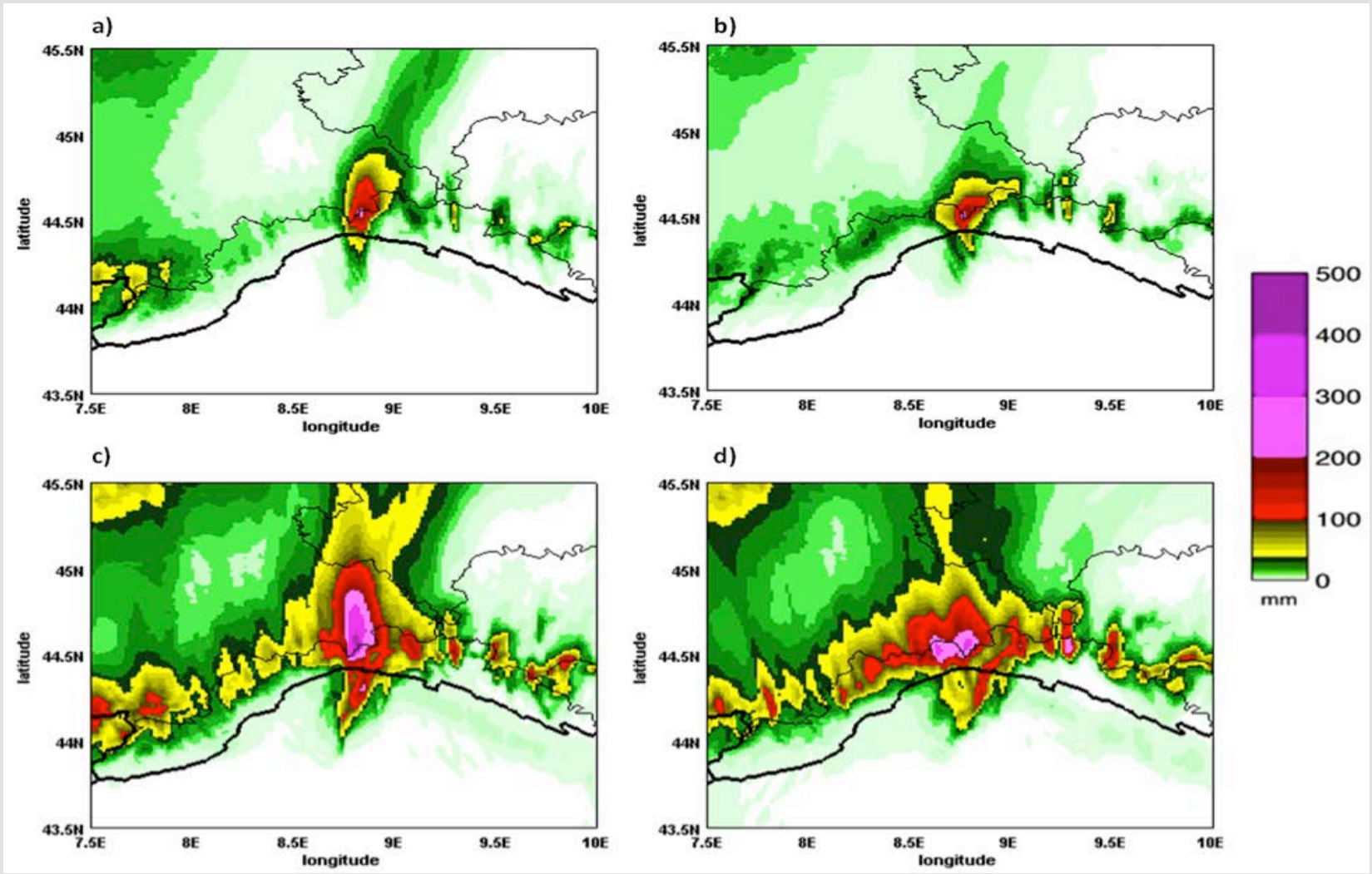
The grid spacing ranges between 5-1 km should make the model able to resolve explicitly, albeit crudely, many convective processes. More studies have investigated numerical simulations at the so-called "grey-zone" resolution (Gerald, 2007) to understand if convective parameterization is still able to work correctly on those scales. It is still an open question (Yu and Lee, 2010).



