

## NASA RESEARCH PRIORITIES

## SCIENTIFIC RETURN

**Earth System Variability & Trends:** How are global precipitation, evaporation, and the cycling of water changing?

**Earth System Responses & Feedback Processes:** How can climate variations induce changes in the global ocean circulation?

**Aquarius Salinity Measurements Will Provide the Missing Parameter that Links Two Major Climate System Components:**

**Global Water Cycle**  
Precipitation  
Evaporation  
Ice Freeze/Melt  
Land Runoff

**Ocean Circulation**  
Surface Height  
Barrier Layers  
El Niño/La Niña  
Thermohaline Flow

Change  
Impact  
Water Flux  
Seawater Density

86% of evaporation & 78% of precipitation occur over the ocean, dominating the water cycle

**Aquarius**  
**Sea Surface Salinity (SSS)**  
Measured in practical salinity units (PSU)

Changes in global ocean circulation and heat transport have lasting climate impact

- Salinity responds to changes in the surface water fluxes and, in turn, alters the surface density field that drives ocean currents
- Observing ocean salinity is the only way to measure how water cycle changes affect the ocean & its circulation

**Aquarius Science Goal** – To understand the regional and global processes that couple changes in the water cycle and ocean circulation and influence present and future climate.

### Science Objectives:

#### Seasonal cycle & year-to-year variability

#### Discovery & Exploration

Salinity mapping of unmeasured regions & features unknown to science

#### Water Cycle

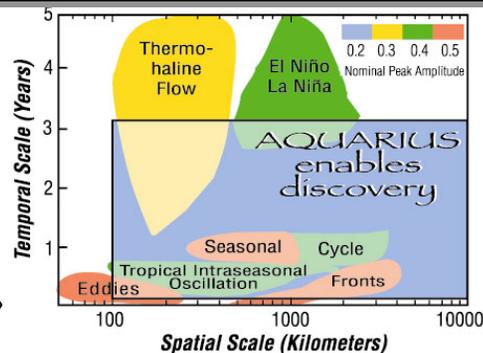
Salinity response to surface water fluxes

#### Ocean Circulation & Climate

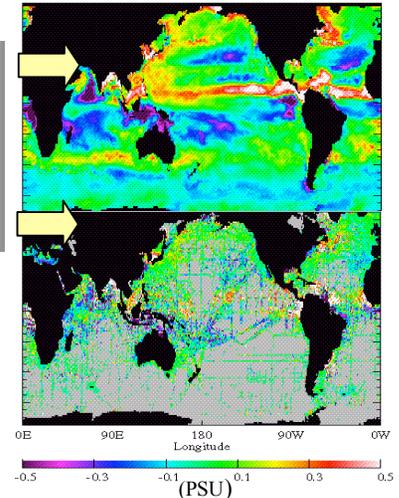
- **Tropics** Climate feedback processes, El Niño, La Niña
- **Mid-Latitudes** Subduction and mode water formation
- **High-Latitudes** Deep water formation processes

### Aquarius Measurement Objectives:

Resolve key ocean and climate phenomena at 100 km and larger spatial scales, monthly and longer time scales.



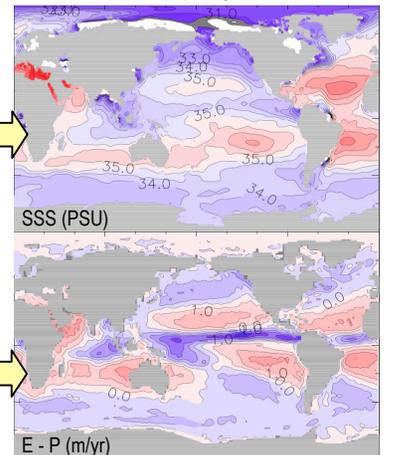
**Aquarius** will show details of global SSS variability, shown with this March-April-May map from an ocean model. Compare with lower map that shows all historical data for March-April-May.



### Aquarius will aid understanding of:

- Seasonal cycle & mixing in climate models
- Salinity transport by currents
- Ocean state & freshwater budget
- SSS impact on tropical climate models & El Niño
- SSS impact on ocean subsurface dynamics
- Ice-ocean interaction
- Processes that keep the Atlantic relatively salty

**Surface salinity is linked to the water cycle:** Mean SSS is highest where evaporation exceeds precipitation ( $E-P > 0$ ), and is lowest where there is excess precipitation, especially in the tropics



### It's the right time for Aquarius:

- Global array of profiling floats will follow surface salinity and density response at depth
- **Aquarius** will complete a satellite-based climate observing system (i.e., rain, wind, sea level, sea surface temperature)

