

Fifteen Years of Collaboration; Twenty-Five Years of Timeseries: the Solid Earth Science ESDR System (SESES)

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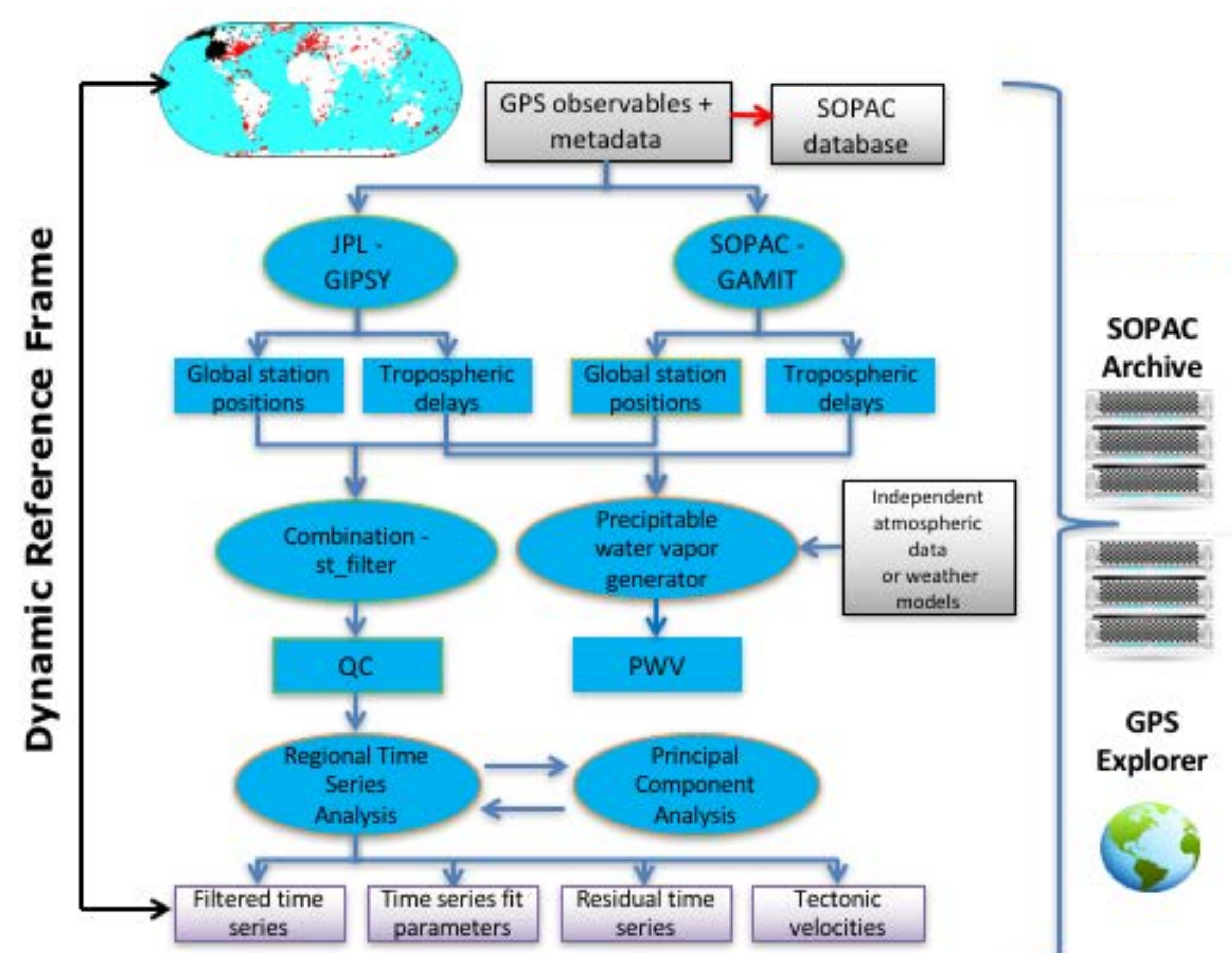
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Abstract JPL and SIO have enjoyed 15+ years of timeseries collaboration from 2003, spanning 3 competitive awards under NASA's Research, Education, and Applications Solutions Network (REASoN) and Making Earth System Data Records for Use in Research Environments (MEASURES) programs. The Solid Earth Science ESDR System (SESES) project produces and disseminates mature, long-term, calibrated and validated, GNSS based Earth Science Data Records (ESDRs) that encompass multiple diverse areas of interest in Earth Science, such as tectonic motion, transient slip and earthquake dynamics, as well as meteorology, climate, and hydrology. Using a unified metadata database and a combination of GNSS solutions generated by two independent analysis centers, the project currently produces several long-term ESDR's:

- Geodetic Displacement Time Series: Daily, combined, cleaned and filtered, trended and detrended GIPSY and GAMIT long-term time series of continuous GPS station positions (global and regional), automatically updated weekly.
- Geodetic Velocities: Weekly updated velocity field + velocity field histories in various reference frames; compendium of all model parameters including earthquake catalog, coseismic offsets, and postseismic model parameters (exponential or logarithmic).
- Residual Series: The residuals of the displacement time series with the model having been removed.
- Troposphere Delay Time Series: Long-term time series of troposphere delay (30-min resolution) at geodetic stations, necessarily estimated during position time series production and automatically updated weekly.
- Precipitable Water Vapor Time Series: Available for stations with onsite meteorological instruments.
- Seismogeodetic records for historic earthquakes: High-rate broadband displacement and seismic velocity time series combining 1 Hz GPS displacements and 100 Hz accelerometer data for select large earthquakes and collocated cGPS and seismic instruments from regional networks.

These products are available from the GPS Explorer portal at <http://geoapp.ucsd.edu>, as well as NASA's Crustal Dynamics Data Information System (CDDIS) Data Archive and Analysis Center (DAAC) at https://cddis.nasa.gov/Data_and_Derived_Products/GNSS/SESES_time_series_products.html

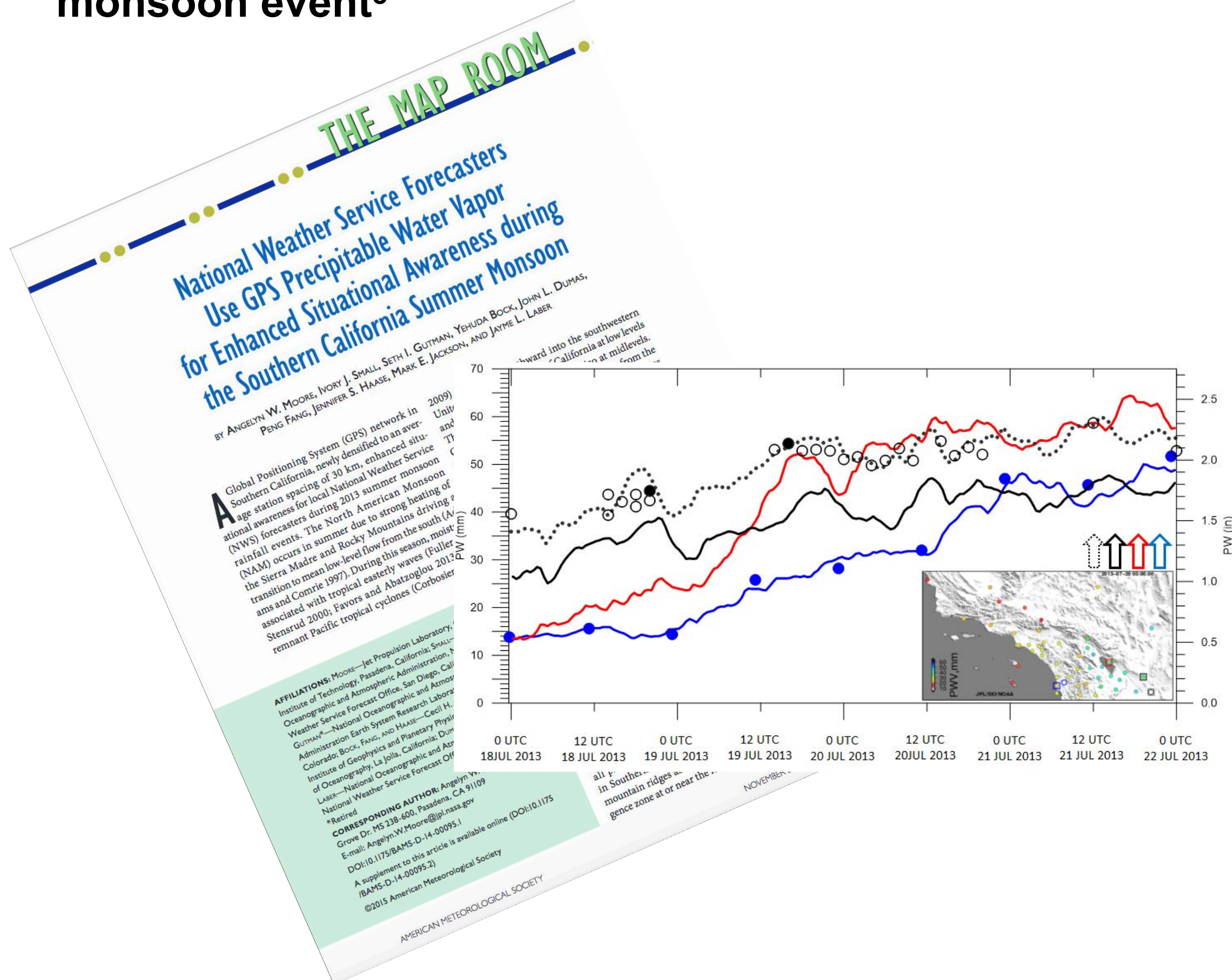
Our project's Earth Science Data Records (ESDRs)