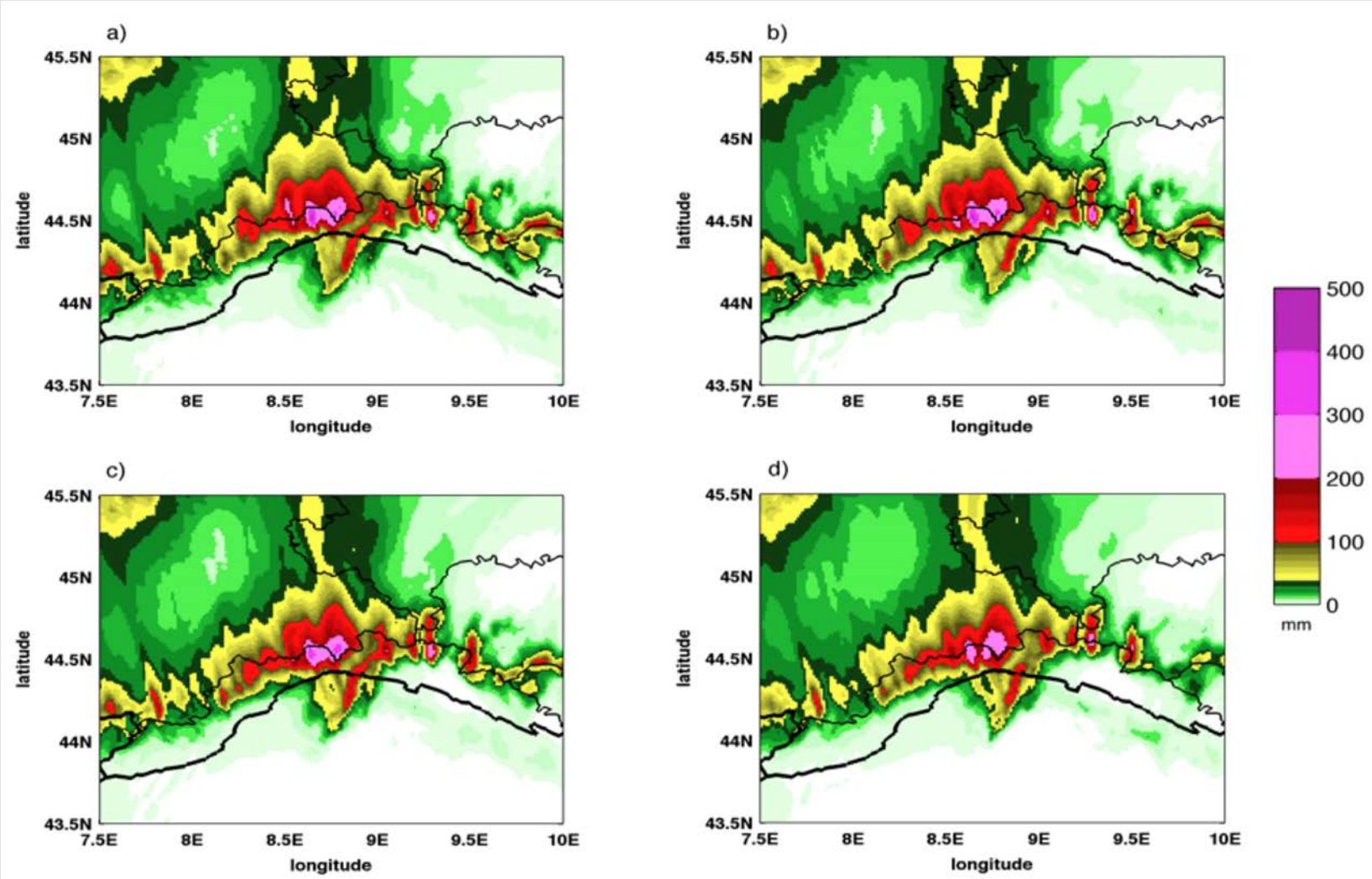
Rainfall depth from 09UTC to 15UTC on November 4th 2011. First line from left to right: KF-KF-W, KF-KF-T, BMJ-BMJ-W, BMJ-BMJ-T. Middle line: from left to right E-E-W, observed rainfall depth, E-E-T. Third line from left to right: KF-E-W, KF-E-T, BMJ-E-W, BMJ-E-T.



