ICTP-RegCM4 Modeli

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İTÜ Meteoroloji Mühendisliği

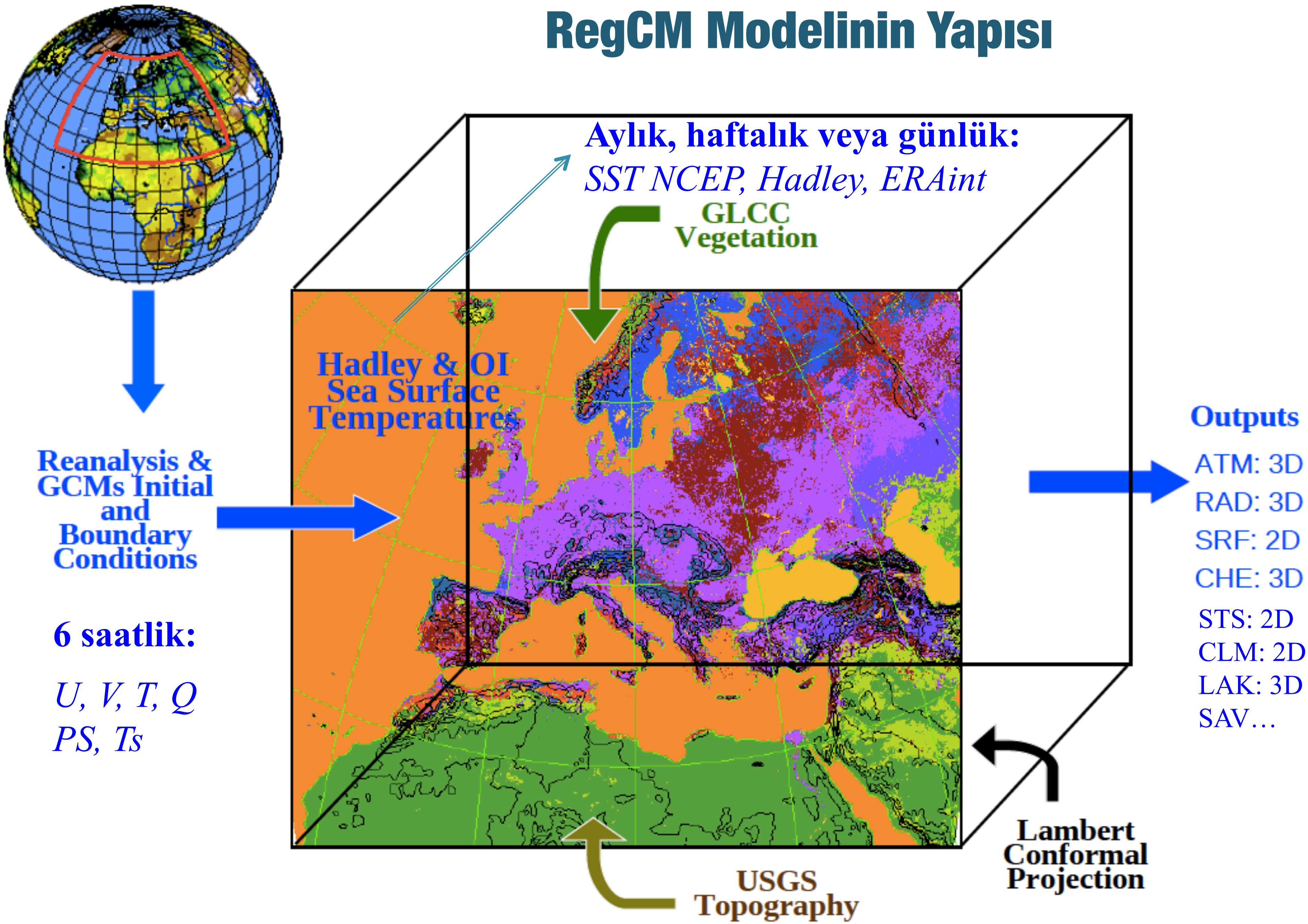
RegCM4 modeli Web sayfaları:

http://gforge.ictp.it/gf/project/regcm/
http://users.ictp.it/~pubregcm/RegCM3/globedat2.htm

