SMAP: Military and Defense Data Users

Dr. Robert E. Davis

US Army Engineer Research and Development Center

Soil Moisture Active-Passive (SMAP) Mission

Hyatt Hotel

1325 Wilson Boulevard

Arlington, VA 22209

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Review NASA's Purview

(1) To evaluate the science that can be accomplished by the SMAP mission as described by the NRC Decadal Study.

(2) Articulate clarifications of design or intent that might be required due to the brevity with which the Decadal survey described the mission

(3) To describe what other measurements from research or operational satellites are necessary to achieve the science expected of the SMAP mission.

Summary of Military and Defense Applications

<u>Air Force Weather Agency</u>: Initialize Numerical Weather Prediction (NWP) Model

- Aviation Weather,
- Severe Weather and Fog Forecasts
- Input into Dust Transport Model (DTM)
- Target Acquisition Weapons Software (TAWS)

<u>Army Research Laboratory, G-2, Engineer R&D Center, Marine Corps</u>:

- Cross Country Mobility (CCM, NRMM)
- Integrated Weather Effects Decision Aid (IWEDA)
- Battlespace Terrain Reasoning & Awareness (BTRA)
- Opportune Landing System (OLS: Joint w/ USAF)

<u>Naval Ice Center:</u>

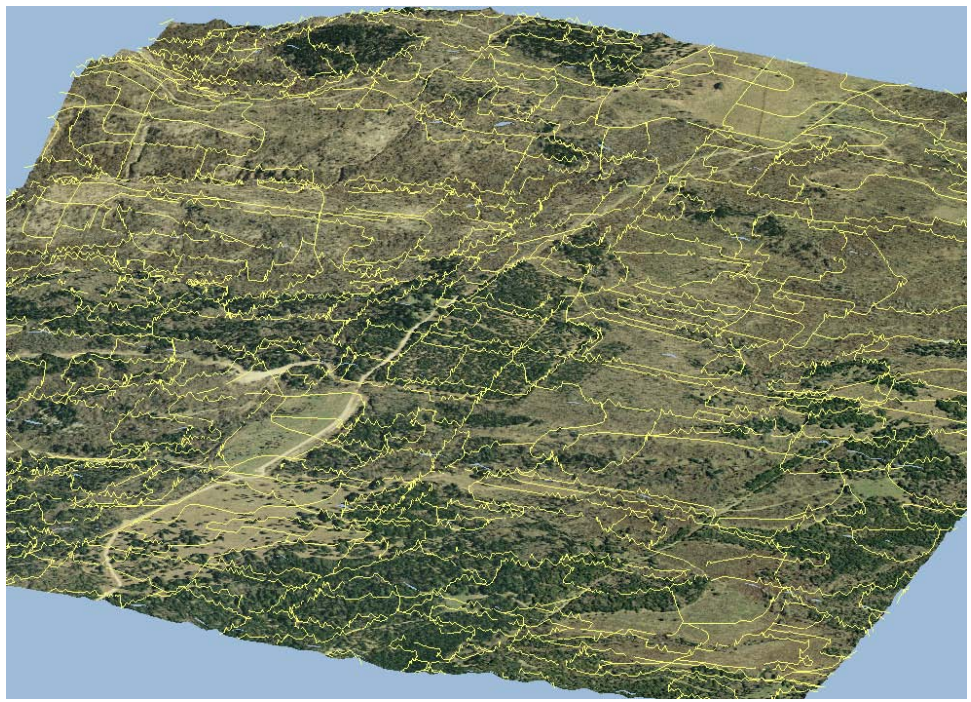
- High Resolution Mapping of Marine and Littoral Ice Cover and Ice Characteristics