Wind field prediction at 10m on November 4th, at 12 UTC, 1 km grid spacing. Panels a) and b) refer to E-E-W and E-E-T settings (28 vertical levels), with IC and BC from IFS model – November 3rd 12 UTC. Panels c) and d) refer to E-E-W and E-E-T settings (28 vertical levels), with IC and BC from IFS model – November 4th 00UTC.



QPF on November 4th, 1 km grid spacing, 28 vertical levels , IC and BC from IFS model (run on November 4th 00UTC). First line: QPF 09-15 UTC on November 4th with panels a) E-E-W and b) E-E-T settings. Second line: daily QPF on November 4th with panels c) E-E-W and d) E-E-T settings



QPF on November 4th, 0-24UTC, 1 km grid spacing, E-E-T setup with 84 vertical levels and IC and BC from IFS model – November 4th 00UTC. Panels a) refers to $Nt_C=25*10^6$ m^{-3}, b) to $Nt_C=50*10^6$ m^{-3}, c) to $Nt_C=100*10^6$ m^{-3}, and d) to $Nt_C=500*10^6$ m^{-3}.

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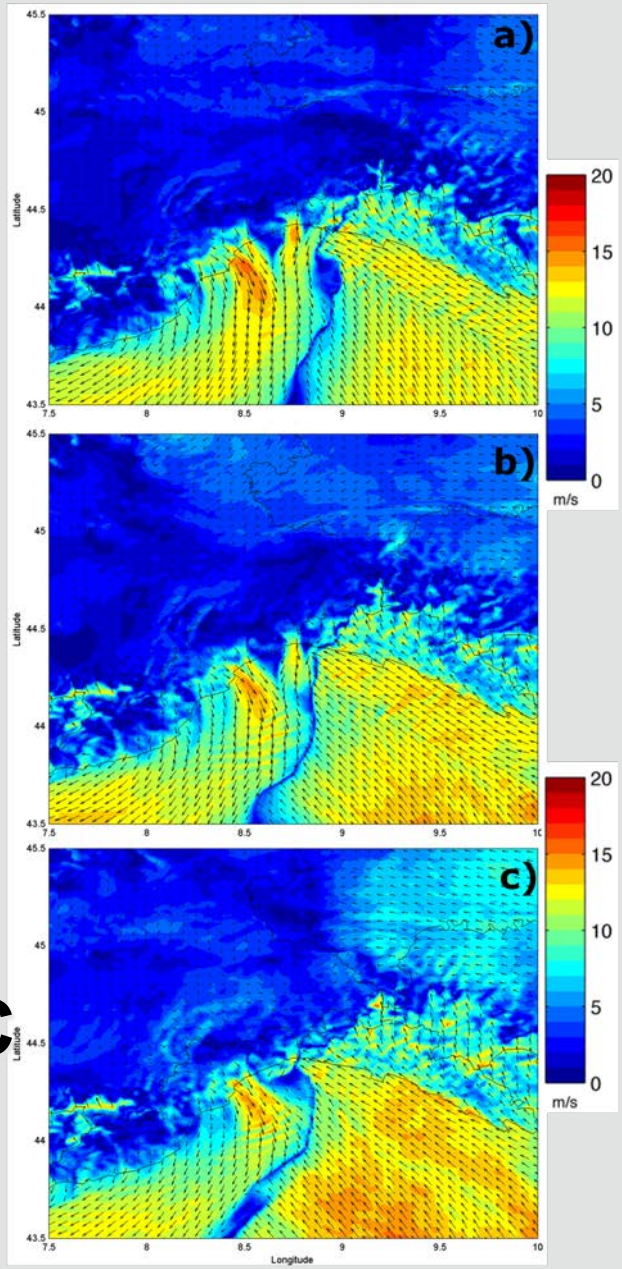
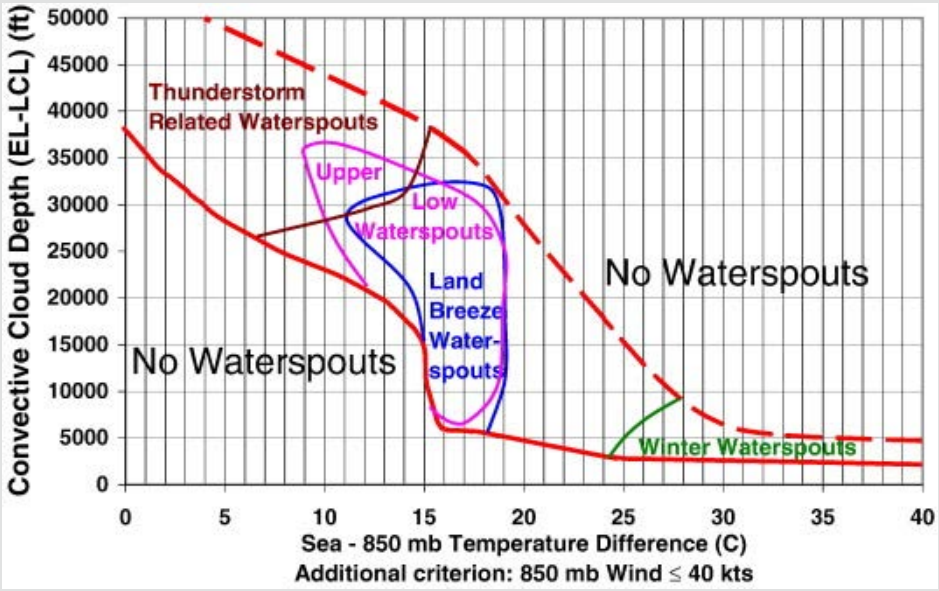
6 UTC

9 UTC

12 UTC



Rain wrapped Tornado/Waterspout taken from Sant' Ilario -GE- looking SW on Nov. 4th at 12.30 PM and 12.35 PM



Keul, A. G., Sioutas, M.V., & Szilagyi, W. (2009). Prognosis of central-eastern Mediterranean waterspouts. Atmospheric Research, 93(1), 426-436.