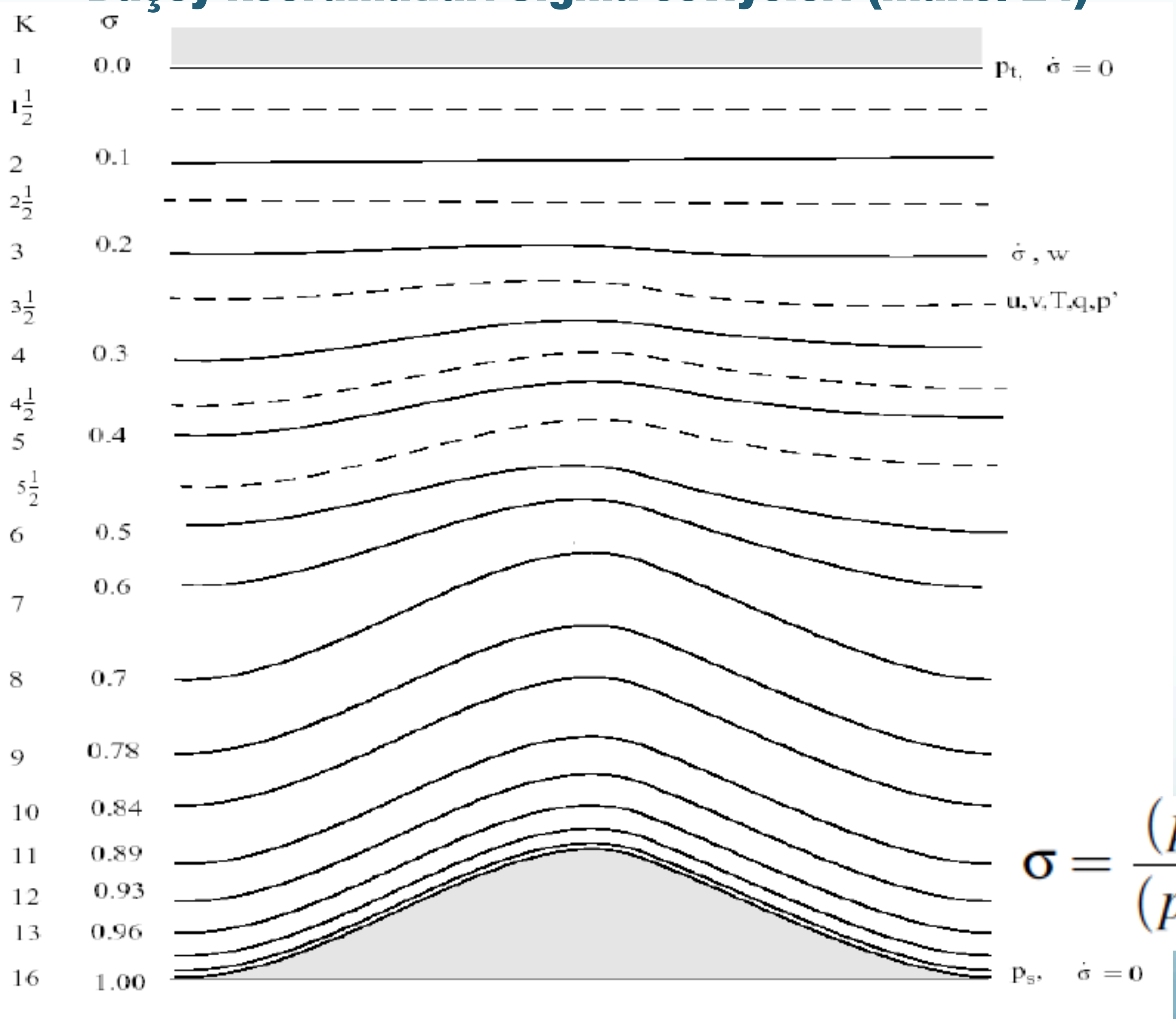
E-posta grubu:

https://lists.ictp.it/mailman/listinfo/regcnet
regcnet@lists.ictp.it

RegCM Modelinin Yapısı

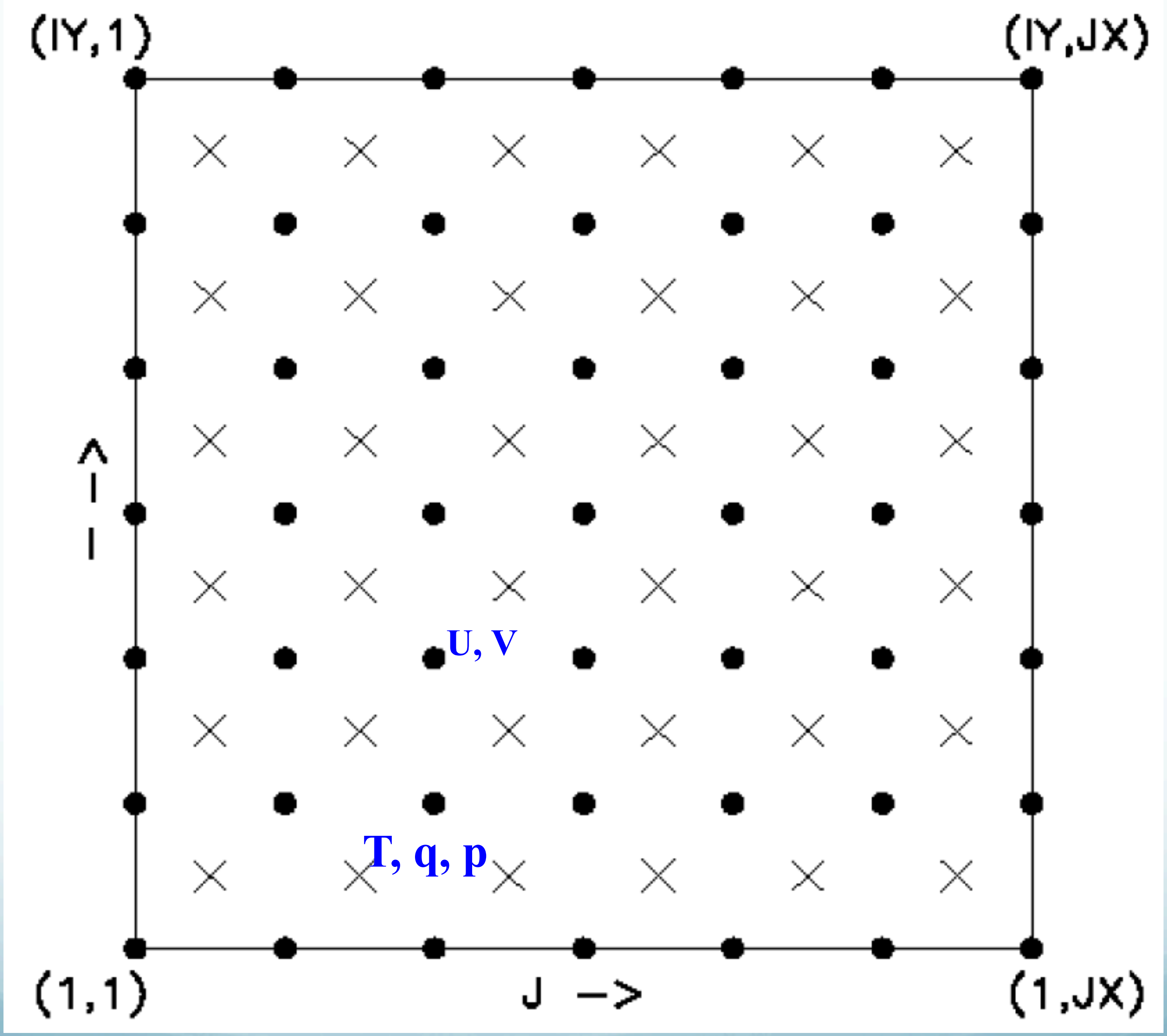


Düşey koordinatlar: Sigma seviyeleri (maks. 24)