Geospatial Research & Engineering

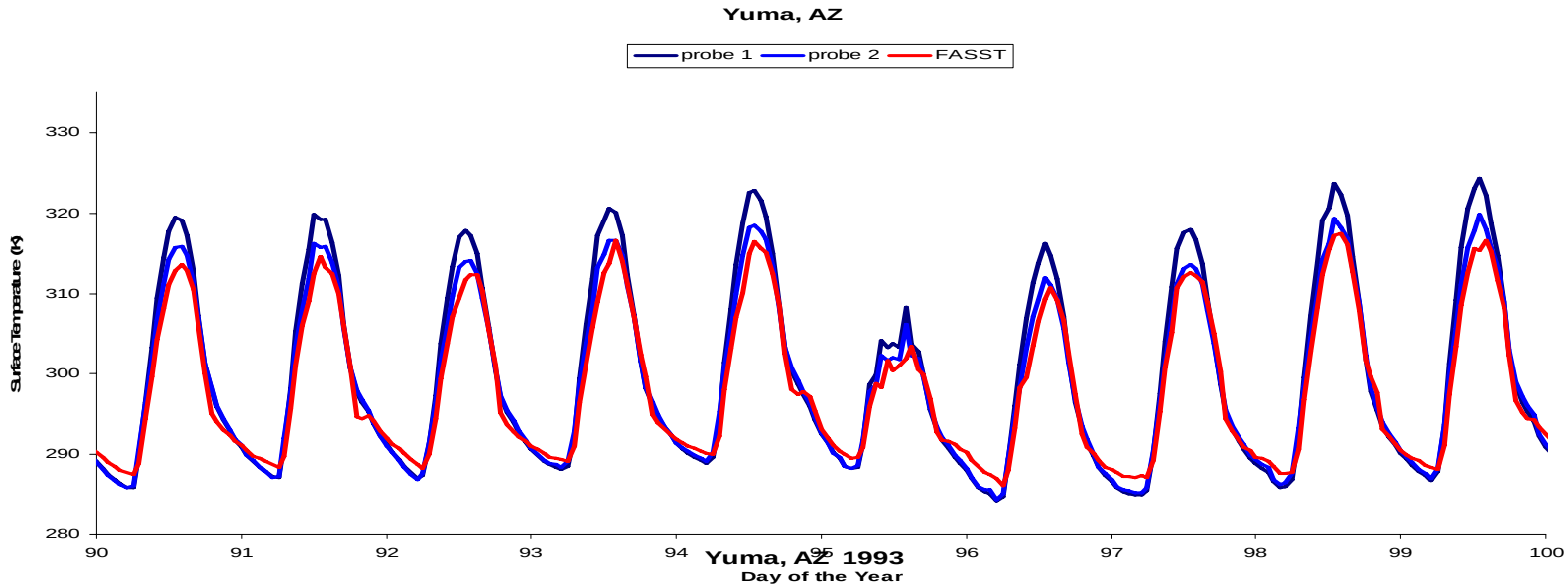
OBJECTIVE: To increase the agility of Battle Command and the Military Decision Making Process (MDMP) … through the effective characterization and application of geo-environmental data, information and knowledge … across the greatest extent of the force … addressing the full spectrum of employment