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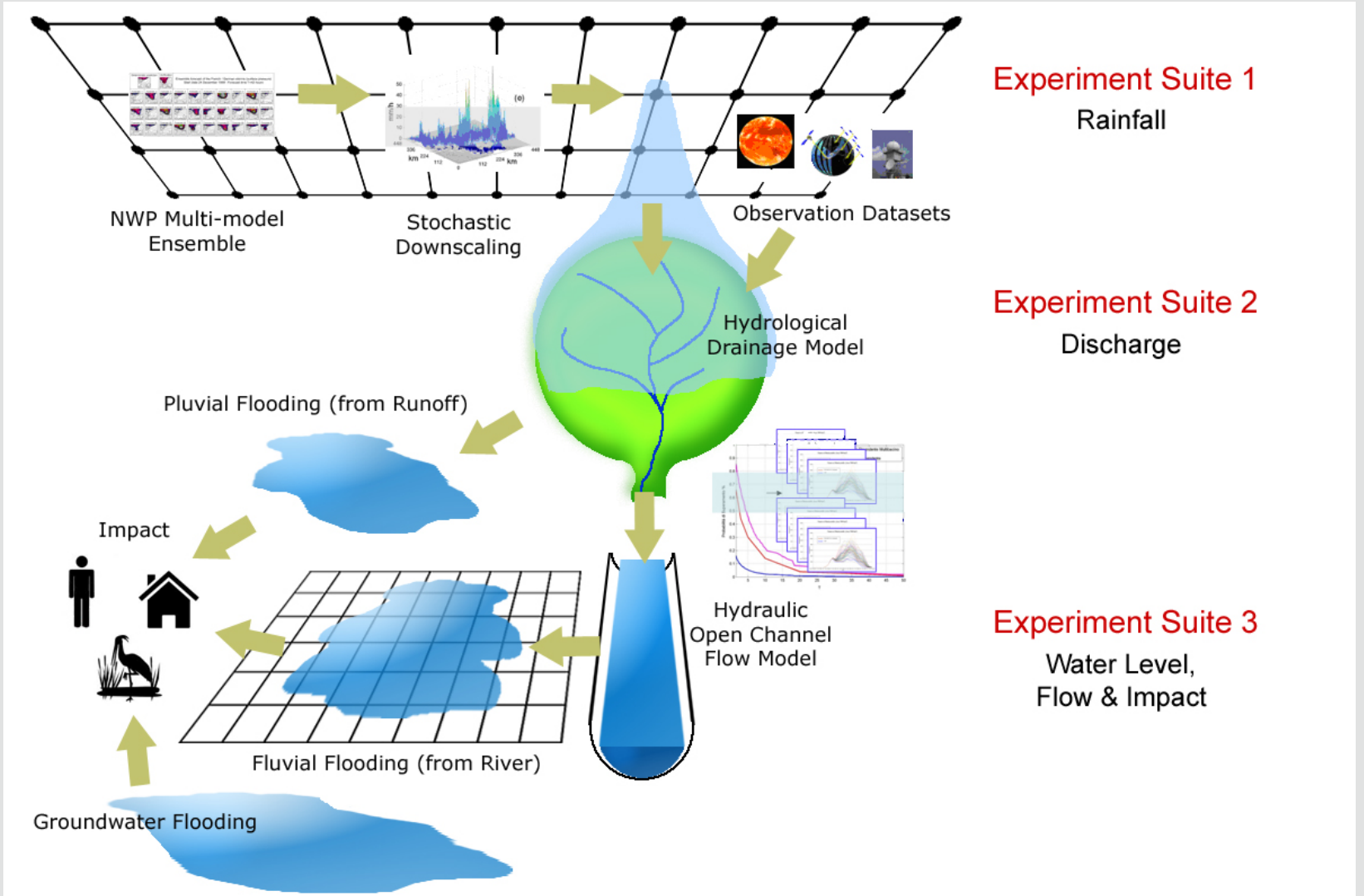
DRIHM EXPERIMENT SUITES