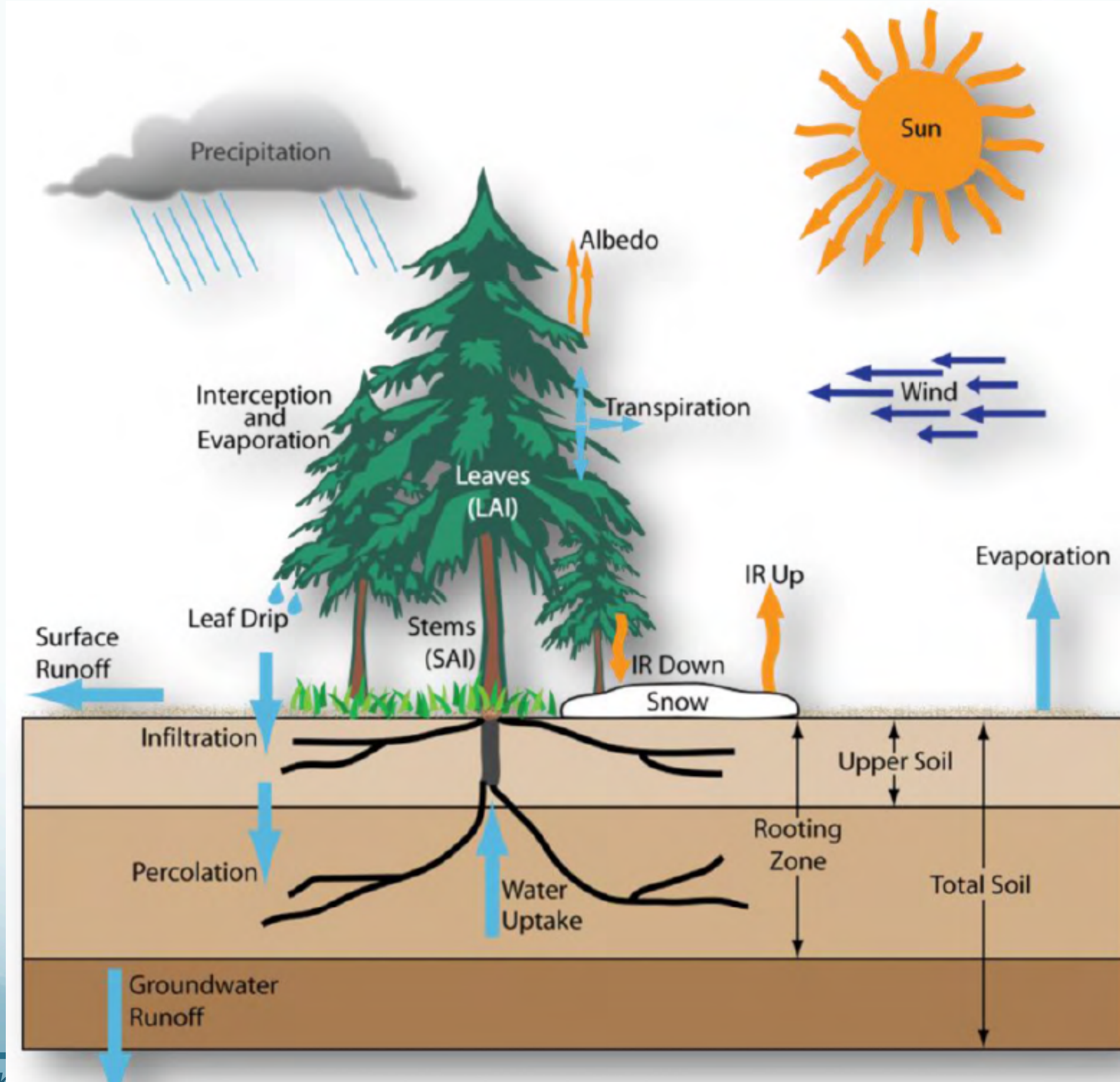


$$\sigma = \frac{(p - p_t)}{(p_s - p_t)}$$

Yatay Grid Yapısı: Arakawa B Grid

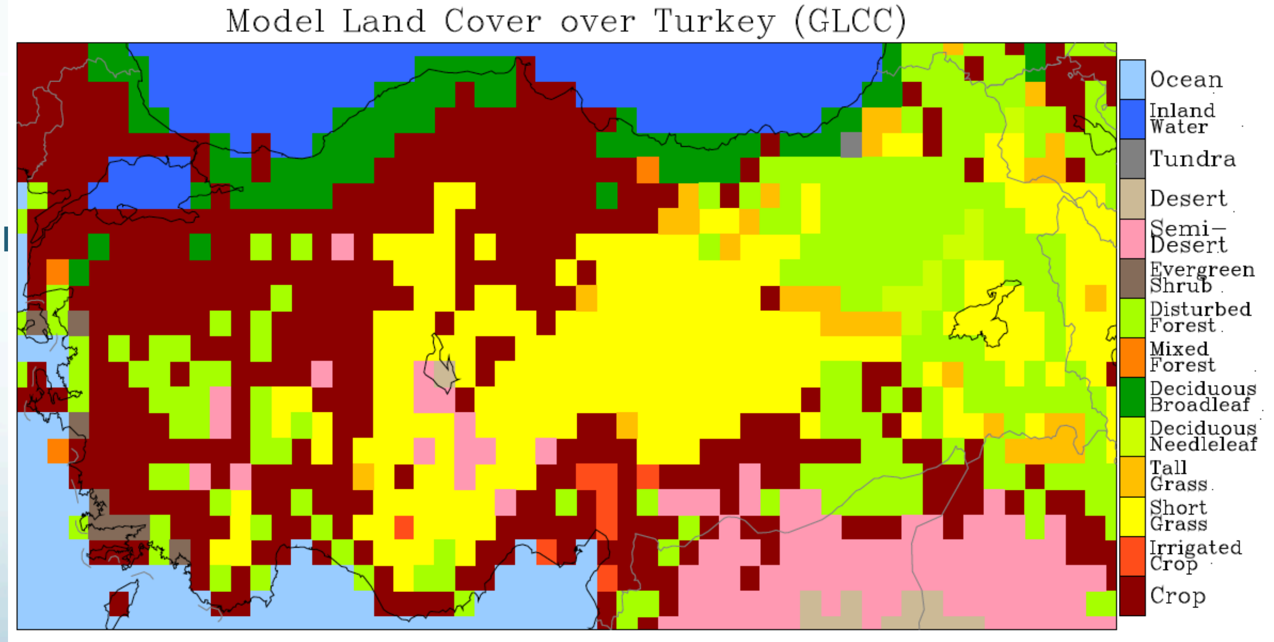


Biosfer-Atmosfer Transfer Modeli: BATS1e



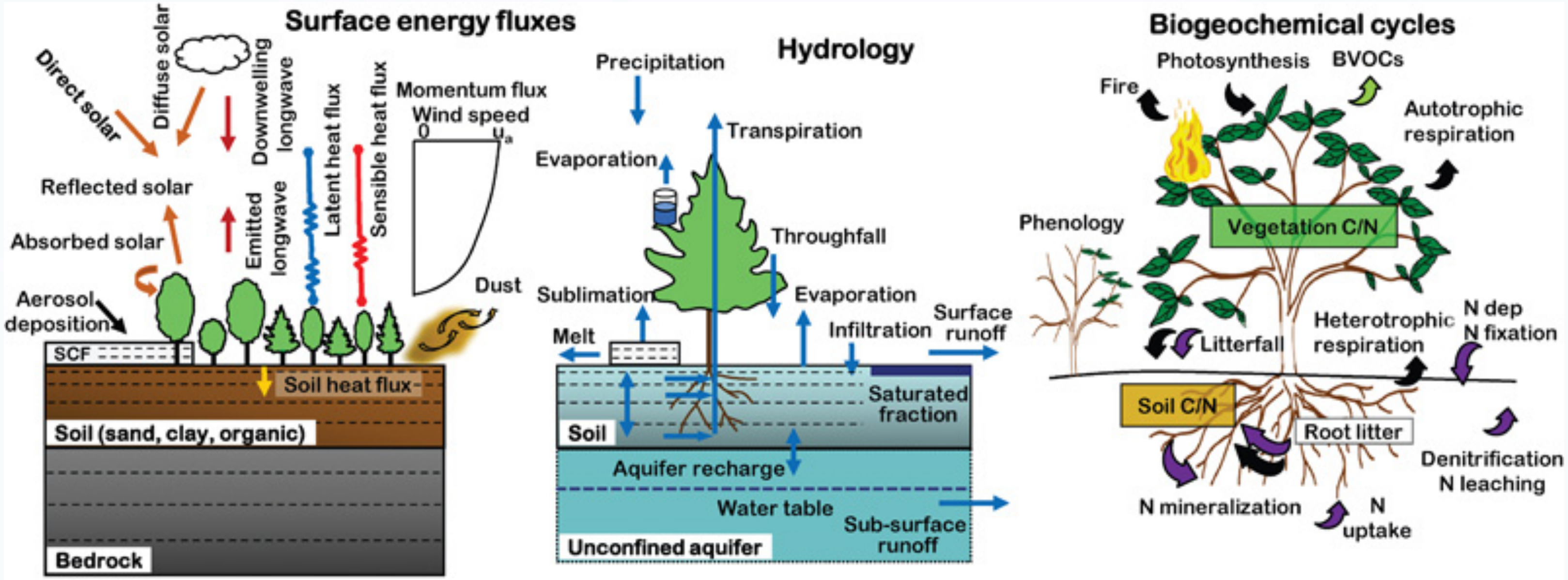
Arazi ve Bitki Örtüsü Tipleri

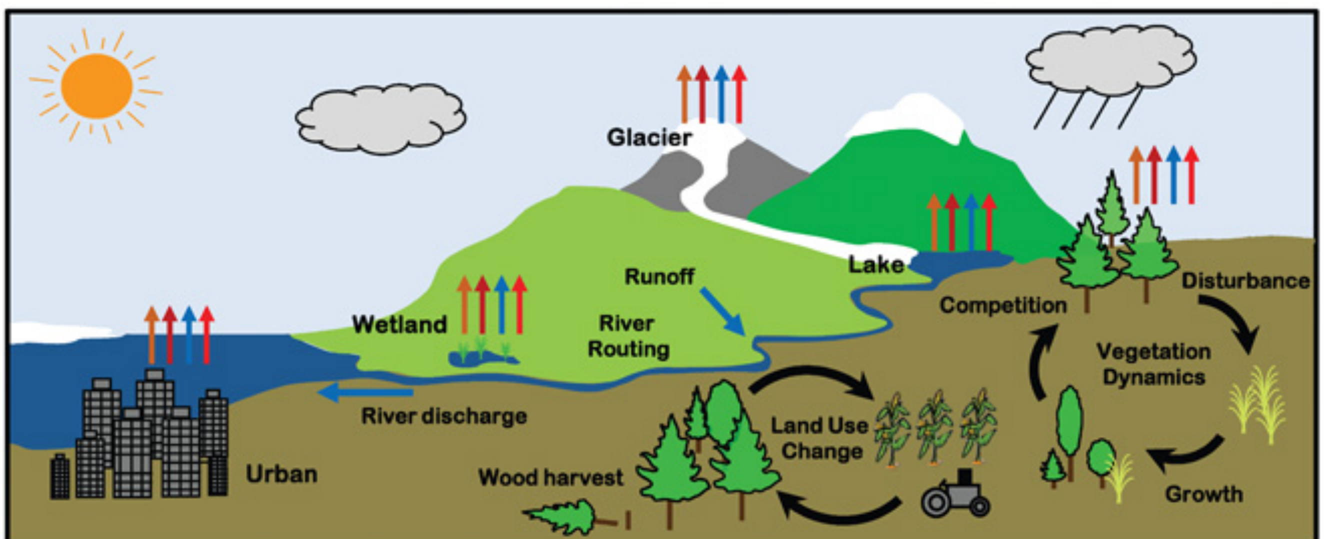
1. Ekin ve karışık tarım
2. Kısa ot
3. Hep yeşil kalan iğne yapraklı ağaç
4. Dökülen yapraklı ağaç
5. Dökülen geniş yapraklı ağaç
6. Hep yeşil kalan geniş yapraklı ağaç
7. Uzun ot
8. Çöl
9. Tundra
10. Sulama yapılan tarımsal ü
11. Yarı-çöl
12. Buz örtüsü/buzul
13. Bataklık
14. İç sular
15. Deniz/okyanus
16. Hep yeşil kalan çalı
17. Yaprak döken çalı
18. Karışık ağaçlık
19. Orman/mozaik alan
20. Su ve toprak karışımı



Community Land Model: CLM

RegCM4'ün diğer yüzey modeli





RegCM Modelinin Çıktıları

STS: Yüzey Ekstremleri (24saat)

TSMAX	Maximum surface temperature
TSMIN	Minimum surface temperature
PRMAX	Maximum total precipitation flu
PR	Mean total precipitation flux
SUND	Duration of sunshine
PSMIN	Minimum of surface pressure
PSAVG	Mean surface pressure
MRROS	Surface Runoff flux
MRRO	Bottom Runoff flux
TASMAX	Maximum 2 meter temperature
TASMIN	Minimum 2 meter temperature
TAS	Mean 2 meter temperature
SFCWINDMAX	Maximum speed of 10m wind

SRF: Yüzey Çıktıları (3 saat)

