Modular MATLAB version of 1-D KPP

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Goals

- Completely rewrite 1-D KPP into MATLAB
  - FORTRAN: ~33 for/do loops
  - GOAL: 1 for loop (time step only)
- Make the code modular
  - Easy to change a specific aspect of the model
- Provide significant documentation (or wiki)
- Create a website with code and user forum
  - Ability to post updated code
- Create .m case studies
  - i.e. convective case study, convection.m

Boundary Layer Depth Calculation

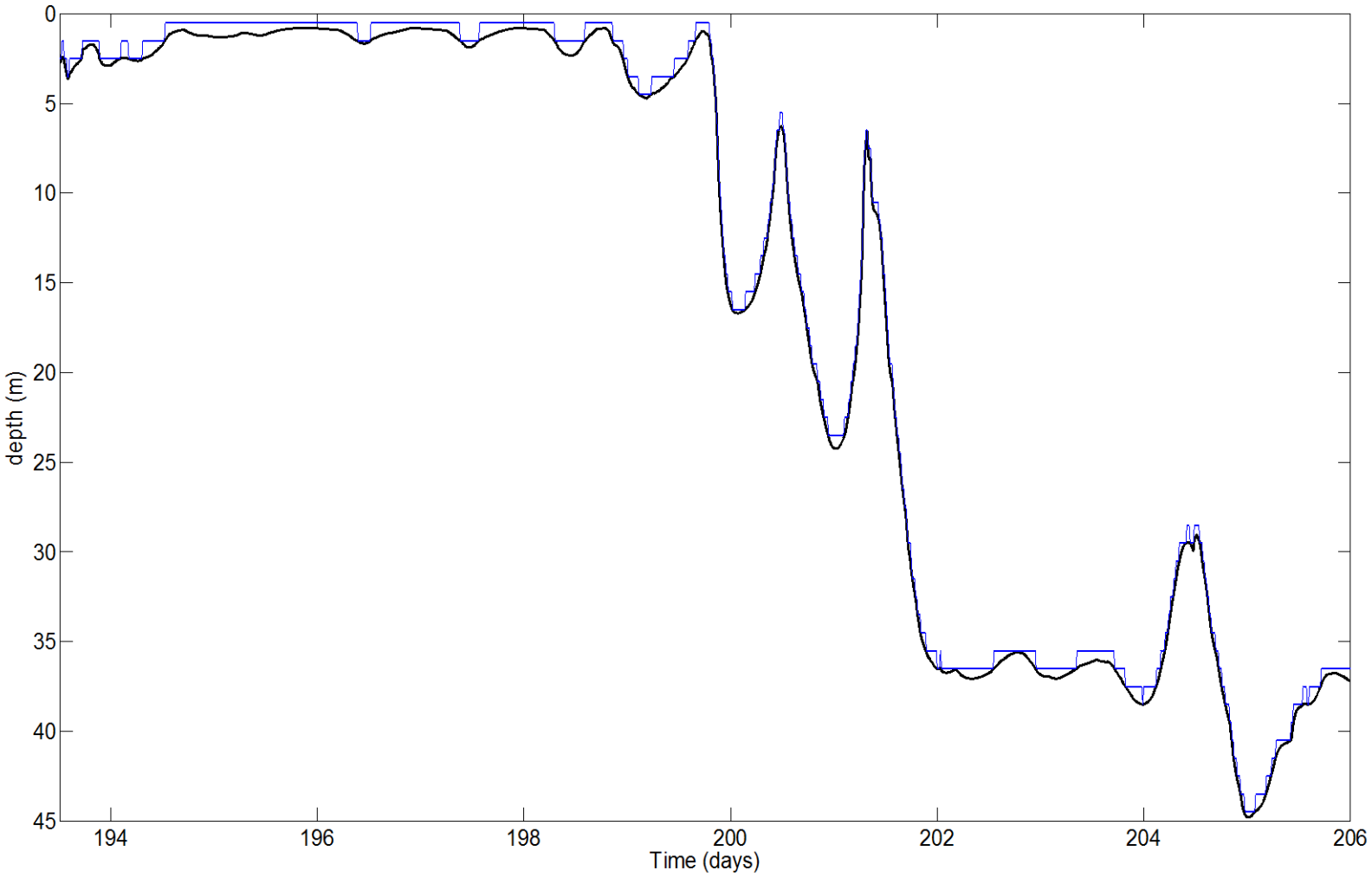
FORTRAN Code

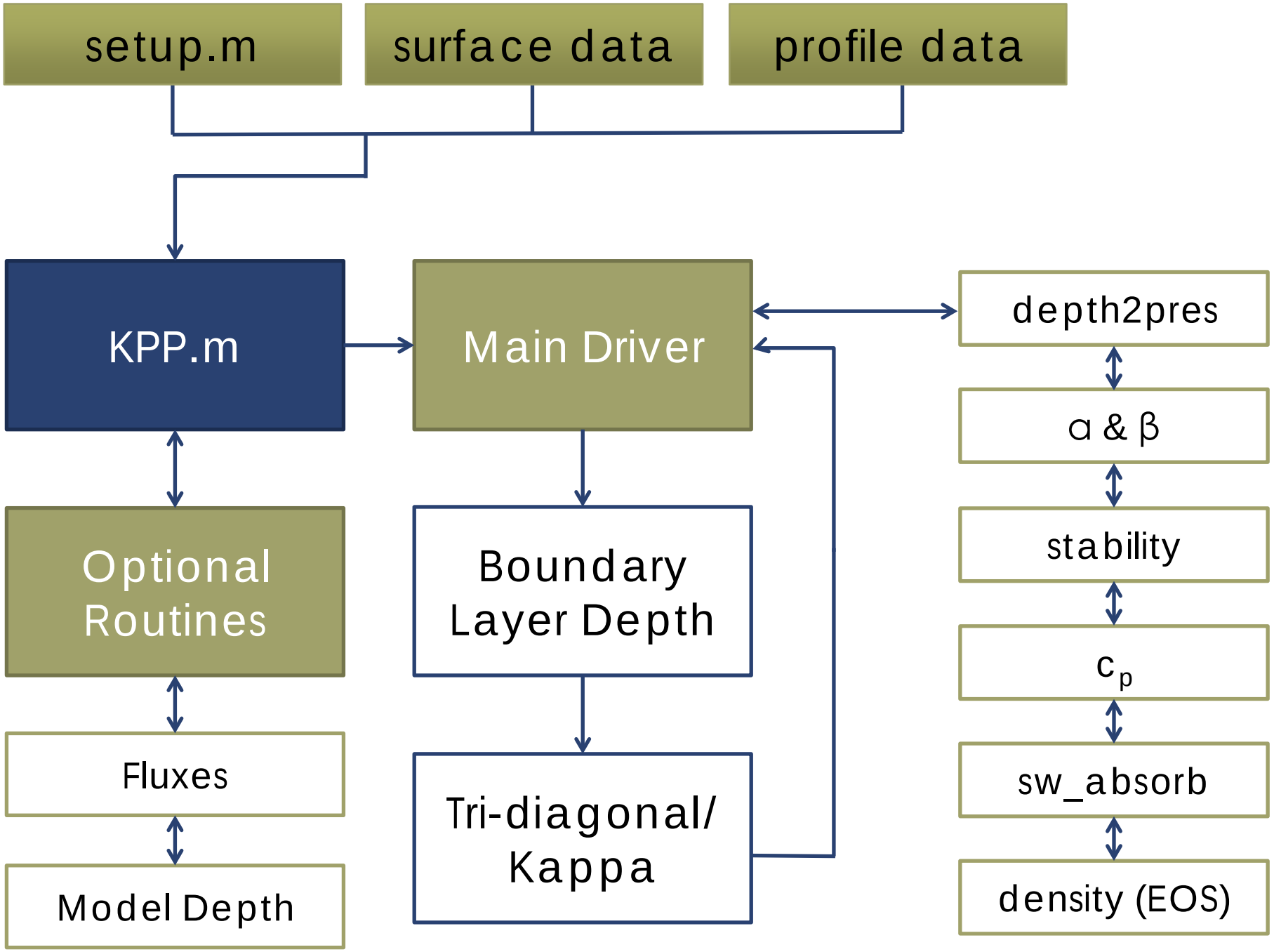
```
 IF((kbl(i).eq.km).and.(Rib(i,ku).ge.Ricr)) then
c     quadratic interpolate to find hbl
            slope_up =  ( Rib(i,k1) - Rib(i,ka) ) / ( z_up - z_upper )
            a_co = ( Rib(i,ku) - Rib(i,ka) + slope_up * ( zgrid(i,kl) - z_up ) ) / ( (z_up - zgrid(i,kl))**2 )
            b_co = slope_up + 2. * a_co * z_up
            c_co = Rib(i,ka) + z_up * (a_co*z_up + slope_up) – Ricr
            sqrt_arg = b_co**2-4.0*a_co*c_co
            if ( ( (abs(b_co) .gt. epsln) .and.  (abs(a_co)/abs(b_co) .le. epsln) ) .or (sqrt_arg .le. 0.0) )   then
                hbl(i) = -z_up + (z_up - zgrid(i,kl)) *(Ricr      - Rib(i,ka))/(Rib(i,ku) - Rib(i,ka))
            else
                hbl(i) = (-b_co + sqrt(sqrt_arg)) / (2.*a_co)
            endif
            kbl(i) = kl
ENDIF
```