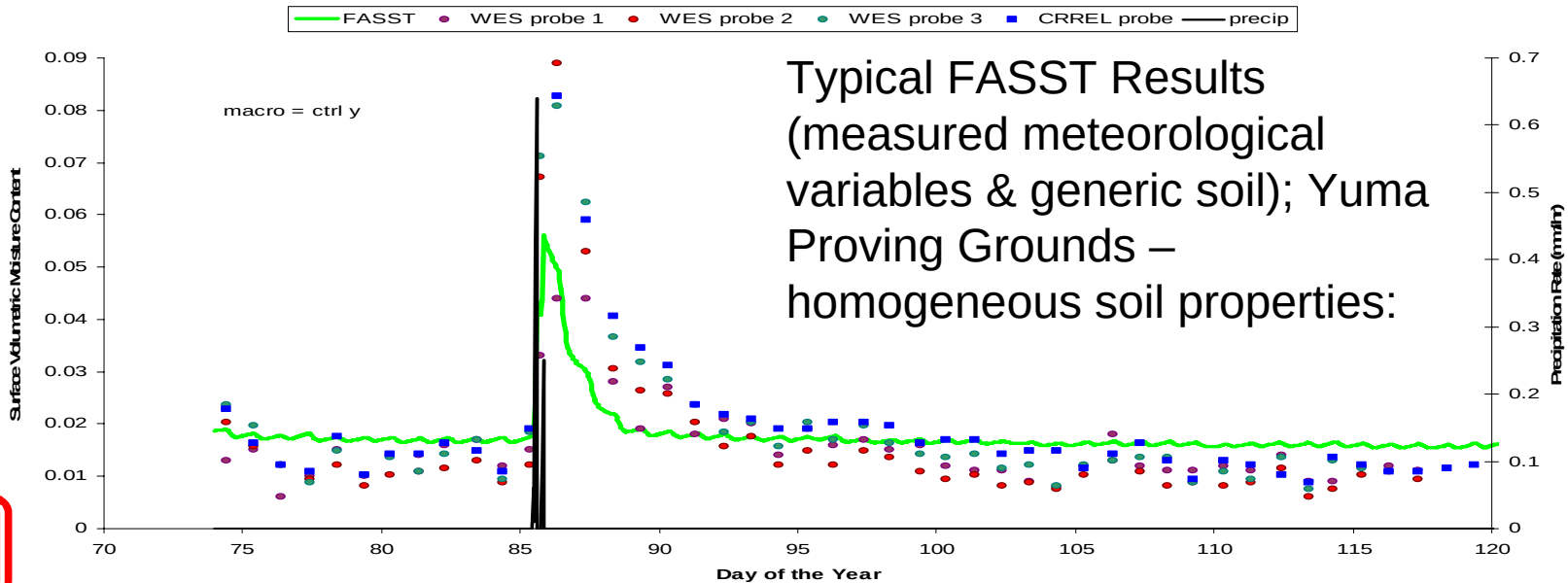
SOIL MOISTURE MODELING / FORECASTING

- **Implementation: Technical Preparation of the Battlepsace**
  - 1D thermal model - FASST: full energy balance approach similar to NOAH.
  - terrain segmentation based on polygons, with finer differentiation over military-relevant terrain types.
  - input meteorology from the Army's Integrated Meteorological System (meso-grid size) looks out 48 h.