Experiment Suite 1
Rainfall

Experiment Suite 2
Discharge

Experiment Suite 3
Water Level, Flow & Impact

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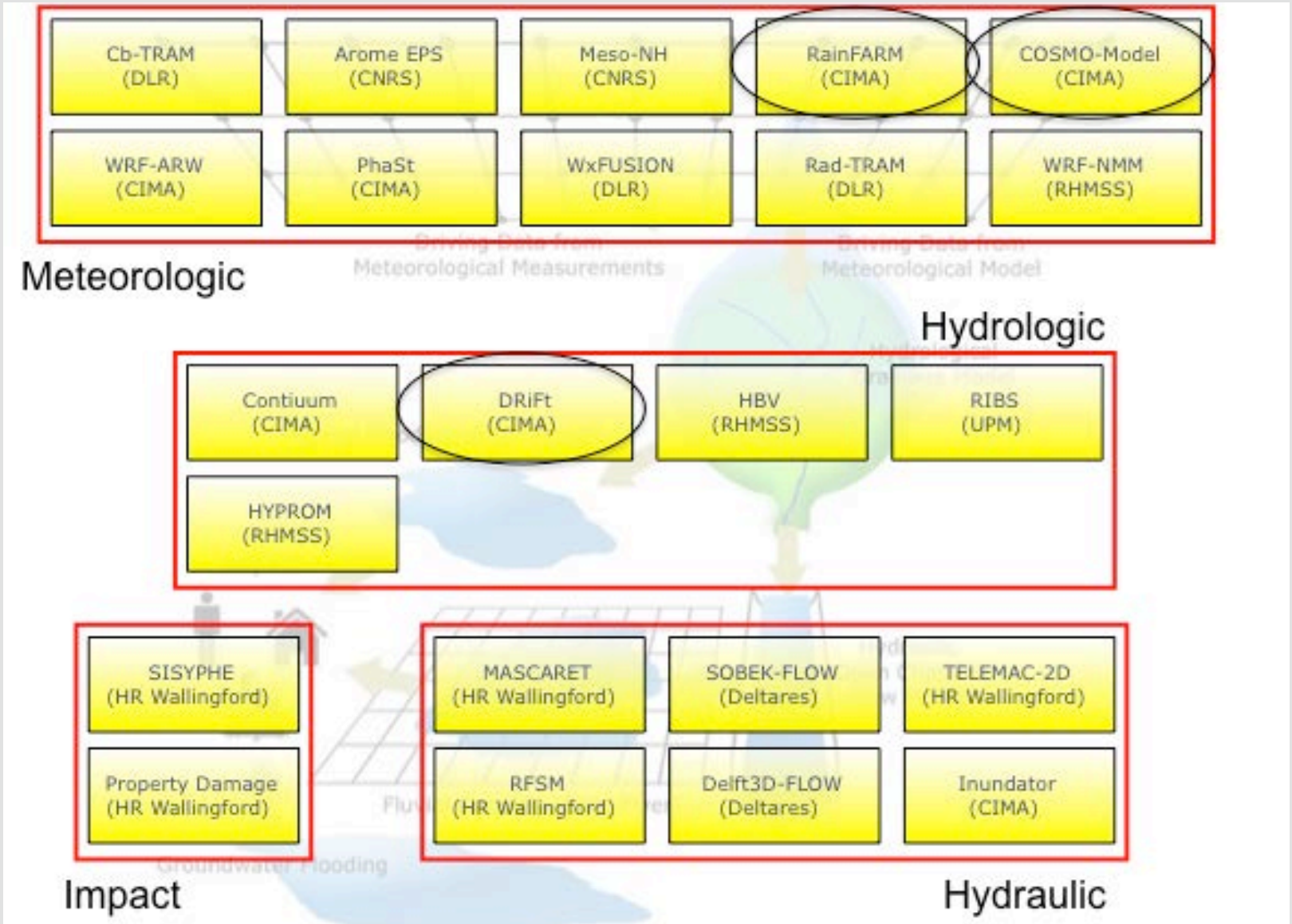