Each week, JPL and SIO independently analyze the GPS station data with uniform metadata. The entire series are combined and modeled. The model is used to generate true-of-date coordinates as a priors for the next week's analysis. In this way, large adjustments from the nominal positions give us automatic quality assessment, alerting us to potential model or data issues. High-rate seismogeodetic displacements are also produced for major earthquakes.

SESES ESDR usage profile:

Retrospective study of a southern California summer monsoon event³



SESES ESDR usage profile:

Fault geometry determination from geodetic slip rates¹



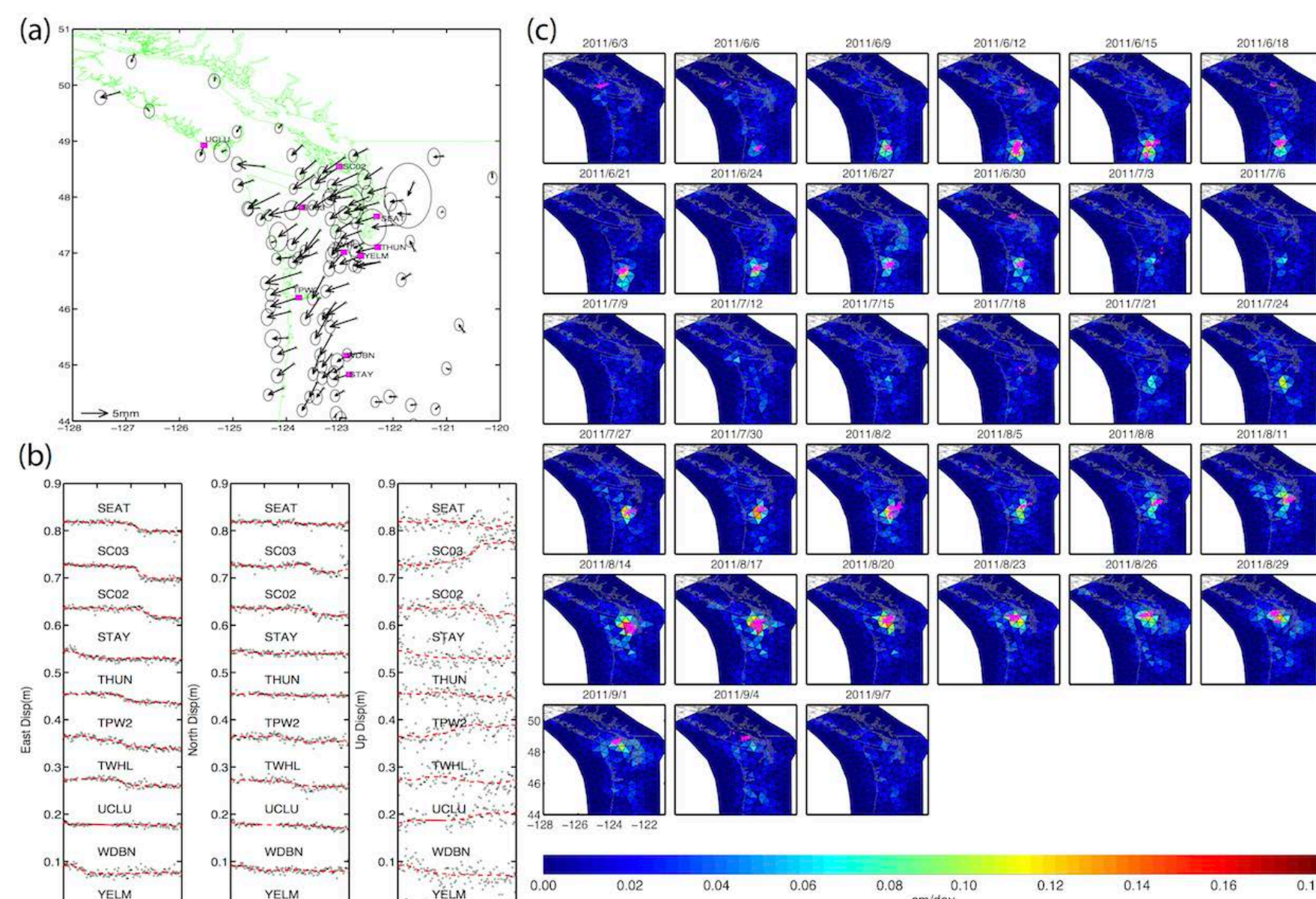
SESES ESDR usage profile:

Changes in water resources across California's physiographic provinces



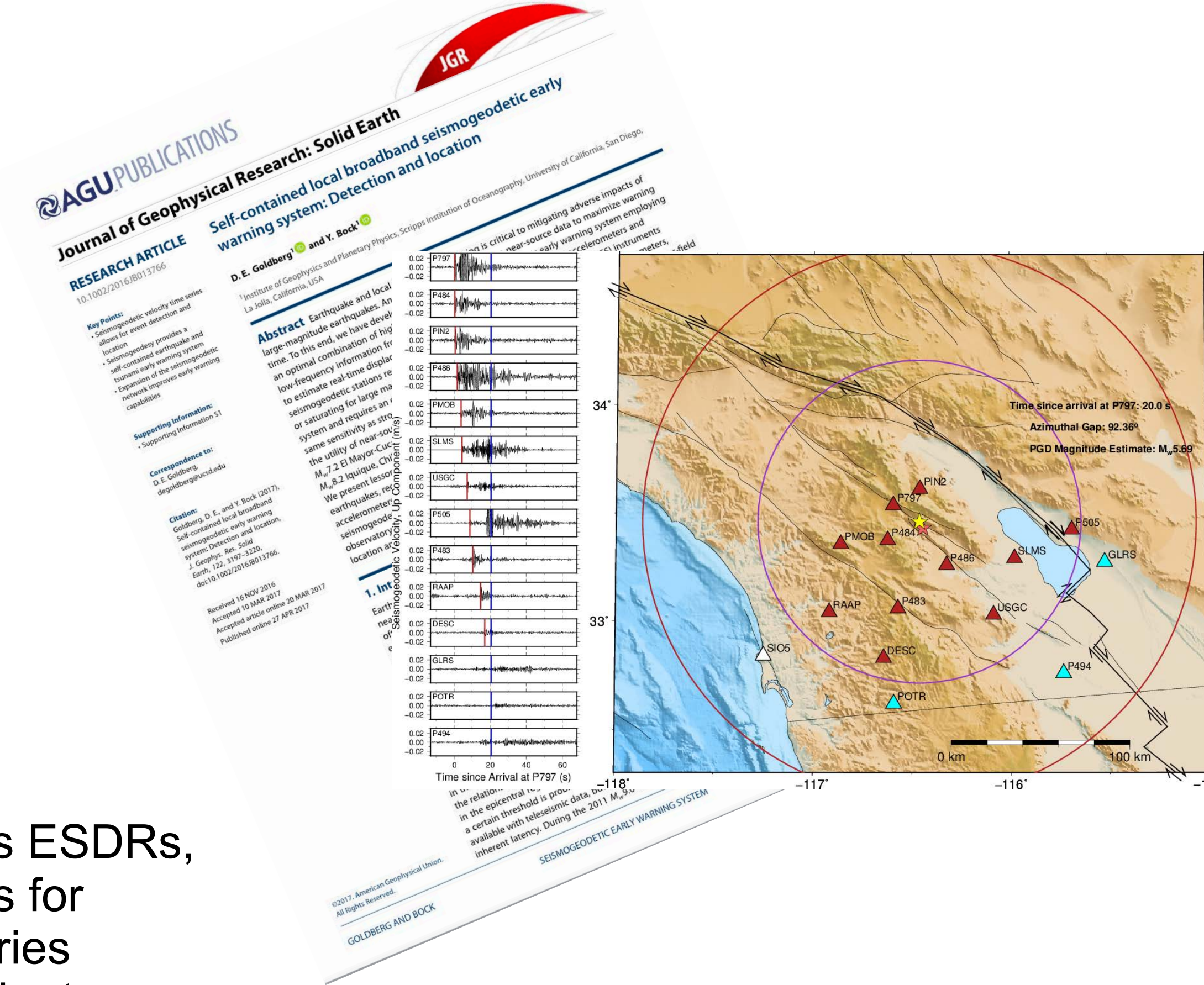
SESES ESDR usage profile:

A transient slip study that uses the combined position time series to unravel "tremor-less" slow tectonic transient events^{4,5}



SESES ESDR usage profile:

Modeled timeseries provide a priori positions for real-time analysis⁶



Future plans

We plan to continue the timeseries ESDRs, and hope to introduce new ESDRs for

- High-rate displacement time series
- Plate Boundary Aseismic Transients
- Change in total water storage

References

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