IGMA	Sigma at half model layers
PTOP	Pressure at model top
XLON	Longitude on Cross Points
XLAT	Latitude on Cross Points
MASK	Land Mask
TOPO	Surface Model Elevation
PS	Surface Pressure
TAU	Surface wind stress
TS	Ground surface temperature
TF	Foliage canopy temperature
PR	Total precipitation flux
EVSPSBL	Total evapotranspiration flux
SNV	Liquid water equivalent of snow
HFSS	Sensible heat flux
RSNL	Net upward longwave energy flux
RSNS	Net downward shortwave energy f
RSDL	Surface downward longwave flux
RSDS	Surface downward shortwave flux
PRC	Convective precipitation flux
ZMLA	Atmospheric Boundary Layer thic
ALDIRS	Surface albedo to direct shortw
ALDIFS	Surface albedo to diffuse short
SUND	Duration of sunshine
SMELT	Snow Melt
MRROS	Surface Runoff flux
MRRO	Total Runoff flux
USTAR	Surface friction velocity
ZO	Surface roughness length
RHOA	Surface air density
UAS	Anemometric zonal (westerly) wi
VAS	Anenometric meridional (souther
TAS	Near surface air temperature
QAS	Near surface air specific humid
HURS	Near surface relative humidity
MRSO	Moisture content of the soil l

RegCM Modelinin Çıktıları

ATM: Atmosfer Çıktıları (6 saat)

UA	Zonal component of wind (wester
VA	Meridional component of wind (s
TA	Air Temperature
OMEGA	Pressure velocity
QAS	Specific humidity in air
CLW	Mass fraction of cloud liquid w
RH	Relative Humidity

RAD: Radyasyon Çıktıları (6 saat)

RSNS	Surface net downward shortwave
RSNL	Surface net upward longwave flu
RTNSCL	Clearsky top of atmosphere net
RSNSCL	Clearsky surface net downward s
RTNLCL	Clearsky top of atmosphere net
RSNLCL	Clearsky net upward longwave fl
RTS	Top of atmosphere incoming shor
RSNT	Net top of atmosphere upward sh
CLT	Total cloud fraction
CLWVI	Total columnar liquid water con
CLIVI	Total columnar ice water conten
RTL	Top of atmosphere net upward lo
CL	Cloud fractional cover
CLW	Cloud liquid water path
QRS	Shortwave radiation heating rat
QRL	Longwave radiation heating rate
TAUCL	Cloud liquid water optical dept
TAUCI	Cloud ice optical depth

RegCM Modelinin Kurulumu

Adım 1. Derleyicileri kur veya kontrol et

Fortran ve C derleyici seçenekleri

- GNU GNU fortran compiler
- intel Intel® ifort fortran compiler
- pgi Portland® pgf90 fortran compiler
- g95 g95 fortran compiler

RegCM Modelinin Kurulumu

Adım 2. Kütüphaneleri kur veya kontrol et.

Kurulması gereken kütüphaneler

- netCDF netCDF Library

  `nc-config --version`

- MPI MPI Library

  `ompi_info --version ompi release`

Önemli: *modeli çalıştırmak için hangi derleyiciyi kullanacaksanız kütüphaneleri de o derleyici ile derlemeniz lazım!*

RegCM Modelinin Kurulumu

http://gforge.ictp.it/gf/project/regcm/frs/

isim@iklim> wget gforge.ictp.it/gf/download/frsrelease/145/822/RegCM-4.3-rc15.tar.gz

isim@iklim> tar zxvf RegCM-4.3-rc15.tar.gz

isim@iklim> cd RegCM-4.3

isim@RegCM-4.3> ./configure CC=icc FC=ifort

isim@RegCM-4.3> make install

RegCM Modelinin Kurulumu

Çalıştırılabilir (exe) dosyalar:

```
ls Bin

aerosol   GrADSNcPlot      icbc       regcmMPI   sigma2p   terrain
average   GrADSNcPrepare   chem_icbc  clm2rcm    regrid    sst
```

İlk simülasyona hazırlık:

```
mkdir -p run/{input,output}
cd run
ln -sf /scratch/$USER/RegCM-4.3-rc1/Bin .
cp /scratch/$USER/RegCM-4.3-rc1/Testing/test_001.in .
gedit test_001.in
```

Bu dosya önemli, bütün değişiklikler bu dosyada

RegCM Modelinin Kurulumu

İlk simülasyona hazırlık süreci:

1. **Topoğrafya ve arazi örtüsünü oluştur**
2. **Modelin kullanacağı Deniz Yüzey Sıcaklıklarını, simülasyon başlangıç ve bitiş tarihi aralığında oluştur**
3. **Modelin kullanacağı sınır şartlarını, simülasyon başlangıç ve bitiş tarihi aralığında oluştur**

```
./Bin/terrain test_001.in
./Bin/sst test_001.in
./Bin/icbc test_001.in
mpirun -np 2 ./Bin/regcmMPI test_001.in
```

İşlemci sayısı önemli

RegCM Modelinin Kurulumu

test_001.in: Model Alanı (domain) parametrelerinin belirlenmesi:

```
&dimparam
iy     = 34,   ! This is number of points in the N/S direction
jx     = 48,   ! This is number of points in the E/W direction
kz     = 18,   ! Number of vertical levels
dsmin  = 0.01, ! Minimum sigma spacing (only used if kz is not 14, 18, or 23)
dsmax  = 0.05, ! Maximum sigma spacing (only used if kz is not 14, 18, or 23)
nsg    = 1,    ! For subgridding, number of points to decompose. If nsg=1,
               ! no subgridding is performed. CLM does NOT work as of now with
               ! subgridding enabled.
```