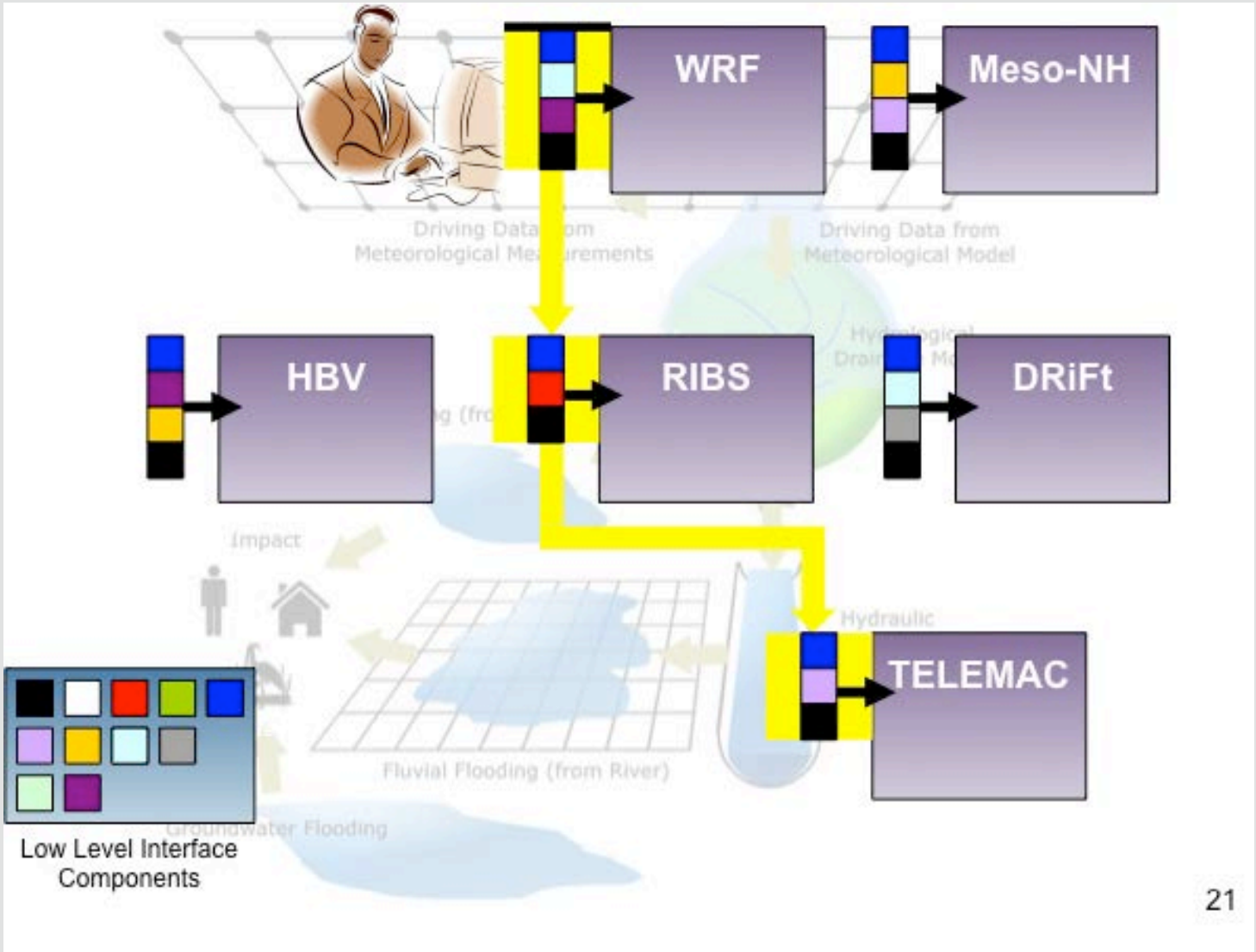
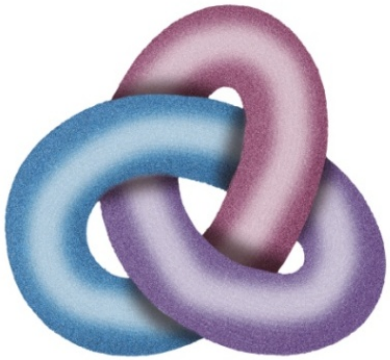


DRIHM Unified Interface Concept





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Discussion