Compiled by Fearghal O'Donncha

* Computed Variables
QQ   - (m2/s2) Turbulent Intensity
QQL   - (m2/s2) Turbulent Intensity * Dimensionless Turbulent Length Scale
DML   - Ratio of QQL/QQ, Non-dimensional Length Scale

QQWV1 - (m2/s2) Bed Turbulent Intensity Due To Waves Only
QQWV2 - (m2/s2) Water Column Turbulent Intensity Due To Waves
QQWC - (m2/s2) NOT USED
FWQQ - (m5/s3)
UUU   - (m3/s2) Temporary variable in calqq
VVV   - (m4/s2) Temporary variable in calqq
FUHU - (m5/s3) Temporary variable in calqq
FVHU - (m5/s3) Temporary variable in calqq
FUHV - (m6/s3) Temporary variable in calqq
FVHV - (m6/s3) Temporary variable in calqq

AV   - Vertical Turbulent Viscosity, depth normalized   (m/s) (m2/s [std SI units] / m = m/s)
AB   - Vertical Molecular Diffusiviy, depth normalized (m/s)
AH   - Horizontal Turbulent Viscosity, depth normalized (m/s)

UHDY - U*HU*DYU (m3/S)
UHDY1 - UHDY ONE TIME LEVEL BACK   (m3/S)
UHDY2 - UHDY TWO TIME LEVELS BACK (m3/S)

DXU   - 0.5*(DXP+DXP(L-1)) (m)
DYU   - 0.5*(DYP+DYP(L-1)) (m)
DXV   - 0.5*(DXP+DXP(LS)) (m)
DYV   - 0.5*(DYP+DYP(LS)) (m)

DXYU - DXU*DYU   (m2)
DXYV - DXV*DYV   (m2)
DXYP - STCAP*DXP*DYP (m2)
DXIU - 1./DXU   (1/m)
DYIU - 1./DYU   (1/m)
DXIV - 1./DXV   (1/m)
DYIV - 1./DYV   (1/m)
DYDI - DYU(L+1)-DYU   (m)
DXDJ - DXV(LN)-DXV   (m)
DXYIP - 1./(STCAP*DXP*DYP)   (1/m2)
DXYIU - 1./(DXU*DYU)   (1/m2)
DXYIV - 1./(DXV*DYV)   (1/m2)
HRU   - SUB*HMU*DYU*DXIU (m)
HRV   - SVB*HMV*DXV*DYIV (m)
HRUO - SUBO*DYU*DXIU   (dimensionless)
HRVO - SVBO*DXV*DYIV   (dimensionless)
SBX   - 0.5*SBX*DYU   (m)
SBY   - 0.5*SBY*DXV   (m)
SBXO - SBX
SBYO - SBY
SNLPX - GID2*SNLPX*DYU
SNLPY - GID2*SNLPY*DXV
FPROX - Dimensionless

SCAX - BC switch for E/W open boundaries (dimensionless), Radiation option dependent
SCAY - BC switch for N/S open boundaries (dimensionless), Radiation option dependent
SAAX - BC switch for E/W open boundaries (dimensionless)
SAAY - BC switch for N/S open boundaries (dimensionless)

HMU & HMV are the area averaged depths at the West (HU) & South (HV) cell faces

(Wave routine)
HMU=0.5*(DXP*DYP*HMP + DXP(L-1)*DYP(L-1)*HMP(L-1))/(DXU*DYU) (m)
HMV=0.5*(DXP*DYP*HMP + DXP(LS)*DYP(LS)*HMP(LS))/(DXV*DYV) (m)

HU & HV are the area averaged depths at the West (HU) & South (HV) cell faces
HU =0.5*(DXP*DYP*HP + DXP(L-1)*DYP(L-1)*HP(L-1)) / (DXU*DYU) (m)
HV =0.5*(DXP*DYP*HP + DXP(LS)*DYP(LS)*HP(LS)) / (DXV*DYV) (m)

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--- CALQQ2T, ISWAVE=1

1st must get dimensions of FUHV

m5/s3
---
m3/s m2/s2
FUHU(L,K)=MAX(UHUW,0.)*QQ(L-1,K) + MIN(UHUW,0.)*QQ(L,K)
(m5/s3)

m6/s3
---
m3/s m2/s2 m
FUHV(L,K)=MAX(UHUW,0.)*QQL(L-1,K)*H1P(L-1) + MIN(UHUW,0.)*QQL(L,K)*H1P(L)
(m6/s3)

m3/s2 m3/s2
--- ---
m2/s2 m s (m5/s3)
1/m2
UUU(L,K)=QQ(L,K)*H1P(L) + DELT*(FUHU(L,K)-FUHU(L+1,K)+FVHU(L,K)-FVHU(LN,K) +
(FWQQ(L,K)-FWQQ(L,K+1))*DZIG(K))*DXYIP(L)
(m3/s2)