RegCM Modelinin Kurulumu

test_001.in: **Harita ve çözünürlük parametrelerinin belirlenmesi:**

```
&geoparam
iproj = 'LAMCON', ! Domain cartographic projection. Supported values are:
                  ! 'LAMCON', Lambert conformal.
                  ! 'POLSTR', Polar stereographic. (Doesn't work)
                  ! 'NORMER', Normal  Mercator.
                  ! 'ROTMER', Rotated Mercator.
ds = 60.0,        ! Grid point horizontal resolution in km
ptop = 5.0,       ! Pressure of model top in cbar
clat = 45.39,     ! Central latitude  of model domain in degrees
                  ! North hemisphere is positive
clon = 13.48,     ! Central longitude of model domain in degrees
                  ! West is negative.
plat = 45.39,     ! Pole latitude (only for rotated Mercator Proj)
plon = 13.48,     ! Pole longitude (only for rotated Mercator Proj)
truelatl = 30.0,  ! Lambert true latitude (low latitude side)
truelath = 60,    ! Lambert true latitude (high latitude side)
i_band = 0,       ! Use this to enable a tropical band. In this case the ds,
                  ! iproj, clat, clon parameters are not considered.
```

RegCM Modelinin Kurulumu

test_001.in: Topoğrafya parametrelerinin belirlenmesi:

```
&terrainparam
domname  = 'AQWA',       ! Name of the domain. Controls naming of input files
smthbdy = .false.,       ! Smoothing Control flag
                         !  true  -> Perform extra smoothing in boundaries
lakedpth    = .false.,   ! If using lakemod (see below), produce from
                         ! terrain program the domain bathymetry
fudge_lnd   = .false.,   ! Fudging Control flag, for landuse of grid
fudge_lnd_s = .false.,   ! Fudging Control flag, for landuse of subgrid
fudge_tex   = .false.,   ! Fudging Control flag, for texture of grid
fudge_tex_s = .false.,   ! Fudging Control flag, for texture of subgrid
fudge_lak   = .false.,   ! Fudging Control flag, for lake of grid
fudge_lak_s = .false.,   ! Fudging Control flag, for lake of subgrid
h2opct = 50.,            ! Surface minimum H2O percent to be considered water
h2ohgt = .false.,        ! Allow water points to have elevation greater than 0
dirter = 'input/',       ! Output directory for terrain files
inpter = 'globdata/',    ! Input directory for SURFACE dataset
/
```

RegCM Modelinin Kurulumu

test_001.in: Sınır şartlarının belirlenmesi:

```
&globdatparam
ibdyfrq =     6,              ! boundary condition interval (hours)
ssttyp = 'OI_WK',             ! Type of Sea Surface Temperature used
                              !  One in: GISST, OISST, OI2ST, OI_WK, OI2WK,
                              !          FV_RF, FV_A2, FV_B2,
                              !          EH5RF, EH5A2, EH5B1, EHA1B,
                              !          ERSST, ERSKT, CCSST, CA_XX, HA_XX
dattyp = 'EIN15',             ! Type of global analysis datasets used
                              !  One in: ECMWF, ERA40, EIN75, EIN15, EIN25,
                              !          ERAHI, NNRP1, NNRP2, NRP2W, GFS11,
                              !          FVGCM, FNEST, EH5RF, EH5A2, EH5B1,
                              !          EHA1B, CCSMN, ECEXY, CA_XX, HA_XX
gdate1 = 1990060100,          ! Start date for ICBC data generation
gdate2 = 1990070100,          ! End data for ICBC data generation
calendar = 'gregorian',       ! Calendar to use (gregorian, noleap or 360_day)
dirglob = 'input/',           ! Path for ICBC produced input files
inpglob = 'globdata/',        ! Path for ICBC global input datasets.
                    ! Look http://users.ictp.it/~pubregcm/RegCM4/globedat.htm
                    ! on how to download them.
```

RegCM Modelinin Kurulumu

test_001.in: **Sınır parametrelerinin belirlenmesi:**

```
&boundaryparam
nspgx  = 12, ! nspgx-1 represent the number of cross point slices on
             ! the boundary sponge or relaxation boundary conditions.
nspgd  = 12, ! nspgd-1 represent the number of dot point slices on
             ! the boundary sponge or relaxation boundary conditions.
high_nudge   =      3.0, ! Nudge value high range
medium_nudge =      2.0, ! Nudge value medium range
low_nudge    =      1.0  ! Nudge value low range
```

test_001.in: **simülasyon başlangıç ve bitiş tarihlerinin belirlenmesi:**

```
&restartparam
ifrest  = .false. ,   ! If a restart
mdate0  = 1990060100, ! Global start (is gdate1, most probably)
mdate1  = 1990060100, ! Start date of this run
mdate2  = 1990060200, ! End date for this run
```