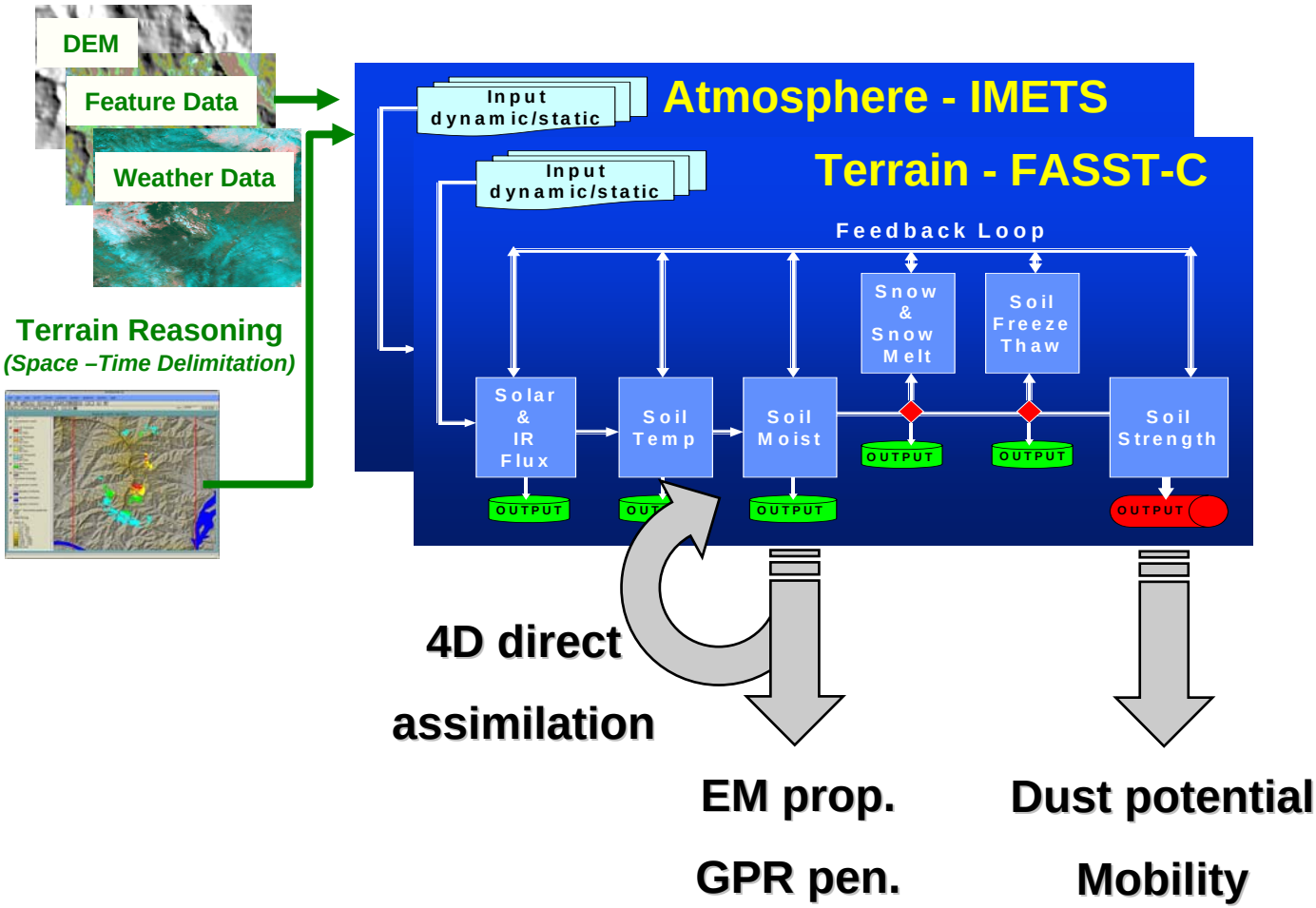
SOIL MOISTURE MODELING





Typical FASST Results (measured meteorological variables & generic soil); Yuma Proving Grounds – homogeneous soil properties:

Concept of Operation



Technical Readiness

- **Soil moisture, 1-D local polygon scale.**
  - Model, physics validation, IOT&E: TRL = 6.
  - Estimation over human-impacted surfaces: TRL = 4.
  - Lateral transport effects, transport parameterization: TRL = 2.
- **Soil moisture, multi-polygon scale.**
  - Centralized v. local computation: TRL = 4.
  - Conservation of mass, energy and lateral effects: TRL = 4.
  - Downscaling from mesogrid, uncertainty est.: TRL = 3.
- **Soil Strength – Mobility/EM propagation.**
  - Vehicle-based speed estimates: TRL = 6.
  - Dust susceptibility under impinging jet: TRL = 2.
  - Tracking of uncertainty over cascading serials: TRL = 2.
  - System of system estimation of risk: unstarted

Summary

- **Military and defense users remain focused on tactical scales for terrestrial applications.**
  - A host of science challenges, from fundamental to applied remain.
  - Data assimilation from remote sensing observations remains as most viable for semi- and non-permissive areas of operation

- **Military and defense users have primary concern in operational systems**
  - SMAP offers a potential to explore technology approach and data application
  - Long term interest remains in operational sensing

- **Support and sustainment operations will likely have more need for soil moisture and other Earth surface products than combat operations.**