Pattern Mining: Monitoring Ocean Eddies
- Spatio-temporal pattern mining using novel multiple object tracking algorithms
- Created an open source data base of 20+ years of eddies and eddy tracks

Extremes and Uncertainty: Heat waves, heavy rainfall
- Extreme value theory in space-time and dependence of extremes on covariates
- Spatiotemporal trends in extremes and physics-guided uncertainty quantification

Network Analysis: Climate Teleconnections
- Scalable method for discovering related graph regions
- Discovery of novel climate teleconnections
- Also applicable in analyzing brain fMRI data

Sparse Predictive Modeling: Precipitation Downscaling
- Hierarchical sparse regression and multi-task learning with spatial smoothing
- Regional climate predictions from global observations

Highlights:
- Highly inter-disciplinary
  - Computer science, hydrology, Earth sciences, statistics, civil engineering
  - ~100 publications (journals, conferences, and workshops) with authors from multiple disciplines
  - Public release of software & data products
  - Advances in computer science driven by Earth science applications
  - Advances in Earth sciences using computer science methods
  - Development of physics-guided data mining paradigm

Relationship mining: Seasonal hurricane activity
- Statistical method for automatic inference of modulating networks
- Discovery of key factors and mechanisms modulating hurricane variability
NSF Expeditions in Computing:

**Understanding Climate Change: A Data-driven Approach**

Sample of Education and Outreach Activities

Engagement with UNEP, IPCC and World Economic Forum and wider climate science and impact community

**Application to Climate: Meningitis Problem over West Africa**

**Education**

**Professional Science Master’s degree program in Climate Change & Society**

**Nurturing a “Climate Informatics” Community**

“Climate change research is now ‘big science,’ comparable in its magnitude, complexity, and societal importance to human genomics and bioinformatics.” *(Nature Climate Change, Oct 2012)*

**Annual Workshop**

Attended by ~ 100 researchers from multiple disciplines

**Workshops and sessions in climate & computer science venues**

**Special Issue:**  
*Physics Driven Data Mining*  
Heavy involvement of Expedition team as authors and guest co-editors in collaboration with leads of the IPCC AR5 and US National Climate Assessment