C VVV(L,K)=QQL1(L,K)*H1P(L) ! John commented out this line

m4/s2 m4/s2

---
m2/s2 m m s (m6/s3
) 1/m2
VVV(L,K)=QQL(L,K)*H1P(L)*H1P(L) + DELT*(FUHV(L,K)-FUHV(L+1,K)+FVHV(L,K)-
FVHV(LN,K) + (FWQQL(L,K)-FWQQL(L,K+1))*DZIG(K))*DXYIP(L)
(m4/s2)

m3/s3
---
m/s m/s2 m
PQQB=AB(L,K)*GP*HP(L)*DZIG(K)*(B(L,K+1)-B(L,K))
(m3/s3)

m3/s3
---
m/s (m2/s2)
PQQU=AV(L,K)*DZIGSD4(K)*(U(L+1,K+1)-U(L+1,K)+U(L,K+1)-U(L,K))**2 +
AV(L,K)*DZIGSD4(K)*(V(LN ,K+1)-V(LN ,K)+V(L,K+1)-V(L,K))**2

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(m3/s3)


         m3/s2
    ---------------
      s  ( m3/s3   )
PQQ=DELT*(PQQB+PQQU)
m3/s2

          m3/s2    m3/s2
UUU(L,K)=UUU(L,K)+2.*PQQ
m3/s2

             m4/s2
     ------------------------
       s    m    ( ND  m3/s3    ND m3/s3)
PQQL=DELT*H1P(L)*(CTE3*PQQB  + CTE1*PQQU)


           m4/s2    ND   m4/s2
VVV(L,K)=VVV(L,K)+DML(L,K)*PQQL         !!!!!!!!!!!! Units WORK!


--- CALQQ2T, ISWAVE=2
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         m3/s3
     ---------------
       m/s  m/s2 m
PQQB=AB(L,K)*GP*HP(L)*DZIG(K)*(B(L,K+1)-B(L,K))
(m3/s3)

                        m3/s3
     ------------------------------------------------------
       m/s              (            m2/s2                 _
PQQU=AV(L,K)*DZIGSD4(K)*(U(L+1,K+1)-U(L+1,K)+U(L,K+1)-U(L,K))**2
(m3/s3)

                        m3/s3
     ------------------------------------------------------
       m/s              (            m2/s2                 _
PQQV=AV(L,K)*DZIGSD4(K)*(V(LN,K+1)-V(LN,K)+V(L,K+1)-V(L,K))**2
(m3/s3)


PQQW= WVFACT*TVAR1W(L,K)

      s  (     m3/s3         )
PQQ=DELT*(PQQU+PQQV+PQQB+PQQW)
m3/s2

         (                  m5/s3                   )
FFTMP=MAX(FUHU(L,K)-FUHU(L+1,K)+FVHU(L,K)-FVHU(LN,K) + (FWQQ(L,K)-
FWQQ(L,K+1))*DZIG(K),0.)
(m5/s3)

            m3/s2            m3/s2
         -------------  ------------------
          m2/s2   m      s    m5/s3  1/m2     m3/s2
UUU(L,K)=QQ(L,K)*H1P(L)+DELT*FFTMP*DXYIP(L) + 2.*PQQ
(m3/s2)

            m4/s2
     ------------------------
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       s   m     ( ND  m3/s3  ND (m3/s3         )
PQQL=DELT*H1P(L)*(CTE3*PQQB+CTE1*(PQQU+PQQV+PQQW))
(m4/s2)


FFTMP=MAX(FUHV(L,K)-FUHV(L+1,K)+FVHV(L,K)-FVHV(LN,K) + (FWQQL(L,K)-
FWQQL(L,K+1))*DZIG(K),0.)
(m6/s3)


               m4/s2                    m4/s2
         ---------------------   ------------------
           m2/s2   m      m       s   m6/s3  1/m2       ND     m4/s2
VVV(L,K)=QQL(L,K)*H1P(L)*H1P(L) +DELT*FFTMP*DXYIP(L) + DML(L,K)*PQQL
(m4/s2)



--- CALQQ2T, ISWAVE=2   OLD AND BAD
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           m3/s3
       ------------
       m/s  m/s2 m
PQQB=AB(L,K)*GP*HP(L)*DZIG(K)*(B(L,K+1)-B(L,K))
(m3/s3)

