Coupling Diagrams

NATIONAL WEATHER SERVICE

JUNE 6, 2023

GFSv16

NUOPC
Connector

NUOPC
Component

Atmosphere:
FV3

Waves:
WW3
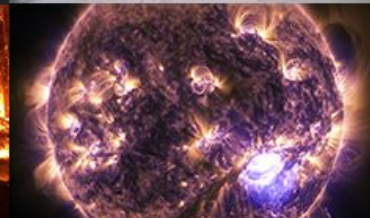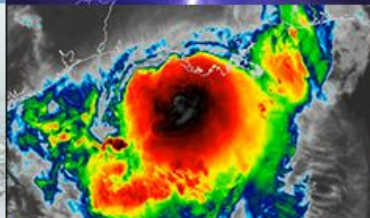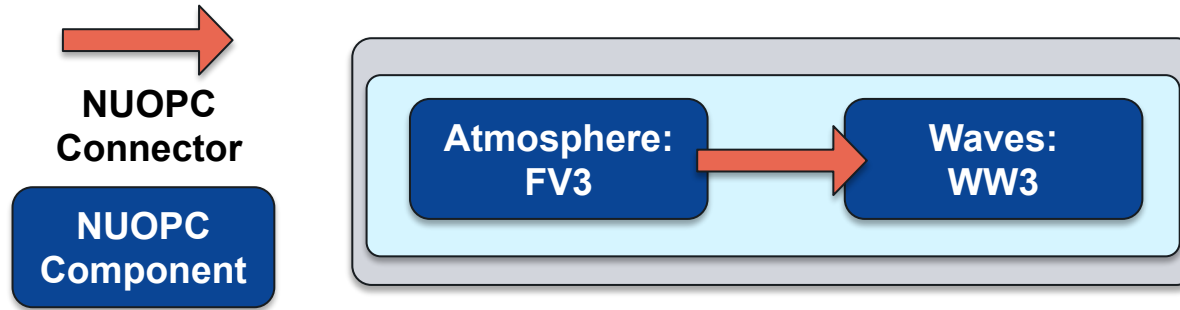
GFSv16: Coupling Diagram

UFS Driver

Atmosphere → **Waves**

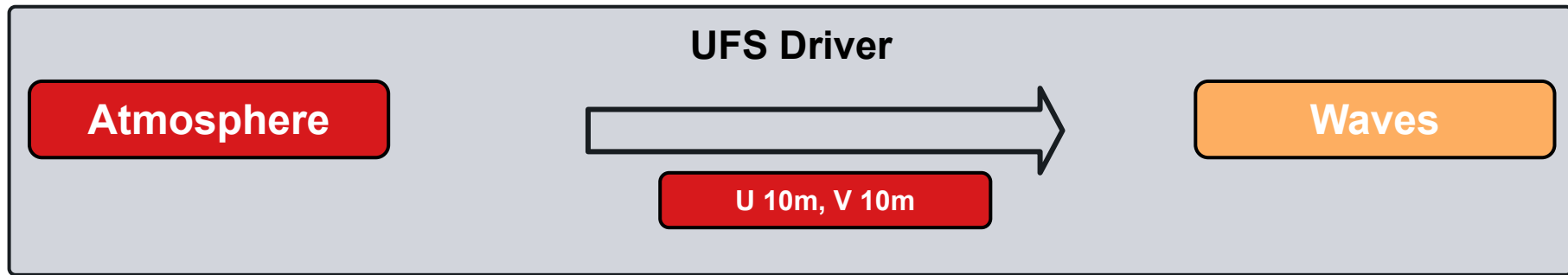**U 10m, V 10m**

- The wave model receives surface currents from RTOFS (Real Time Ocean Forecasting System)
- The wave model uses an ice analysis for ice concentration