MATLAB

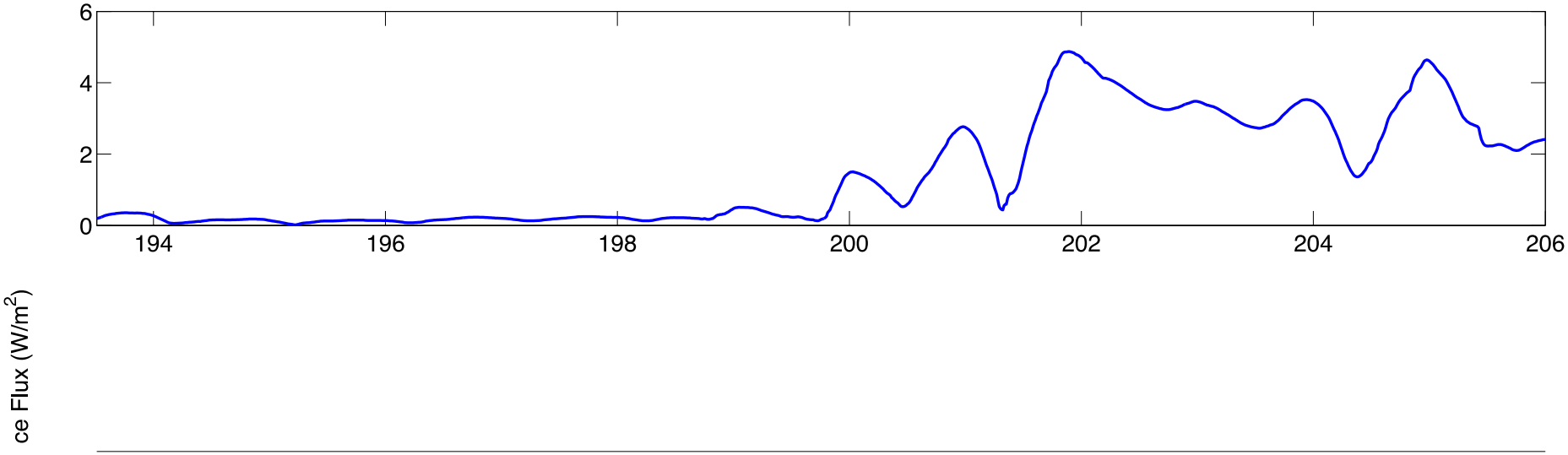
```
m = (Rib(xhbl)-Rib(xhbl-1))./(z_t(xhbl)-z_t(xhbl-1));
R = [Rib(xhbl); Rib(xhbl+1); m];
A = [z_t(xhbl)^2,   z_t(xhbl),   1;  z_t(xhbl+1)^2, z_t(xhbl+1), 1; 2*z_t(xhbl),   1,          0];
Y = A\R;
hbl = (-Y(2) + sqrt(Y(2).^2 - 4.*Y(1).*(Y(3)-Ricr))./(2.*Y(1));
```

Boundary Layer Depth Calculation




setup.m
surface data
profile data
KPP.m
Main Driver
depth2pres
α & β
stability
c_p
sw_absorb
density (EOS)
Optional Routines
Fluxes
Model Depth
Boundary Layer Depth
Tri-diagonal/ Kappa

Easy Diagnostics: Obukhov Length



+ Stable, 0 Neutral, - Unstable

Final Thoughts

- 1-D MATLAB version is computationally efficient
- We are in “final development stages”
- Need beta testers
- Feed back on specific aspects of model development
- Provide a stand-alone 1D model “out of box” ready to use
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