PQQU=(U(L+1,K+1)-U(L+1,K)+U(L,K+1)-U(L,K))**2
(m2/s2)

PQQV=(V(LN,K+1)-V(LN,K)+V(L,K+1)-V(L,K))**2
(m2/s2)

PQQW= WVFACT*TVAR1W(L,K)
????

                 m3/s2
     ----------------------------------
                   m3/s3
          -------------------------------
     s   (  m/s                 m2/s2   )
PQQ=DELT*(AV(L,K)*DZIGSD4(K)*(PQQU+PQQV)+PQQB+PQQW)
(m3/s2)

FFTMP=FUHU(L,K)-FUHU(L+1,K)+FVHU(L,K)-FVHU(LN,K) + (FWQQ(L,K)-
FWQQ(L,K+1))*DZIG(K)
(m5/s3)

               m3/s2             m3/s2            m3/s2
           -------------    -------------------   ------
            m2/s2   m        s   m5/s3  1/m2
UUU(L,K) = QQ(L,K)*H1P(L) + DELT*FFTMP*DXYIP(L) + 2.*PQQ
m3/s2

FFTMP=FUHV(L,K)-FUHV(L+1,K)+FVHV(L,K)-FVHV(LN,K) + (FWQQL(L,K)-
FWQQL(L,K+1))*DZIG(K)
(m6/s3)

                  m4/s2                  m4/s2
           ---------------------    ------------------
            m2/s2    m       m       s   m6/s3  1/m2                  m3/s2
VVV(L,K) = QQL(L,K)*H1P(L)*H1P(L) + DELT*FFTMP*DXYIP(L) + CTE1*DML(L,K)*PQQ
(m4/s2)
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--- CALQQ2  ORGINAL CODE - NO ISWAVE IMPLEMENTATION
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PQQ Units = m3/s2
PQQ=DELT*(AB(L,K)*GP*HP(L)*DZIG(K)*(B(L,K+1)-B(L,K)) +
AV(L,K)*DZIGSD4(K)*(U(L+1,K+1)-U(L+1,K)+U(L,K+1)-U(L,K))**2 +
AV(L,K)*DZIGSD4(K)*(V(LN,K+1)-V(LN,K)+V(L,K+1)-V(L,K))**2)
      s    m/s  m/s2  m                                  m/s     ND       (
m2/s2                         )
          ---------------------------------------
-----------------------------------------------------------
                        m3/s3
m3/s3
    ------------------------------------------------
                     m3/s2


UUU Units = m3/s2
UUU(L,K)=QQ(L,K)*HP(L)+2.*PQQ
          m2/s2    m     m3/s2
          ------------
             m3/s2

VVV Units = m3/s2
VVV(L,K)=QQL1(L,K)*HP(L)+CTE1*DML(L,K)*PQQ
           m2/s2    m     ND   ND      m3/s2


--- CALQQ2 ISWAVE=2
-------------------------------------------------------------


         m3/s3
     ---------------
       m/s  m/s2 m
PQQB=AB(L,K)*GP*HP(L)*DZIG(K)*(B(L,K+1)-B(L,K))
(m3/s3)

                         m3/s3
     ------------------------------------------------------
       m/s               (            m2/s2                    _
PQQU=AV(L,K)*DZIGSD4(K)*(U(L+1,K+1)-U(L+1,K)+U(L,K+1)-U(L,K))**2
(m3/s3)

                         m3/s3
     ------------------------------------------------------
       m/s               (            m2/s2                    _
PQQV=AV(L,K)*DZIGSD4(K)*(V(LN,K+1)-V(LN,K)+V(L,K+1)-V(L,K))**2
(m3/s3)


PQQW= WVFACT*TVAR1W(L,K)
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```
      s  (     m3/s3         )
PQQ=DELT*(PQQU+PQQV+PQQB+PQQW)
m3/s2

             m3/s2
          -------------
           m2/s2   m        m3/s2
UUU(L,K)=QQ(L,K)*H1P(L) + 2.*PQQ
(m3/s2)


            m3/s2              m3/s2
     ---------------    --------------------
       s    ND m3/s3     ND  (     m3/s3    )
PQQL=DELT*(CTE3*PQQB  + CTE1*(PQQU+PQQV+PQQW))
(m3/s2)

              m3/s2            m3/s2
          --------------    -------------
           m2/s2     m       ND     m3/s2
VVV(L,K)=QQL(L,K)*H1P(L) + DML(L,K)*PQQL
(m3/s2)
```