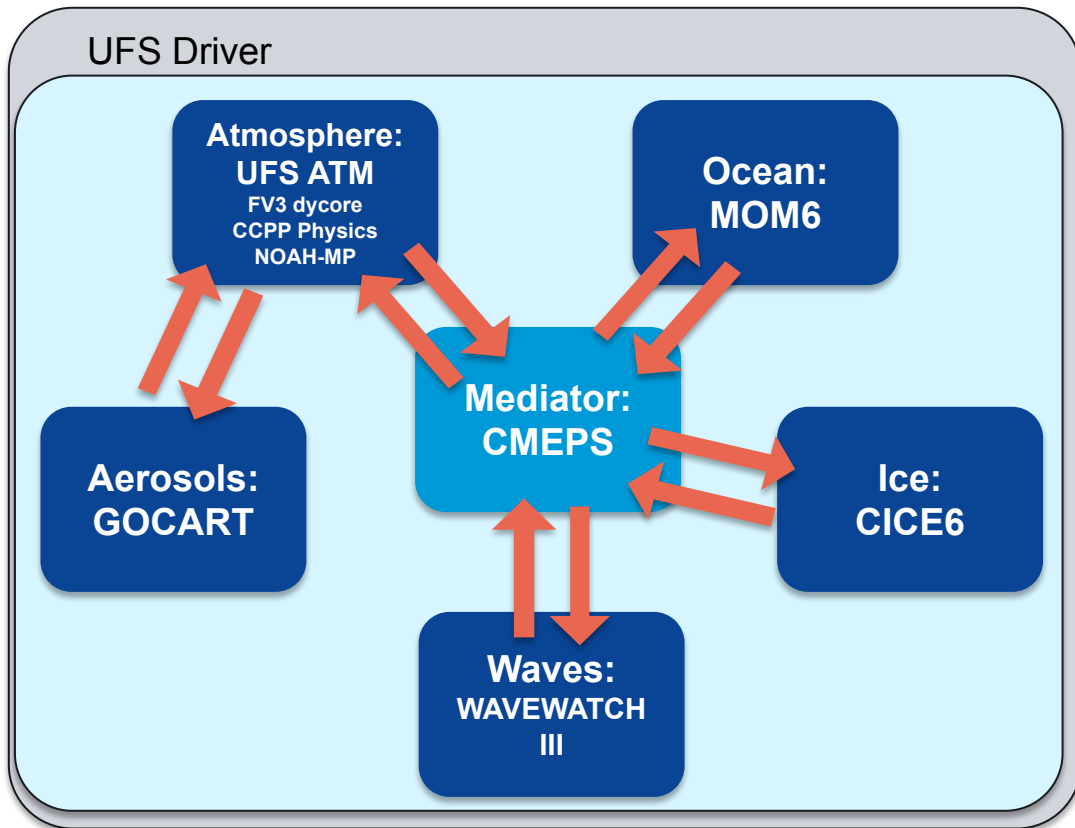# GFSv17 Coupled System Overview

5-way Coupled System

- Atm
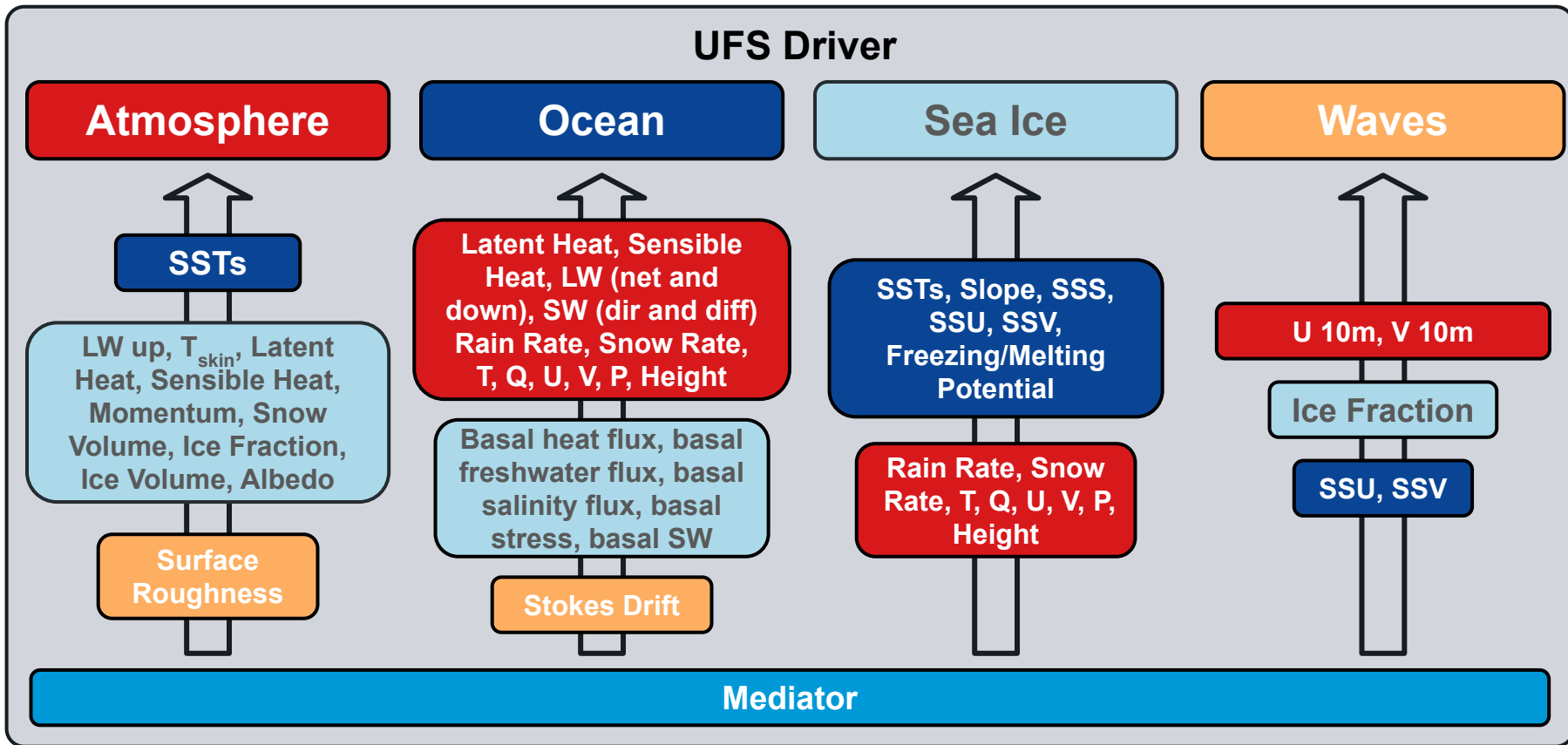- Land
- Ocean
- Ice
- Wave

Aerosol

- Undecided

Coupling Schematic

- In the figure on the next slide, the fields being passed to each model are in color coded boxes from the component that calculates the field.
  - For example, the ocean model in dark blue passes SSU, SSV (u and v components of surface current) to the wave model.

GFSv17: Coupling Diagram

UFS Driver

Atmosphere

SSTs

LW up, T_{skin}, Latent Heat, Sensible Heat, Momentum, Snow Volume, Ice Fraction, Ice Volume, Albedo

Surface Roughness

Ocean

Latent Heat, Sensible Heat, LW (net and down), SW (dir and diff) Rain Rate, Snow Rate, T, Q, U, V, P, Height

Basal heat flux, basal freshwater flux, basal salinity flux, basal stress, basal SW

Stokes Drift

Sea Ice

SSTs, Slope, SSS, SSU, SSV, Freezing/Melting Potential

Rain Rate, Snow Rate, T, Q, U, V, P, Height

Waves

U 10m, V 10m

Ice Fraction

SSU, SSV

Mediator

Coupling with Aerosol Model

- The next slide shows the field exchanges between the atmosphere and aerosol models
  - Feedback to atmosphere:
    - <> are passed back to be transported (advection and diffusion) in the atmospheric model
    - <> undergo wet deposition within microphysics
  - Feedback to atmospheric physics:
    - Direct radiation feedback can be turned on/off with prognostic aerosols

ATM-Aero: Coupling Diagram

UFS Driver

Atmosphere

Latent Heat, Sensible Heat, T, Q, U, V, P, Height, Cloud Frac, PBLH, Area, Rain Rate, Land/Sea Mask, z0, Soil Wetness & Moisture, Friction Velocity, Lake/Ocean/Snow/Ice fraction, Tracer Mass Fraction, 10m U & V

Aerosols

Tracer Mass Fraction, Tracer upward surface flux, tracer downward surface flux

Tracer transport (advection and diffusion) and wet scavenging. Currently a flag for with or without radiative feedback with prognostic aerosols