RegCM Modelinin Kurulumu

test_001.in: CFL şartlarının belirlenmesi:

```
&timeparam
dt      =   150., ! time step in seconds
dtrad   =    30., ! time interval solar radiation calculated (minutes)
dtabem  =    18., ! time interval absorption-emission calculated (hours)
dtsrf   =   600., ! time interval at which land model is called (seconds)
```

dx(km)	dt(sec)	abatm(sec)	abemh(hr)	radfrq(min)
10	30	90	18	30
20	60	120	18	30
30	100	300	18	30
45	150	300	18	30
50	150	450	18	30
60	200	600	18	30
90	225	900	18	30

$3*dx \leq dt$

RegCM Modelinin Kurulumu

test_001.in: çıktıların periodlarının belirlenmesi:

```
&outparam
ifsave  = .true. ,            ! Create SAV files for restart
savfrq  =    48.,             ! Frequency in hours to create them
ifatm   = .true. ,            ! Output ATM ?
atmfrq  =     6.,             ! Frequency in hours to write to ATM
ifrad   = .true. ,            ! Output RAD ?
radfrq  =     6.,             ! Frequency in hours to write to RAD
ifsrf   = .true. ,            ! Output SRF ?
ifsts   = .true. ,            ! Output STS ?
ifsub   = .true. ,            ! Output SUB ?
srffrq  =     3.,             ! Frequency in hours to write SRF and SUB (and CLM)
iflak   = .true.,             ! Output LAK ?
lakfrq  =     6.,             ! Frequency in hours to write to LAK if lakemod is 1
                              ! It must be an integer multiple of batfrq
ifchem  = .true.,             ! Output CHE ?
chemfrq =     6.,             ! Frequency in hours to write to CHE
atm_enablevar = 14*.true., ! Mask to eventually disable variables ATM
srf_enablevar = 24*.true., ! Mask to eventually disable variables SRF
sts_enablevar = 9*.true.,  ! Mask to eventually disable variables STS
lak_enablevar = 16*.true., ! Mask to eventually disable variables LAK
sub_enablevar = 16*.true., ! Mask to eventually disable variables SUB
rad_enablevar = 15*.true., ! Mask to eventually disable variables RAD
che_enablevar = 17*.true., ! Mask to eventually disable variables CHE
dirout  = './output',      ! Path where all output will be placed
```

test_001.in: sınır tabaka ve yağış parametrizayonları:

```
&physicsparam
iboudy  =          5,  ! Lateral Boundary conditions scheme
                       !   0 => Fixed
                       !   1 => Relaxation, linear technique.
                       !   2 => Time-dependent
                       !   3 => Time and inflow/outflow dependent.
                       !   4 => Sponge (Perkey & Kreitzberg, MWR 1976)
                       !   5 => Relaxation, exponential technique.
ibltyp  =          1,  ! Boundary layer scheme
                       !   0 => Frictionless
                       !   1 => Holtslag PBL (Holtslag, 1990)
                       !   2 => UW PBL (Bretherton and McCaa, 2004)
                       !  99 => Holtslag PBL, with UW in diag. mode
icup    =          4,  ! Cumulus convection scheme
                       !   1 => Kuo
                       !   2 => Grell
                       !   3 => Betts-Miller (1986) DOES NOT WORK !!!
                       !   4 => Emanuel (1991)
                       !   5 => Tiedtke (1986) UNTESTED !!!
                       !  99 => Use Grell over land and Emanuel over ocean
                       !  98 => Use Emanuel over land and Grell over ocean
  igcc  =          1,  ! Grell Scheme Cumulus closure scheme
                       !   1 => Arakawa & Schubert (1974)
                       !   2 => Fritsch & Chappell (1980)
ipptls  =          1,  ! Moisture scheme
                       !   1 => Explicit moisture (SUBEX; Pal et al 2000)
```

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RegCM Modelinin Kurulumu

test_001.in: okyanus parametrizasyonları ve sera gazı konstrasyonlarını belirlenmesi:

```
iocnflx =           2,   ! Ocean Flux scheme
                         !   1 => Use BATS1e Monin-Obukhov
                         !   2 => Zeng et al (1998)
  iocnrough =       1,   ! Zeng Ocean model roughness formula to use.
                         !   1 => (0.0065*ustar*ustar)/egrav
                         !   2 => (0.013*ustar*ustar)/egrav + 0.11*visa/ustar
ipgf    =           0,   ! Pressure gradient force scheme
                         !   0 => Use full fields
                         !   1 => Hydrostatic deduction with pert. temperature
iemiss  =           0,   ! Calculate emission
lakemod =           0,   ! Use lake model
ichem   =           1,   ! Use active aerosol chemical model
scenario =      'A1B',   ! IPCC Scenario to use in A1B,RF,A2,B1,B2
                         ! RCP Scenarios in RCP3PD,RCP4.5,RCP6,RCP8.5
idcsst   =           0,  ! Use diurnal cycle sst scheme
iseaice  =           0,  ! Model seaice effects
idesseas =           1,  ! Model desert seasonal albedo variability
iconvlwp =           1,  ! Use convective liquid water path as the large-scale
                         ! liquid water path
```

RegCM Modelinin Kurulumu

`test_001.in`: **diğer parametrizasyonları belirlenmesi:**

&subexparam

&grellparam

&emanparam

&tiedtkeparam

&uwparam

&chemparam

&clmparam


get
your
hands
dirty